

PE-259
(522) M.Sc. Physics (Second Semester)
Examination June 2022
Compulsory/Optional
QUANTUM MECHANICS (I)
Paper-II

Time: Three Hours

Maximum Marks: 080
Minimum Passing Marks:

नोट: दोनों खण्डों से निर्देशानुसार उत्तर दीजिए। प्रश्नों के अंक उनके दाहिनी ओर अंकित हैं।

Note: Answer from both section as directed. The figures in the right-hand margin indicate marks.

SECTION-A

1. Answer the following questions:- [1 X 10 = 10]
 - (I) The expression for probability current density is _____.
 - (II) Write Einstein photo electric effect equation.
 - (III) Write expectation value of momentum P_x .
 - (IV) Write the condition A or an operator to be unity.
 - (V) X component of Pauli's spin matrices σ_x in matrix form can be written as _____.
 - (VI) What is Stark effect?
 - (VII) Write expression for eigen function for Hydrogen atom in radial part.
 - (VIII) Find the value of operator $[y, P_x]$
 - (IX) Write expression for Hamiltonian for perturbed Harmonic Oscillator.
 - (X) Define Spin angular momentum.

2. Answer the following questions:- [2 X 5 = 10]
 - (I) Establish time dependent Schrodinger wave equation.
 - (II) Explain uncertainty relation of x and p_x .
 - (III) Explain addition of angular momentum.
 - (IV) Discuss Bra and Ket notation.
 - (V) What is meant by perturbation?

SECTION-B

- Answer the following questions:- [15 X 4 = 60]
3. What is Compton effect? How does it explain the particle nature of radiation.
Or,
Solve Schrodinger equation for potential well.

 4. What is a wave packet? Obtain an expression for Gaussian wave packet.
Or,
Describe various representations and their transformations using unitary operators U , V and W .

 5. Obtain eigen value and eigen functions of angular momentum operators.
Or,
Write Schrodinger equation for radial part in Hydrogen atom and solve it. Obtain eigen value and eigen function.

 6. Discuss the time dependent perturbation theory for non degenerate case of first order.
Or,
Solve Schrodinger equation for first order Stark effect in Hydrogen.