Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: MAR / APR 2025
Faculty: Science and Technology

Program: B.Sc. (Gen03) **Semester: VI** **SET: A**
Program (Specific): General B.Sc. **Course Type: DSC**
Class: T.Y.B.Sc. (Gen) **Max. Marks: 35**
Name of the Course: Soid State Physics
Course Code: 24-PHY-361 **Time: 2Hr**
Paper: I

Instructions to the candidate:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Draw a well labeled diagram wherever necessary.*
4) *Use of scientific calculator and log table is allowed.*

Q.1. Define the following. **(5)**

a) Space lattice
b) Primitive Cell
c) Reciprocal lattice
d) Mean free path
e) Curie temperature

Q.2. Answer the following. (Any 4/6) **(4)**

a) There are how many space lattices in a cubic system?
b) What are symmetry operations?
c) Why ordinary optical grating cannot diffract X rays?
d) State two applications of Hall effect.
e) Define fermi level.
f) Explain ferrimagnetism.

Q.3. Answer the following. (Any 4/6) **(8)**

a) With the help of a neat diagram show that atomic radius of a simple cubic structure is r = a/2.
b) Write a note on hexagonal lattice in two dimensions.
c) State various spectroscopic techniques used in analysis of crystal structure.
d) Hall coefficient depends on which factors?
e) Explain zero-point energy.

f) Find the susceptibility when the curie constant is 0.2 and the energy difference in critical temperature and paramagnetic curie temperature is 0.01.

Q.4. Answer the following. (Any 2/4) (8)

a) Discuss crystal structure of NaCl in detail. Draw a neat diagram.

b) An X-ray analysis of crystal is made with monochromatic X rays of wavelength 0.6 Å. Bragg's reflections are obtained at an angle of (a) 6.45^0, (b) 9.15^0 and (c) 13^0. Calculate the interplanar spacing of the crystal.

c) Differentiate between classical free electron theory and quantum free electron theory.

d) Define magnetic susceptibility.
Prove that susceptibility of superconductor is -1 and relative permeability is zero.

Q.5. Answer the following. (Any 2/4) (10)

a) Show that the reciprocal of a reciprocal lattice is a direct lattice.

b) An FCC crystal has an atomic radius of 1.246 Å . What are d_{200}, d_{220} and d_{111} spacings?

c) State and prove Langevin theory of paramagnetism.

d) What is superconductivity? Mention important property changes that occur in superconductors. State names of superconducting materials.