No. of Printed Pages : **2**

21PHY4C11L

Sl. No.

M.Sc. IV Semester Degree Examination, Sept./Oct. - 2024

PHYSICS

Advanced Quantum Mechanics

(NEP)

Time : 3 Hours Maximum Marks : 70

Note : *Answer **any five** of the following questions with Question No.**1 (Q1)** is **Compulsory**, each question carries **equal** marks.*

1. (a) Obtain first and second order time dependent equations for a given physical system using perturbation theory. **8**

(b) Explain the Fermi-Golden rule and its role in estimating rate of transition probability. **6**

2. (a) Construct symmetric and antisymmetric wave function for indistinguishable particles. **5**

(b) Obtain Clebsch-Gordan coefficients when two angular moments $j_1 = 1/2$ and $j_2 = 1/2$. **9**

3. (a) Explain the conservation of linear momentum during a spatial displacement. **7**

(b) Define parity and explain its significance in space inversion symmetry. **7**

4. (a) Discuss the Klein-Gordan equation for the free particle. **7**

(b) Establish Dirac's equation for an electron and calculate its magnetic moment. **7**

5. (a) Explain the concept of functional derivatives and their role in deriving the Lagrange equation. **7**

(b) Give an account of second quantization for a harmonic oscillator. **7**

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6. (a) Calculate the expectation value of operators L^2, Lx, Ly and Lz on a given eigen state $|1,1\rangle$, $|1,0\rangle$. **8**

(b) Why time reversal operator is not linear ? Explain. **6**

7. (a) Using Dirac's equation, obtain the energies of the bound states of H-atom. **8**

(b) Explain the significance of the classical Hamiltonian from the Lagrangian formulation. **6**

8. (a) Derive the matrix form of operator L^2, L_+, L_- and Lx for state 1=1. **5**

(b) Show that bosons can occupy the same quantum state using Pauli's exclusion principle. **5**

(c) Give the physical interpretation of Dirac's α and β matrices. **4**

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