School of Basic Sciences

Department of Basic Sciences
Mid Term Examination

Exam Date: 03 Oct 2023
Time : 90 Minutes
Marks : 50

Sem V - C1UD502B - Quantum Mechanics and Spectroscopy

Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

1)	Explain the operators in quantum mechanics	K2	(2)
2)	What do you understand by phase velocity.	K1	(3)
3)	What is the wavelength of an electron moving at 5.31 x 10^6 m/sec? Given: mass of electron = 9.11×10^{-31} kg, h = 6.626×10^{-34} J s	K2	(4)
4)	Show that the group velocity of a wave associated with a material particle is same as the particle velocity 'v'.	K2	(6)
5)	Apply the concept of quantum mechanics and describe the time-evolution of expectation values.	K3	(6)
6)	Solve the following relation on operator $\hat{L},\ [\hat{L_x}, \hat{L_y}] = ih\hat{L_z}$	K3	(9)
7)	Categorize the quantum mechanical operators for some physical observables. Write 6 different observables and make a table including symbols in classical physics, Operator in QM and Operation.	K4	(8)
8)	An electron and photon each have a wavelength of 1.2 Å. Compare the momentum and total energy and also the ration of kinetic energy. Mass of the particle =$1.67 \times 10^{-24}\ kg$ and 1 eV= 1.6×10^{-19} joule.	K4	(12)

OR

	A neutron and photon each have a wavelength 0.02 Å. analyze the momentum and total energy and also the ration of kinetic energy. Mass of rest electron =1.67×10^{-27} kg and 1 eV= 1.6×10^{-19} joule.	K4	(12)