Jashore University of Science and Technology

Department of Physics

Bachelor of Science with Honours in Physics
1st semester of 3rd year (2025–2026)
Course code: 053313 PHY 3107
Course title: Solid State Physics I
Assignment no.: 2 **Date: 31 October 2026**

Deadline for submission: 27 November 2026, 10:00 AM

1. What is a phonon? Derive the dispersion relation for lattice vibrations in a one-dimensional crystal with a diatomic lattice. Discuss the physical meaning of the acoustic phonon branch obtained from the relation.

2. Explain the basic assumptions of Einstein's theory of lattice specific heat. Derive the expression for the molar specific heat of a crystalline solid according to this model.

3. 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.

4. Describe the Fermi-Dirac distribution function, accompanied by an appropriate sketch of the distribution. How does it explain the occupancy of energy states in a fermion system? Why is the derivative of the Fermi-Dirac distribution function non-zero within the temperature range of k_BT around the Fermi energy?