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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021 ONLY) **SUBJECT CODE 21PPS204**

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS): POLLACHI

END-OF-SEMESTER EXAMINATIONS: JULY–2022

M.Sc. PHYSICS **MAXIMUM MARKS: 70**

SEMESTER - II **TIME: 3 HOURS**

CORE-IV : QUANTUM MECHANICS - I

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS. (K1)

1. An ---------- is a mathematical operation which may be applied to a function which changes the function to another function.
   (a) Operator (b) eigen value (c) eigen function (d) equation
2. ---------- symmetric Systems are those in which the potential energy of the particle does not depend on Θ and φ and is only the function of radial distance r.
   (a) Elliptically (b) Spherically (c) conoically (d) Rotational
3. Two different components of angular momentum does ----------.
   (a) commute (b) does not commute (c) commute each other (d)the same
4. When the potential function is a slowly varying function of position, the problem can be solved by the approximate method known as ----------method.
   (a) variation (b) WKB (c)perturbation (d) variable separable
5. The optical theorem relates the total scattering cross – section to the scattering amplitude in the forward direction, that is the scattering amplitude for Θ = ----------.
   (a) 0 (b)1 (c) -1 (d) -0

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES (K2)

6. When do you say the given vector space is Hilbert space?
7. When is the rigid rotator said to be in a fixed plane?
8. State Pauli's exclusion Principle.
9. What is Stark effect?
10. Define: Scattering cross section.

SECTION – B (5 X 4 = 20 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11.(a)State and prove the Ehrenfest's theorem

(OR)

(b)Write a note on Schwarz inequality.

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12. (a) Get the solution of φ equation for Hydrogen Atom.

(OR)

(b) Obtain an expression for spherical Bessel's function in 3D square well potential.

13. (a) Solve: $[L^2 , L_X]$

(OR)

(b) Discuss the symmetric and anti-symmetric wave functions for a system of identical particles.

14. (a) Give the basic ideas of Variation method.

(OR)

(b) Write a note on Validity of WKB approximation.

15. (a) Get the Scattering cross section expression for Screened Coulomb potential.

(OR)

(b) Obtain the condition for Validity of Born approximation.

SECTION – C (4 X 10 = 40 MARKS)

ANSWER ANY FOUR OUT OF SIX QUESTIONS. (K4 (Or) K5)
(16thQUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS FROM Qn. No : 17 to 21)

16. Explain the Schrodinger representation in equations of motion.

17. Discuss the Change of Basis in Unitary transformations.

18. Get the solution for 3D Harmonic Oscillator.

19. Write a note on Addition of angular momenta and CG Coefficients.

20. Evaluate the first order energy and wave function in Perturbation theory for a system with Non- Degenerate energy levels.

21. Describe the Partial Wave Analysis.

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