Ds Arvind Kumar Physics

20/11/23

End Semester Examination

Subject Code: PH-211 Subject Name: Quantum Physics

Semester: 3rd Branch: B.Tech. (Engg. Physics)

Max. Marks: 50 Max. Time: 03 Hours

Note: Attempt all questions.

Q1: (a) Write the mathematical expression for a wave packet that represents waves associated with a moving particle. (2)

(b) Solve the commutation relation: $[\widehat{p_x}, \hat{X}]$ (2)

(c) Write down time independent Schrödinger's equation (2)

(d) Write a mathematical expression for $\widehat{L_z}$. (2)

(e) Write down the periodic boundary condition for the rigid rotor case. (2)

Q2: Consider two states, $I\psi\rangle = 9iI\phi_1\rangle + 2I\phi_2\rangle$, and $I\varphi\rangle = -\frac{i}{\sqrt{2}}I\phi_1\rangle + \frac{1}{\sqrt{2}}I\phi_2\rangle$ where vectors, $I\phi_1\rangle$ and $I\phi_2\rangle$ form a complete and orthonormal basis. Calculate the operators $I\psi\rangle\langle\varphi I$ and $I\varphi\rangle\langle\psi I$. (10)

Q3: Consider a particle incident on a step potential of height V_o from the left with energy E greater than V_o. Calculate the reflection and transmission coefficients (10)

Q4: Determine the expression for the 1-D Harmonic oscillator's energy eigenvalues and eigenfunctions. (10)

Q5: Discuss in detail the space quantization of angular momentum components and their magnitudes. (10)