

**P-115**

Total Pages : 3

Roll No. ....

**MPHY-506**

**Elementary Solid State Physics**

M.Sc. Physics (MSCPHY)

2 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 ( $9\frac{1}{2}$ ) marks each. Learners are required to answer any Two (02) questions only.  
( $2 \times 9\frac{1}{2} = 19$ )

1. What do you understand by structure factor? Establish a relation between structure factor and Miller's indices.

2. What do you understand by dislocations in a crystal structure? Explain edge dislocation and screw dislocation.
3. Define density of states of electrons. How does density of states of the free electrons vary with their energy? Obtain expression for it.
4. Derive Bragg's law of  $x$ -ray diffraction by crystals. Describe Laue method in detail and mention its applications.
5. Define Fermi energy of a metal and obtain an expression for it. Prove that the Fermi energy is independent of the size of metal.

## **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. How least square method is used to determine lattice parameter?
2. Explain free electron theory of metals.

3. Show that the conductivity of a semiconductor is given by

$$\sigma = ne\mu_n + pe\mu_p$$

4. Calculate the Fermi energy in copper on the assumption that each copper atom contributes one electron to the electron gas. Given; density of copper = 8.94 gm/cm<sup>3</sup>, atomic mass of copper = 63.5 and Avogadro number =  $6.02 \times 10^{23}$  mole<sup>-1</sup>.
5. Explain the significance of holes in band theory of solids.
6. What is Hall Effect? Give an elementary theory of Hall Effect.
7. What is thermal expansion? Explain why it is necessary to include anharmonic interactions to understand this phenomenon.
8. Define amorphous materials. Discuss their x-ray diffraction pattern.
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