CH-3103- Quantum Chemistry II

Total marks = 20   Duration: 1 hour

Note: Answer all questions. Each question contains 5 marks.

1. Calculate the most probable value of r in 1s state. Wave function for 1s state is given by $\psi_{100} = \dfrac{1}{\sqrt{\pi}}\left(\dfrac{1}{a_0}\right)^{3/2} \exp\left(-\dfrac{r}{a_0}\right)$.

2. Calculate the probability that a hydrogen 1s electron will be found within a distance a_0 from the nucleus. [Given: $\int x^2 e^{bx} dx = e^{bx}\left(\dfrac{x^2}{b} - \dfrac{2x}{b^2} + \dfrac{2}{b^3}\right)$]

3. Prove that $\left[\hat{L}_z, \hat{L}_+\right] = \hat{L}_+$

4. If $\left[\hat{A}, \hat{B}\right] = c\hat{B}$, where c is a constant and $\hat{A}\psi = a\psi$, then prove that $\hat{A}(\hat{B}\psi) = (a+c)(\hat{B}\psi)$.