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MSCPH-512

Advanced Quantum Mechanics

M.Sc. Physics (MSCPH)

3rd Semester Examination, 2023 (June)

Time : 2 Hours] **Max. Marks : 70**

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

(2×19=38)

1. Describe the optical theorem and show that the first born approximation method or quantum scattering violates the optical theorem.

2. Discuss briefly the time dependent perturbation theory and derive an expression for the transition probability to a group of states per unit time.

3. Give a simple derivation of Klein-Gordan equation. What types of particles obey this equation ? Discuss the difficulties historically associated with the interpretation of this equation and how they have been overcome.

4. Describe indentical particles and exhange degeneracy. Discuss Schwinger's action principle.

5. What do you mean creation, annihilation and number operator ? Hence describe occupation number representation in the case of Bose-Einstein and Fermi-Dirac statistics.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. (4×8=32)

1. Define the scattering cross-section. Describe the method of partial waves for potential scattering.

2. Give some applications of time-dependent perturbation theory.

3. Distinguish between adiabatic approximation and sudden approximation.

4. Mention the difficulties with K-G equation and interpretate the negative energy states.

5. Discuss the magnetic moment of an electron due to spin.

6. Explain symmetric and antisymmetric functions for many particle system.

7. Discuss Lagrangian and Hamiltonian densities.

8. Explain in brief quantization of non-relativistic Schrödinger matter field.
