# Jashore University of Science and Technology

## Department of Physics

### Bachelor of Science with Honours in Physics

### First semester of Third year

**Course no.: PHY 3103** **Course title: Quantum Mechanics I**

**Assignment no.: 01** **Date: May 03, 2022**

**Last date of submission: May 12, 2022**

**1.** Show that the components of angular momentum operator $\hat{\mathbf{L}}$ do not commute with each other but they all commute with $\hat{\mathbf{L}}^2$. [5]

**2.** Let $\hat{\mathbf{L}}$ be a quantum-mechanical angular momentum operator. Evaluate $[[\hat{L}_x, \hat{L}_y], [\hat{L}_y, \hat{L}_z]]$. [4]

**3.** Derive the expressions to write angular momentum operators $\hat{L}_x$, $\hat{L}_y$, $\hat{L}_z$ and $\hat{\mathbf{L}}^2$ in spherical coordinates. [4]

**4.** If $\hat{L}_z Y_{lm} = \hbar m Y_{lm}$, where $Y_{lm}$ is the spherical harmonics show that $m \in \mathbb{Z}$. [4]

**5.** Write down the properties of eigenvalue of $\hat{\mathbf{L}}^2$. [3]