Roll No : .....

Total No. of Questions : **11**] [Total No. of Printed Pages : **3**

SP–708

M.Sc. (Final) Examination, 2021

PHYSICS

Paper - V

(Condensed Matter Physics)

Time : 1½ Hours] [*Maximum Marks : 75*

Section–A **(Marks : 2 × 10 = 20)**

Note :– Answer all *ten* questions (Answer limit **50** words). Each question carries **2** marks.

Section–B **(Marks : 5 × 5 = 25)**

Note :– Answer all *five* questions. Each question has internal choice (Answer limit **200** words). Each question carries **5** marks.

Section–C **(Marks : 10 × 3 = 30)**

Note :– Answer any *three* questions out of five (Answer limit **500** words). Each question carries **10** marks.

Section–A 2 each

1. (i) What is Reciprocal Lattice ? Write the reciprocal lattice vector for SC.

   (ii) Calculate packing fraction of a fcc structure.

(iii) Define the Schottky and Frenkel Defects.

(iv) What do you mean by tight binding approximation ?

(v) Define Fermi Level and Fermi Energy.

(vi) Explain ferrimagnetism using one example.

(vii) Prove that the magnetic susceptibility of super-conductors of type one is –1.

(viii) What is energy gap in super-conductors ?

(ix) Write *two* uses of super-conductors ?

(x) What is the Cooper pair ?

Section–B 5 each

2. Describe the classification of Bravais lattices and their properties giving on example each.

Or

Derive an expression for atomic structure factor.

3. Explain the dislocations in crystal growth.

Or

State and prove the Bloch Theorem.

4. Discuss about Quantum Hall Effect.

Or

Explain the Langevin theory of Paramagnetism.

5. Explain the Meissner Effect.

Or

For a super-conducting specimen of V_3 Ga alloy, the critical magnetic fields are 4.2×10^5 and 1.4×10^5 Am^{-1} at 13 K and 14 K respectively. Calculate the critical temperature.

6. Describe the BCS theory of super-conductivity.

Or

Differentiate between type-I and type-II super-conductors.

Section–C 10 each

7. Write the short notes on the following :

   (i) Laue method for X-ray diffraction.

   (ii) Debye Schesser technique for X-ray diffraction.

8. Derive the expression of the effective mass of a carrier is a band. Discuss physical origins of the effective mass.

9. Discuss the following :

   (i) Weiss theory of ferromagnetism

   (ii) Neel model for antiferromagnetism

10. Derive London equation and explain penetration depth in super-conductors.

11. Discuss the d.c. and a.c. Josephson effect.