SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai — 600 044.
M.Sc. END SEMESTER EXAMINATIONS NOVEMBER - 2022
SEMESTER - I
22PPHCT1003 - Quantum Mechanics - I

Total Duration : 2 Hrs 30 Mins. Total Marks : 60

Section A

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Brief on normalization and box normalization on a wave function.
2. State and prove Heissenberg's uncertainty principle.
3. Obtain the radial equation for a particle in a central potential.
4. Write short notes on
   (a) state vectors and their conjugates
   (b)norm and scalar product.
5. Write a short note on self adjointness of an operator.
6. Prove the following:
   (i) $[J_z, J_+] = \hbar J_+$
   (ii) $[J_+, J_-] = 2\hbar J_z$.
7. Write short notes on symmetric properties of Clebsh – Gordan coefficients.
8. Brief on WKB approximation.

Section B

Part A

Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. State and prove Ehrenfest theorem.
10. Obtain the energy eigen values and eigen functions of a hydrogen atom.
11. Discuss on unitary transformation induced by change of co-ordinate system involved with translation.
12. Describe the theory of spin angular momentum based on Pauli's spin matrices.

Part B

Compulsory question $(1 \times 10 = 10$ Marks)

13. Obtain the expression for the first order correction terms in eigen values and the eigen functions using time – dependent perturbation theory.

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