A–093

Total Pages : 3 **Roll No. .....**

MSCPH-512

M.Sc. PHYSICS (MSCPH)

(Advanced Quantum Mechanics)

3rd Semester Examination, 2024 (June)

Time : 2:00 Hrs. 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 answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) 2×19=38

***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.

1. Give the theory of Born approximation in the scattering. Use it to find the Rutherford's scattering cross-section formula.
2. Discuss transition probability and derive Fermi-Golden rule. Explain the limit of this rule.
3. Derive Dirac's relativistic wave equation. Obtain spin orbital coupling energy.
4. Describe identical particles and exchange degeneracy. Discuss Schwinger's action principle.
5. Describe quantization of the Schrodinger equation for non relativistic domain. What are creation and annihilation operators ?

Section–B

(Short Answer Type Questions) 4×8=32

***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.

1. Explain Phase shift in scattering process and obtain optical theorem.
2. Deduce the transition probability per unit time for emission where perturbation term has harmonic form.
3. Distinguish between adiabatic approximation and sudden approximation.

4. Derive Klein-Gordan equation and mention difficulties associated with the interpretation of this equation.
5. Show that Dirac equation predicts both positive and negative energy states for electron.
6. Explain symmetric and antisymmetric functions for many particle system.
7. Obtain expression for Hamiltonian density.
8. Discuss commutation and anticommutation relations.

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