

CC-XI

QUANTUM MECHANICS & APPLICATIONS

1 MARK QUESTIONS:

1. What is Schrödinger time independent wave equation?
2. What is Schrödinger time dependent wave equations?
3. What do you mean by eigen values?
4. What do you mean by eigen functions?
5. Mention the properties of wave-functions.
6. Give interpretation of wave-functions?
7. What is an operator?
8. What is Hermitian operator.
9. Write operators associated with energy and momentum.
10. What do you mean by eigen function and eigenvalues of an operator?
11. Explain the concept of Hamiltonian.
12. Explain stationary states.
13. Explain energy eigen values.
14. What do you mean by Gaussian wave-packet?
15. What is Fourier transform?
16. What is a commutator?
17. State Heisenberg's uncertainty principle.
18. What is the value of commutator of position and momentum operators?
19. Explain a single step potential barrier
20. What is Bohr's magneton?

1.5 MARK QUESTIONS:

1. Show that sum of two Hermitian operators is Hermitian.
2. Show that every eigenvalue of Hermitian operator is real.
3. Derive momentum space wave function.
4. Give the Fourier analysis of a wave-function.
5. What is Parseval's formula.
6. Describe the physical significance of wave-functions.
7. Explain the Fourier transform to a rectangular wave function.
8. Discuss the boundary conditions at the surface of infinite potential.
9. Write the boundary conditions in the problems of potential step.
10. Discuss one dimensional square well potential.
11. Explain the quantum numbers associated with vector model of the atom.
12. Describe space quantization.
13. Explain the concept of electron spin.
14. Explain orbital angular momentum and spin orbital.
15. Discuss electron angular momentum.
16. Discuss spin and spin angular momentum.

17. Explain magnetic moment of an orbital electron.
18. Explain magnetic moment due to electron spin.
19. Describe Stern-Gerlach experiment.
20. Explain Larmor's experiment theorem.
21. Derive energy eigen function of simple harmonic oscillator.
22. Discuss the normalization of eigen function.
23. Show that momentum operator commutes with the free particle Hamiltonian operator.

2.5 MARK QUESTIONS:

1. Show that the product of commuting Hermitian operators is Hermitian.
2. What do you mean by expectation value of a dynamical quantity?
3. Write expressions for expectation value of energy and momentum.
4. Write the equation of motion for operators.
5. Two eigen functions of Hermitian operator belonging to different eigenvalues are orthogonal.
6. Show that position operator (x) and momentum operator (p) are Hermitian.
7. Explain the conditions for physical acceptability of wave-functions.
8. Give the normalization of wave-functions.
9. What do you mean by probability and probabilities current densities?
10. Explain linearity and superposition principle.
11. Write down Schrödinger wave equation for free particle.
12. Write a short note on tunnel effect.
13. What do you mean by quantum mechanical scattering?
14. Define scattering amplitude and phase shift.
15. Discuss the problem of scattering in an attractive potential.

5 MARK QUESTIONS:

1. Derive Schrödinger time independent wave equation. What is the significance of wave function?
2. Derive Schrödinger time dependent wave equation. Give the properties of wave function.
3. Develop the time independent Schrödinger wave equation. What are the conditions that must be satisfied by the solution of this equation?
4. Derive Schrödinger wave equation. Explain eigen-values and eigen-functions.
5. What is meant by Hermitian operator? Show that Hermitian operators give real eigen values.
6. Define Hermitian operator. Explain few properties of Hermitian operator.
7. What do you mean by Hermitian operator? Show that eigen functions of Hermitian operator belonging to different eigenvalues are orthogonal.

8. What is Hermitian operator? Show that if two Hermitian operators commute, then their product is also Hermitian operator.
9. Derive Schrödinger time dependent wave equation and give its solution.
10. What is Gaussian wave-packet. Explain the spread of Gaussian wave packet for a free particle in one dimension.
11. Write short notes on I) J-J coupling II) L-S coupling