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**B. Sc. (Pass Course) 5th Sem.  
(Regular/Re-appear/Improvement) (Mercy  
Chance) Examination – December-2023**

**PHYSICS-I (Solid State Physics)**

Paper : PHY-501

*Time : Three Hours ] [ Maximum Marks : 45*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

**Note :** Attempt *five* questions in all, selecting at least *one* question from each Unit.

**UNIT – I**

1. (a) What do you understand by liquid crystals ? Discuss the various types of liquid crystals. Give *three* applications of liquid crystals. 6
- (b) What are crystalline and amorphous solids ? Give their examples. 3

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2. (a) Define crystal translation vector, crystal lattice and unit cell. 6
- (b) What do you understand by Wigner Seitz primitive cell ? What is the major difference between conventional primitive cell and Wigner Seitz primitive cell ? 3

**UNIT – II**

3. (a) Derive the formula to find the interplanar spacing for a simple cubic lattice. 6
- (b) The lattice constants for an orthorhombic lattice are 2.3, 3.0 and 3.2 Å. Find the spacing between (111) planes. 3
4. (a) What do you understand by miller indices ? Draw the (221), (010), (110) and (111) planes in cubic unit cell. 3
- (b) Distinguish between the crystal structure of sodium chloride ( $NaCl$ ) and cesium chloride ( $CsCl$ ). 6
5. What do you understand by Bragg's diffraction law ? Discuss the method for determination of structure of finely powder sample. What are the various applications of X-ray diffraction powder method ? 9

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## UNIT - III

6. (a) What do you mean by reciprocal lattice ? Discuss the important properties of reciprocal lattice. 5
- (b) Prove that reciprocal of a reciprocal lattice is direct lattice itself. 4
7. (a) Prove that the reciprocal lattice vector  $\vec{G} = h\vec{A} + k\vec{B} + l\vec{C}$  is perpendicular to direct lattice plane  $hkl$ . 6
- (b) The primitive translation vectors of hexagonal space lattice are  $\vec{a} = \frac{a}{2}\hat{i} + \frac{a}{\sqrt{3}}\hat{j}$ ,  $\vec{b} = -\frac{a}{2}\hat{i} + \frac{a}{\sqrt{3}}\hat{j}$  and  $\vec{c} = c\hat{k}$ . Find the primitive translation vectors of reciprocal lattice. 3
8. What are the assumptions considered for the development of Debye's model of specific heat of solids ? Derive an expression for the lattice heat capacity in Debye's model. What are the shortcomings of Debye's model ? 9