A-0594

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

MSCPH–512

M.Sc. PHYSICS (MSCPH)

(Advanced Quantum Mechanics)

3rd Semester Examination, Session December 2024

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. Explain scattering cross section, phase shift in scattering problem. Deduce expression for the scattering cross-section of particles by a spherically symmetric potential.

2. Develop the semi-classical radiation theory and use it to determine the condition for allowed transition.

3. Solve the Dirac's equation a particle in central field force and calculate the spin orbit coupling energy.

4. Discuss exchange degeneracy of indistinguishable particle. Explain different state of He atom.

5. Give an account of second quantization for a harmonic oscillator and interpret the annihilation operators. Show that an electromagnetic field can be thought of as mathematically equivalent to a system of harmonic oscillators.

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. Derive the theory of Born-approximation in scattering to calculate scattering length.

2. Deduce the transition probability per unit time for emission where perturbation term has harmonic form.

3. Discuss Fermi's-Golden rule.

4. Explain the interpretation of negative energy states in relativistic quantum mechanics.

5. Show that the Dirac's matrices have spin –1/2.

6. Obtain Klein-Gordon equation and discuss its shortcomings.

7. What is Schwinger's action principle ?

8. Discuss commutation and anticommutation relations.

****