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MSCPH-506

Condensed Matter Physics
M.Sc. Physics (MSCPH)
2nd Semester Examination, 2023 (June)

Time : 2 Hours]   **Max. Marks : 70**

Note : This paper is of Seventy (70) 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 Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

(2×19=38)

1. What is a crystal structure? Draw the crystal structure of NaCl crystal and explain its lattice vectors, primitive vector, coordinate number, packing fraction.

2. Obtain the phonon dispersion relation in a crystal with two atom per primitive basis. How many optical and acoustic branches are possible in this type of crystal vibration?

3. Define phonon heat capacity and find out expression for Debye T^3 law by using Debye model of heat capacity.

4. Explain Kronig-Penney model in detail and justify the origin of energy bonds in solids with the help of this model.

5. Give the BCS theory of superconductivity in detail.

SECTION–B
(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. (4×8=32)

1. Define reciprocal lattice vectors and write down diffraction condition in reciprocal lattice system.

2. Evaluate the Madelung constant for a line of ions of alternating sign with distance R between ions.

3. Define Hall Effect and Hall coefficient.

4. What is effective mass? Find out the expression for effective mass of electron.

5. Define superconductivity, Meissner effect and types of superconductors.

6. Define plasmons, polaritons and polarons.

7. What are Schottkey and Frenkel defects?

8. Calculate the interplaner spacing for (321) plane in a simple cubic lattice. The lattice constant is 4.2×10^{-10}m.

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