

Jashore University of Science and Technology

Department of Physics

Bachelor of Science with Honours in Physics

2nd semester of 3rd year (2022 – 2023)

Course code: PHY 3205

Course title: Solid State Physics I

Class test no.: 2

Date: 19 January 2025

Roll:

1. Write down the expression for the Lennard-Jones potential. Provide a clear explanation of its physical significance, and illustrate it with a well-labeled sketch. [5]

2. Using the Lennard-Jones potential, calculate the ratio of the cohesive energies of neon in the bcc and fcc structures. The lattice sums for the bcc structures are [5]

$$\sum_j' p_{ij}^{12} = 9.11418; \quad \sum_j' p_{ij}^6 = 12.2533$$

3. What is a phonon? Describe its physical significance and list some of its key properties. [5]

4. In a system with two atoms per primitive unit cell, how many phonon modes are present? Explain the reasoning behind your answer. [5]

5. Define the following terms and explain their significance in solid-state physics: (i) Density of states (DOS), (ii) Debye temperature and (iii) Fermi level. [5]