

# **Jashore University of Science and Technology**

## **Department of Physics**

**Bachelor of Science with Honours in Physics**

**2nd semester of 3rd year (2023–2024)**

**Course code: PHY 3205**

**Assignment no.: 1**

**Course title: Solid State Physics I**

**Date: 01 December 2025**

**Deadline for submission: 04 December 2025, 10:00 PM**

- 1.** Derive an expression for the attractive interaction between atoms in a solid composed of inert gases. Provide a detailed explanation of the underlying physical principles and assumptions.
- 2.** What is the Madelung constant? Derive its expression for a one-dimensional ionic crystal and discuss its significance in determining the lattice energy of ionic solids.
- 3.** Derive the dispersion relation for lattice vibrations in a one-dimensional crystal with a monatomic basis. Discuss the physical meaning of the acoustic phonon branch obtained from the relation.
- 4.** Establish the Debye  $T^3$  law for the heat capacity of solids at low temperatures. Define the Debye temperature and explain its significance in this model.