



K22P 0194

Reg. No. :

Name :

II Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.) Examination, April 2022
(2018 Admission Onwards)

PHYSICS

PHY2C06 : Quantum Mechanics – I

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer both questions (Either a or b). Each question carries 12 marks.

1. a) Distinguish between Schrodinger, Heisenberg pictures and interaction pictures in quantum mechanics. Outline the interaction picture. Obtain the solution of linear Harmonic oscillator using Schrodinger picture.

OR

- b) What are Clebsch Gordan Coefficients ? Deduce recursion relations for Clebsch Gordan Coefficients.

2. a) Explain symmetry transformation. Discuss the effect of time reversal in the time dependent Schrodinger equation.

OR

- b) From time independent perturbation theory, arrive at the expression to the correction in the second order, for the energy of a system subject to a small perturbation.

SECTION – B

Answer any four. Each question carries 9 marks. 1 mark for Part – a, 3 marks for Part – b, 5 marks for Part – c.

1. a) Outline Dirac's bra and ket notation.
b) Explain the properties of Hilbert Space.
c) Prove that two eigen vectors of a Hermitian operator belonging to different eigen values are orthogonal.

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2. a) Define commutator of two operators A and B.
b) Discuss the properties of commutators.
c) Derive the general uncertainty principle.
3. a) What is a parity operator ?
b) Explain the basic postulates of quantum mechanics.
c) Obtain the equation of motion for the state vector in the interaction picture.
4. a) Define orbital angular momentum operator.
b) Obtain angular momentum matrices J_x , J_y and J_z for $j = \frac{1}{2}$.
c) Derive the expression for L_+ , L_- and L^2 in spherical polar coordinates.
5. a) What is unitary transformation ?
b) Show that an observable A is a constant of motion if the corresponding operator commutes with the Hamiltonian.
c) Show that rotational invariance of the Hamiltonian leads to the conservation of angular momentum.
6. a) What do you understand by classical turning point ?
b) Discuss the validity conditions of WKB approximation.
c) Derive connection formula.