

C 82888

(Pages : 2)

Name.....

Reg. No.....

SECOND SEMESTER M.A./M.Sc./M.Com. DEGREE EXAMINATION, JUNE 2020

(CUCSS)

Physics

PHY 2C 05 QUANTUM MECHANICS—I

(2012 Admissions)

Time : Three Hours

Maximum : 36 Weightage

Section A

12 Short questions answerable within 5 minutes.

Answer all questions, each carries 1 weightage.

1. What are the admissibility conditions on a wavefunction ?
2. The zero-point energy is a manifestation of which principle ?
3. What is the condition for two eigen vectors to be orthogonal ?
4. Explain the matrix representation of a wave function ?
5. State and explain the Schrödinger equation in matrix form.
6. Briefly explain addition of angular momenta.
7. Explain the properties of Pauli spin matrices.
8. What is phase shift ? Explain the nature of phase shift in the case of repulsive and attractive square well potentials ?
9. Conservation of angular momentum is a consequence of the rotational invariance of the system. Substantiate
10. What is scattering amplitude ? How is it related to scattering cross section ?
11. Define differential cross section and total cross section. What is the unit in which they are measured ?
12. Explain symmetric and antisymmetric wavefunctions.

(12 × 1 = 12 weightage)

Turn over

Section B

2 essay questions answerable within 30 minutes.

Answer any **two** questions, each carries 6 weightage.

13. Explain what is meant by a Hermitian operator. Show that :
 - a) The eigen values of a Hermitian operator are real ; and
 - b) Eigen functions of a Hermitian operator belongs to different eigen values are orthogonal.
14. What are clebsch Gordan co-efficients ? Mention their properties and selection rules ?
15. Write short notes on :
 - a) Symmetric and anti-symmetric wave functions.
 - b) Pauli exclusion principle and Spin wave functions for two electrons.
16. What is phase shift ? Explain the nature of phase shift in the case of attractive square well potentials.

(2 × 6 = 12 weightage)

Section C

3 problems answerable within 15 minutes

Answer any **three** questions, each carries 4 weightage.

17. Discuss the Heisenberg pictures.
18. Show that the expectation value of the momentum P for a bound state of a one particle system is zero for a stationary state.
19. A bullet of mass 0.03 kg is moving with a velocity 500 m/s . The speed is measured up to an accuracy of 0.02%. Calculate the uncertainty in x. Also comments on the result.
20. If $[A, L_x] = [A, L_y] = [A, L_z] = 0$ what is the value of $[A^2, L^2]$?
21. Show that Pauli spin matrices satisfy $\sigma_i \sigma_j + \sigma_j \sigma_i = 2I \delta_{ij}$ (I is a 2×2 matrix).
22. Discuss validity conditions for Bom approximation.

(3 × 4 = 12 weightage)