M.Sc . DEGREE EXAMINATION,APRIL 2020
I Year I Semester
Quantum Mechanics-I

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. Give the Heisenberg's uncertainty principle.
2. Define Eigen values and Eigen functions.
3. What do you mean by central forces?
4. Define spherical harmonics.
5. Write down the Dirac notation.
6. Define Hilbert space.
7. Mention application of variation method.
8. Give the WKB quantization rule.
9. Write the spin and Pauli matrices.
10. Write down the Clebsch-Gordan Coefficients.
11. Define the terms: parity operation and time reversal.
12. What do you mean by unitary transformations?

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. List out the postulates of quantum mechanics.
14. Describe the barrier penetration problem.
15. Explain coordinate and momentum representations.
16. Outline on symmetries and conservation laws.
17. For Paulis matrices, prove that: (i) $[\sigma_x, \sigma_y] = 2i\sigma_z$, and (ii) $\sigma_x\sigma_y\sigma_z = i$.
18. Give interpretation and conditions on the wave function.
19. Prove that any two eigenfunctions of a Hermitian operator that belongs to different eigenvalues are orthogonal.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. State and prove the Ehrenfests theorem.
21. Establish the Schrodingers equation for a linear harmonic oscillator and solve it to obtain its Eigen values and Eigen functions.
22. Discuss the Schrodinger and interaction pictures.
23. Explain time-independent perturbation theory for non-degenerate and degenerate levels.
24. Explain the following in brief: (i)Spin angular momentum, and (ii)Non-relativistic Hamiltonian.

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