UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

Program: MSc Physics (All Batches)   **Semester: II**
Course: Quantum Mechanics-II   **Time: 3 hrs.**
Course Code: PHYS 7018   **Max. Marks: 100**

Instructions: Read all the instructions carefully:
1. *Attempt all the questions of Section A, B & C.*
2. *Section B & Section C have internal choices.*

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Interpret the concept of identical particles. What is the difference between Bosons and Fermions?	4	CO4
Q 2	Define harmonic and sudden perturbations.	4	CO1
Q 3	Outline the method of WKB approximation.	4	CO2
Q 4	State optical theorem for scattering problem.	4	CO3
Q 5	Why does the Dirac theory is more important than Klein-Gordon theory?	4	CO4
SECTION B			
(4Qx10M= 40 Marks)			
Q 6	Describe the time independent perturbation theory for non-degenerate stationary state. Obtain first order corrected eigen value.	10	CO1
Q 7	Obtain the relation between scattering angles in laboratory frame and center of mass frame.	10	CO3
Q 8	State and explain Pauli's exclusion principle for a system of two identical particles.	10	CO4
Q 9	State Fermi-Dirac statistics and explain its significance. **OR**	10	CO4

	What are symmetric and antisymmetric wave functions? Show that the antisymmetric wave function of two electrons would vanish if both occupy the same position with identical spin.		
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Apply the variation method to determine the ground state of Helium.	**20**	**CO2**
Q 11	Derive an expression for the total scattering cross-section of the particles by spherically symmetric potential. **OR** What is phase shift? Deduce an expression for it. Explain the nature of phase shift in case of repulsive and attractive potentials.	**20**	**CO3**