PART - A (8 x 4 = 32 Marks)  
(Short Answer Type)

1. Show that the momentum operator is Hermitian.
2. Show that eigen values of Hermitian operator are real.
3. Write a note on stationary states.
4. Distinguish between Schrodinger, Heisenberg and interaction pictures.
5. Write a note on Clebsch-Gordon coefficients.
6. What are the properties of Pauli spin matrices?
7. What are the space and time unitary operators?
8. Write a note on space inversion.

PART - B (4 x 12 = 48 Marks)  
(Essay Answer Type)

9. a) If a ket is simultaneously the eigen ket of two different operators then show that the two operators commute.  
   b) What is projection operator? State its physical significance.  
   c) Show that the state vector can be represented by a column matrix and the operator by a square matrix.

10. a) Define raising and lowering operators. Using these operators obtain the energy eigen values of one dimensional linear harmonic oscillator.  
   OR  
   b) Obtain the solution for the radial part of the Schrodinger equation for Hydrogen atom.

11. a) Calculate the Clebsch-Gordon coefficients for a system having  
      \[ j_1 = \frac{1}{2} \text{ and } j_2 = \frac{1}{2}. \]  
      OR  
      b) State the eigen value equations for the operators \( J^2 \) and \( J_z \).

12. a) Show that translational symmetry in space and time gives the conservation of linear momentum and energy respectively.  
   OR  
   b) Explain how the generator for infinitesimal rotation is related to angular momentum.

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