

Jashore University of Science and Technology
Department of Physics
Bachelor of Science with Honours in Physics
First semester of Third year
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Course no.: PHY 3103
Assignment no.: 01

Course title: Quantum Mechanics I
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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 $\hat{\mathbf{L}}^2$. [4]
2. Let $\hat{\mathbf{L}}$ be a quantum-mechanical angular momentum operator. Evaluate $[[\hat{L}_x, \hat{L}_y], [\hat{L}_y, \hat{L}_z]]$. [2]
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. [6]
4. Derive the the Schrödinger equation for a hydrogen like atom in terms of the relative coordinate \mathbf{r} and center of mass coordinate \mathbf{R} . Hence find the wave function that describes the ground state of the hydrogen atom. [8]