Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

M.Sc.(Physics) (2015 to 2017) (Sem.–3)

CONDENSED MATTER PHYSICS

Subject Code : MPH-304

M.Code : 72617

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTIONS TO CANDIDATES :

1. **Attempt FIVE questions in all including the compulsory question no.9**

1. a) Discuss orientational polarizability and obtain an expression known as Langevin-Debye equation. (12)

   b) Derive Clausis-Mosotti equation in SI system. (8)

2. a) What are ferroelectric materials? Show that the dielectric constant of a ferroelectric should follow the Curie-Weiss law above the Curie temperature. (10)

   b) Derive Kramers-Kronig relations to find the real part of the response of a linear passive system. (10)

3. a) Explain transport phenomenon in solids and obtain Boltzmann transport equation. (10)

   b) Using the stationary Boltzmann equation, obtain an expression for mobility of charged particles in a classical gas. (10)

4. a) What do you mean by plasma oscillations and Plasmon? (8)

   b) Determine the Hartree-Fock equation for one electron system. (12)

5. a) Calculate the velocity of the electron for one dimensional crystal in the Tight Binding model, and prove that the velocity vanishes at the zone edge. (12)

   b) Differentiate between the nearly free electron theory and tight binding method. (8)

6. a) Show in an antiferromagnetic spin wave that the neighbouring spins precess in the same direction and with the same angular velocity but have different amplitudes and phases. (10)

   b) Briefly describe direct exchange and super exchange magnetic interactions. (10)

7. a) Discuss in detail Ginzburg-Landau theory which leads to explain successfully various properties exhibited by superconductors. (12)

   b) Give the relevant theory of DC Josephson effect. (8)

8. a) Derive the London equations for superconductivity. Show that London equations could explain the Meissner effect. (12)

   b) Give brief out line of BCS theoiy of superconductivity. (8)

9. **Write briefly :** (2.5 × 8 = 20)

   a) Describe photoluminescence phenomenon.

   b) What is polariton?

   c) Describe the thermoelectric phenomenon.

   d) What are Mott insulators?

   e) What are high temperature superconductors?

   f) What do you mean by spintronics?

   g) Explain the isotope effect in superconductors.

   h) What is London penetration depth?

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.