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THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2022

(CBCSS)

Physics

PHY 3C 09—QUANTUM MECHANICS—II

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

Answer **all** *questions.*
Each question carries weightage 1.

1. Explain the consequence of linear stark effect in hydrogen atom.
2. What is the principle of non-degenerate time independent perturbation theory ?
3. What are the limitations of WKB approximation ?
4. Describe the principle of Variational method.
5. Briefly discuss detailed balancing. Explain why the intensity of stimulated emission between two atomic levels is much less than that of stimulated absorption.
6. What is differential scattering cross section ? How is it related to number of particles scattered ?
7. What is Weyl equation ? Give its significance.
8. Give Klein Gordon equation. Give its features.

(8 × 1 = 8 weightage)

Section B

Answer any **two** *questions.*
Each question carries weightage 5.

9. Discuss time independent perturbation theory and apply it to find the shift in energy levels of an atom when placed in weak and strong magnetic fields.
10. Discuss WKB approximation with respect to tunnelling a potential barrier and hence explain alpha decay from the nucleus.

Turn over

11. Discuss scattering by a central potential and hence state and prove optical theorem.

12. Find the nonrelativistic limit of Dirac equation and hence show that the positive energy p particles are electrons.

(2 × 5 = 10 weigh

Section C

Answer any **four** *questions.*
Each question carries weightage 3.

13. Apply stationary perturbation theory to find the energy levels of Anharmonic oscillator.

14. Using Variational principle find the ground state energy of one dimensional harmonic osc

15. Give an account of electric dipole approximation and obtain expression for transition prob for unit time.

16. Apply Time dependent perturbation theory in the case of Harmonic perturbation to fi transition probabilities.

17. Show that the scattering cross section is independent of energy and scattering angle for scat by square well potential.

18. Find the equation of continuity for the Dirac particle and hence derive the expression for cons current from Dirac equation.

19. Show that the orbital angular momentum is not conserved for Dirac particles.

(4 × 3 = 12 weig