TM243255N

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, NOVEMBER 2024

2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY

SEMESTER III - CORE COURSE PHYSICS

PH3C09TM20 - Quantum Mechanics – II

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Write down the quantization conditions obtained from WKB method in problems with two infinite vertical walls.
2. When can WKB method be applied?
3. Comment on 'detailed balancing'.
4. Give reason for regarding time dependent perturbation as an inexhaustible source or sink of energy.
5. Explain the symmetrization requirement for identical particles.
6. Write down the properties of Dirac matrices.
7. Explain the importance of Klein-Gordon equation.
8. The dimension of Dirac matrices have to be even. Why ?
9. Give the relation between scattering amplitude and differential cross section.
10. Briefly discuss Ramsauer-Townsend effect.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. What are connection formulas? Why are they necessary in WKB approximation?
12. Apply stationary state perturbation theory to find the energy of a harmonic oscillator.
13. Arrive at an expression for atomic wave function for a photoelectron showing transition from initial state |i> to a continuum of final states.
14. If there are two indistinguishable particles in two different orthogonal and normalized states, show that they tend to be closer together.
15. Verify that probability density and current density defined for Dirac equation satisfy the continuity equation.
16. Bring out the limitations of KG equations. How are they remedied in Dirac equation?
17. Describe the perturbation effects when a charged particle is placed in an external electromagnetic field.
18. Evaluate the scattering amplitude for Yukawa potential.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Discuss the barrier penetration problem on the basis of WKB approximation.
20. Discuss the decay of initial ket under perturbation. Also obtain an expression for rate of decay as a function of transition probability from initial state to other final states.
21. Discuss the phase shift analysis for hard sphere scattering.
22. Derive the Dirac equation and hence find the conserved current.