No. of Printed Pages : **1**

21PHY2C6L

Sl. No.

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

PHYSICS

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) Describe Planck's quantum hypothesis and its significance in explaining the black body radiation. **5**

(b) State and prove Ehrenfest's theorem $(F_x) = \frac{d(P_x)}{dt}$. **9**

2. (a) Explain the degeneracy and non-degeneracy state of the quantum system. **5**

(b) Solve the radial part of the Schrodinger wave equation of the hydrogen atom. **9**

3. (a) Explain the Hilbert space with an example. **6**

(b) Evaluate the commutators, $\left[x, \frac{d}{dx}\right]$ and $\left[\frac{d}{dx}, F(x)\right]$. **8**

4. (a) Derive an expression for the linear harmonic oscillator by matrix method. **7**

(b) Discuss the Bohr-Sommerfeld quantum condition. **7**

5. (a) Obtain the expression for total scattering cross-section. **7**

(b) Explain the Born approximation in the theory of scattering. **7**

6. (a) Normalize the wave function $\psi(x) = A \exp(-ax^2)$, where 'A' and 'a' are constants over the domain $\infty \leq x \leq \infty$. **7**

(b) Discuss the algebra of Bra and Ket. **7**

7. (a) Discuss the normal state of the He-atom using the variation method. **6**

(b) Explain the nature of phase shift in the case of repulsive and attractive potentials. **8**

8. (a) Prove that Hermitian operators have real eigenvalues. **5**

(b) Explain briefly the theory of alpha decay using the WKB approximation. **5**

(c) Write a note on the optical theorem. **4**

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