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MPHY-507

Solid State Physics

M.Sc. Physics (MSCPHY)

2nd Semester Examination, 2023 (June)

Time : 2 Hours] **[Max. Marks : 35**

Note : This paper is of Thirty Five (35) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

1. Explain the Debye model of heat capacity in details. Find out the expression for heat capacity and explain the behaviour of solids at low temperature and high temperature.

2. Obtain Clausius-Mosotti equation and explain how it can be used to determine the dipole moment of a polar molecule from dielectric measurement?

3. Obtain the vibrational spectrum of a linear diatomic lattice and show that in 1-D linear diatomic lattice, both acoustic and optical branches of dispersion curve meet at zone boundary.

4. How are Cooper Pairs formed? Explain the BCS theory of superconductivity and discuss the energy gap based on this theory.

5. Define anti-ferromagnetism and give the molecular field theory of anti-ferromagnetism.

SECTION–B
(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. What are Phonons? Give the properties of Phonon.

2. What do you understand by the normal modes of vibration? Suppose a vibrating linear monatomic lattice is constrained to obey periodic boundary conditions, so that the motion of the first and last atoms is identical. Find the number of normal modes of vibration for this system.

3. What is Gruneisen parameter? Show that the lattice vibrational frequency ω varies inversely as γth power of volume.

4. Explain the main characteristics of the ferroelectric crystals.

5. What do you mean by orientational polarization? Discuss the temperature dependence of orientation polarization.

6. Write a short note on Piezoelectricity.

7. Discuss Curie-Weiss law and its applications.

8. What is Coherence length in superconductors? Explain its physical meaning.
