

45071

M.Sc. DEGREE EXAMINATION, MARCH/APRIL 2019.

FOURTH SEMESTER

Physics

Paper I — QUANTUM MECHANICS — II

Time : Three hours

Maximum : 75 marks

(No additional sheet will be supplied)

SECTION A — (5 × 3 = 15 marks)

Answer any FIVE of the following.

Each question carries 3 marks.

Each answer should not exceed 2 pages.

1. Explain symmetric and anti-symmetric wave functions.
2. Describe Pauli's exclusion principle.
3. Show that L^2 commutes with any three components of L .
4. Write the eigen values for L^2 and L_z .
5. What are the inadequacies of Klein Gordon equation?
6. Write the properties Dirac's matrices.
7. Write the Hamiltonian formulation of field.
8. Explain the phenomenon of creation and annihilation.

SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. (a) Discuss the theory of hydrogen molecule and obtain its symmetric and anti-symmetric wave function.
(b) Explain the origin of ortho - and para - hydrogen.

Or

10. (a) Which are called identical particles? Explain the physical meaning of identity.
(b) Construct the symmetric and anti-symmetric wave functions from the unsymmetrical wave function.

11. (a) What is spin angular momentum? Obtain Pauli's spin matrices.
(b) Discuss the commutative relations among the Pauli's spin matrices.

Or

12. What are Clebsch Gordan coefficients? Obtain Clebsch Gordan coefficients for angular momentum $J_1 = J_2 = 1/2$.
13. (a) Derive Klein — Gordon relativistic equation for a free particle.
(b) Write the Klein — Gordon relativistic equation in co-variant form.

Or

14. (a) Write the Dirac's relativistic equation for a free particle and explain the significance of Dirac's matrices.
(b) Discuss how the spin and angular momentum of electrons are explained by Dirac's equation.
15. (a) Explain the method of canonical quantization.
(b) Discuss the quantization of non-relativistic Schrodinger's equation.

Or

16. (a) What is occupation number representation and how it is useful to explain creation and annihilation?
(b) Explain the system of Fermions and Bosons.

