45071

M.Sc. DEGREE EXAMINATION, MARCH/APRIL 2020.

FOURTH SEMESTER

Physics

Paper I — QUANTUM MECHANICS – II

Time : Three hours

Maximum : 75 marks

(No additional sheet will be supplied)

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

Each question carries 3 marks.

Each answer should not exceed 1 page.

1. Interpret the concept of indistinguishability of identical particles.

2. Construct the wave functions for two Fermions.

3. Obtain the commutation relations of L_x and L_z and L_x and L_y.

4. Obtain the Pauli spin matrices.

5. What are the inadequacies of Klein–Gorden equation?

6. Discuss the existence of spin angular momentum.

7. Explain the concept of second quantization.

8. Write a note on creation and annihilation operators.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. Define the particle exchange operator and show that its eigen values are plus one or minus one. Basing on the concept of identical particles formulate the Pauli's principle.

Or

10. Deduce the symmetric and anti-symmetric wave functions of hydrogen molecule. Discuss ortho and para hydrogen.

11. Obtain the eigen values and eigen functions to L^2.

Or

12. Obtain clebsch Gordon coefficients for angular momentum $J_1 = 1$ and $J_2 = 1/2$.

13. Derive Klein-Gorden relativistic equation for a free particle and explain probability and probability current density.

Or

14. Derive the Dirac relativistic wave equation for a free particle and write the properties of Dirac matrices.

15. Show that the classical Hamiltonian equations in motion for a field agree with the Lagragian equation in a cell approximation.

Or

16. Discuss the quantization of non-relativistic Schrodinger equation. Write the occupation number representation for bosons.

_____

45071