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Total Pages : 3   Roll No. ....

MPHY-506

Elementary Solid State Physics

M.Sc. Physics (MSCPHY-20)

2nd Semester Examination, 2022 (June)

Time : 2 Hours]   **Max. Marks : 40**

Note : This paper is of Forty (40) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Ten (10) marks each. Learners are required to answer any Two (02) questions only.

(2×10=20)

1. Explain the Bravais Lattice in three dimension. Draw and explain NaCl structure in detail.

2. Discuss the problem of an electron moving in a periodic potential. Explain the occurrence of energy gap in a semiconductor.

3. Define the concept of effective mass. Explain the Kronig Penny model for solids in detail.

4. State the conditions for LASER action in crystal. Explain the construction and action of Ruby LASER. Mention some of the important applications of LASER in industry.

5. Explain drift velocity, collision time and relaxation time of free electrons in metals. Discuss the various drawback of classical free electron theory of metals and explain the assumptions made in quantum theory to overcome these drawbacks.

SECTION–B
(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Five (05) marks each. Learners are required to answer any Four (04) questions only. (4×5=20)

1. What is Hall Effect? Explain how Hall coefficient is used to determine the mobility of charge carriers.

2. Explain Schottky and Frenkel defects.

3. What do you mean by coordination number? Find out the coordination number of simple cubic, body centered and face centered crystal structure.

4. What do you mean by Fermi level? Show that for an intrinsic semiconductor Fermi level lies in the middle of band gap.

5. Explain Bragg's law for X-ray diffraction in crystals.

6. What are the major differences between an edge & screw dislocation? Which of these can cross slip?

7. Calculate the energy of an electron below the Fermi level at a temperature 200 K for $F(E) = 0.9$ and Fermi energy $E_F = 3eV$.

8. Describe the terms stimulated and spontaneous emission.

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