F 4703 (Pages : 2) Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JANUARY 2017

Third Semester

Faculty of Science

Branch II—Physics—A—Pure Physics

PH 3C 09—QUANTUM MECHANICS—II

(2012 Admission onwards)

Time : Three Hours Maximum Weight : 30

Part A

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

1. Bring out the Dyson's series and features.
2. What is Fermi golden rule ? Explain.
3. Obtain the expression for differential scattering cross-section.
4. Explain the relevance of Yukawa potential.
5. Explain Ramsaur-Towensend effect.
6. Give the conserved current representation.
7. What is meant by relativistic covariance of Dirac equation ?
8. State and explain the Noether's theorem.
9. State the quantisation rules for bosons.
10. What is positive definite Hamiltonian?

(6 × 1 = 6)

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. Bring out the limitations of KG equations. How are they remedied in Dirac equations ?

Turn over

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

14. How did Dirac interpret the possible negative energy solution for a free particle ? Discuss.

15. Obtain the quantisation rules for Bose particles.

16. Discuss the canonical quantisation of Dirac field.

(4 × 2 = 8)

Part C (Essay)

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

17. (a) Give the time dependent perturbation for a Harmonic perturbation. Discuss the dipole approximation.

Or

(b) Use time dependent perturbation theory to obtain the transition probability per unit time for a periodic perturbing field.

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

Or

(b) Explain the technique of expanding a plane wave in terms of partial waves. Apply the partial wave method to study scattering by a square well potential and obtain an expression for the s-wave scattering cross-section.

19. (a) Show that Dirac equation is co-variant under Lorentz transformation. What are the bilinear co-variants of Dirac function ?

Or

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

20. (a) Obtain the Euler Lagrangian equation for the fields.

Or

(b) Discuss the quantization of KG field.

(4 × 4 = 16)