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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JANUARY 2024

Third Semester

Faculty of Science

Branch II—Physics (A)—Pure Physics

PH 3C 09—QUANTUM MECHANICS—II

(2018 Admissions—Supplementary/2017, 2016 and 2015 Admissions—Mercy Chance)

Time : Three Hours Maximum Weight : 30

Part A

Answer any **six** *questions.*
Each question carries 1 *weight.*

1. What is harmonic perturbation ?
2. What is Fermi's golden rule ?
3. Obtain the expression for differential scattering cross-section.
4. What is the resonance scattering ? Give an example.
5. Explain the relevance of Yukawa potential.
6. What are gamma matrices ?
7. What are the short comings of Klein-Gordon equation ?
8. What is positive definite Hamiltonian ?
9. What is Noether's theorem and its consequences ?
10. What is meant by canonical quantization of Dirac field ?

$(6 \times 1 = 6)$

Turn over

Part B

Answer any **four** *questions.*
Each question carries 2 *weight.*

11. Calculate the transition probability for two discrete; levels coupled by a triangular perturbation V (t) acting for a time equal to its period T.

12. For a rigid sphere potential of radius a, show that the scattering cross-section is given by $\sigma = 4\pi a^2$.

13. Discuss Ramsaur-Townsend effect.

14. Obtain the Dirac equation in covariant form.

15. Obtain the quantization rules for Bose particles.

16. Discuss the canonical quantization of Dirac field.

$(4 \times 2 = 8)$

Part C

Answer **all** *questions.*
Each question carries 4 *weight.*

17. (a) What is transition probability ? Obtain an expression for total transition probability in case of constant perturbation.

Or

(b) Discuss the sudden and adiabatic approximation in detail.

18. (a) Obtain the differential cross-section for scattering in the Born approximation for a Gaussian potential.

Or

(b) Discuss the partial wave analysis and apply it to the problem of hard sphere scattering.

19. (a) Obtain the free particle solution of Dirac equation and explain their significance.

Or

(b) Derive Klein-Gordon relativistic wave equation.

20. (a) Discuss the quantization in Klein Gordon field.

Or

(b) Obtain the Euler-Lagrange equation for fields.

$(4 \times 4 = 16)$