M.Sc DEGREE EXAMINATION,APRIL 2019
I Year I Semester
Quantum Mechanics - I

Time : 3 Hours   **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. Define stationary state.
2. State uncertainity principle.
3. Define Quantum mechanical tunneling.
4. What are ladder operators?
5. Define Hillbert space.
6. Write a note on parity and time reversal.
7. State Variation theorem.
8. Prove that the hydrogen atom does not show a first order STARK effect.
9. Evaluate the state vectors in the coupled representation for $j_1 = \frac{1}{2}$ and $j_2 = \frac{1}{2}$
10. State any four properties of Pauli spin matrices.
11. State WKB quantization rule.
12. Evaluate $[L_x , L_y]$.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. State the postulates of quantum mechanics.
14. Discuss reduction of two body problem with respect to change of coordinates.
15. Give an account of unitary transformations associated with translations and rotations.
16. Discuss the validity of WKB approximation.
17. What are Clebsch-Gordon co-efficients? Mention their properties.
18. Solve particle in a box problem using Schroedinger equation and derive the expressions for the energy and wave function.
19. Write a note on symmetric and anti-symmetric wave functions.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. State and prove Ehrenfest's theorems.

21. Solve the linear harmonic oscillator using operator method and obtain the expressions for energy and wavefunction of the harmonic oscillator.

22. Discuss Schroedinger's picture in detail and obtain the equation of motion.

23. Discuss time independent perturbation theory for non degenerate case and evaluate the wave function and energy corrected upto the I order.

24. Discuss the theory of matrix formulation of angular momentum and its components and evaluate J^2, J_z, J_x, J_y, J_+ and J in matrix form for $J = \frac{1}{2}$.

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