Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: QUANTUM MECHANICS II — **Semester : VI**

Program: INTEGRATED B.SC-M.SC (PHYSICS) — **Time : 03 hrs.**

Course Code: PHYS 3034 — **Max. Marks: 100**

Instructions: ALL QUESTIONS IN SECTION ARE MANDATORY
QUESTION #9 AND #11 HAVE INTERNAL CHOICES

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Relate 'norm' to 'inner product' in Quantum Mechanics.	**4**	**CO1**
Q 2	What is a Unitary operator, and what is its significance in QM?	**3+1**	**CO1**
Q 3	What is an orthonormal basis?	**4**	**CO1**
Q 4	What is the significance of Eigen values and Eigen vectors in Quantum Physics?	**4**	**CO1**
Q 5	Exchange interaction is a 'Quantum' entity. What is it?	**4**	**CO2**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Are Fermions and Bosons distinguishable? Explain.	**10**	**CO4**
Q 7	Appraise the principle used in the Variation Method (Variational Principle) in Quantum Physics.	**10**	**CO2**
Q 8	What are the different types of reference frames considered in a scattering experiment? Compare them.	**10**	**CO3**
Q 9	Elaborate on Symmetric wave functions. OR Write a short note on Klein Gordon equation.	**10**	**CO4**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	What is the use of the Perturbation theory in Quantum Physics? Analyze the conditions when it can be used,	**4+4+12**	**CO1**

	Derive the expressions for the first-order and second order Energy terms in the energy of a non-degenerate level with known unperturbed Energy eigenvalue.		
Q 11	Define i) Differential scattering cross section, ii) total scattering cross section, and iii) scattering amplitude, with proper notations. a) Solve quantum mechanically scattering of a particle with another and obtain an expression for the scattering amplitude. OR b) Consider the scattering to be happening at low energy and obtain the above required quantity by the method of partial waves.	**3+3+3** **+11**	**CO3**