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, 2023**

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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]