WA-5327

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M. Sc. (Sem. II) Examination, June-2024

PHYSICS

PAPER - PHY - 2003

Quantum Mechanics - II

Time Allowed : **Three Hours**

Max. Marks : **70**

Min. Marks : **28**

This question paper contains two sections as under.

Section-A ***Max. Marks-20***

This section will have 10 questions, having 02 questions from each unit with no internal choice. Answer in about 20 words. All questions will have equal marks. (10×2=20)

Section-B ***Max. Marks-50***

This section will have 10 questions, having 02 questions from each unit, one question to be attempted from each unit. Words limit approximately 400-500 words. Questions may have sub divisions. All questions will have equal marks. (10×5=50)

SECTION - A

1 (i) Define differential scattering cross section.

(ii) State the optical theorem.

(iii) What is Born approximation?

(iv) Write down the Lippman-Schwinger equation.

(v) What do you understand by the term "probability current density"?

(vi) Write down the completeness relations for Dirac Spinors.

(vii) What is charge conjugation?

(viii) What is Klein paradox?

(ix) Explain the transversality condition.

(x) Define annihilation operator.

SECTION - B

UNIT - I

2 Derive the solution of scattering problem by the method of partial wave analysis.

OR

Explain the process of scattering from a delta potential in one dimension. Derive the reflection and transmission coefficients for a particle encountering a delta potential barrier. Discuss how these coefficients depend on the energy of incident particle and strength of the potential.

UNIT - II

3 Explain the role of the Green function in solving the scattering problem in QM. How does the Green function help in determining the scattering amplitude and the wave function of a particle scattered by a potential ?

OR

Discuss the Coulomb scattering problem under first Born Approximation in elastic scattering.

UNIT - III

4 Obtain the solution of free particle KG equation in momentum representation. Provide interpretation of negative probability density and negative energy solutions.

OR

Write down Dirac equation for a free particle. Discuss the properties of Dirac matrices. Obtain solution of the free particle Dirac equation.

UNIT - IV

5 (a) Describe Lorentz covariance of Dirac equation.

(b) Explain Zitter bewegung.

OR

Explain projection operators involving four momentum and spin, hanty, charge conjugation, time reversal and CPT operators for Dirac spinors.

UNIT - V

6 Describe :

(i) Quantization of K G Field

(ii) Photon as a quantum mechanical excitation of the radiation field.

OR

Explain Feynman Rules of QED and Feynman diagrams.
