D 132058 **(Pages : 2)** **Name.....**

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY] EXAMINATION, NOVEMBER 2025

(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. What is hyperfine splitting in hydrogen atom ?
2. Explain briefly the principle of time independent perturbation theory.
3. List the connection formulas in WKB approximation.
4. Explain briefly the variation method for excited states.
5. Discuss validity of Born approximation.
6. What do you mean by condition of detailed balancing ?
7. What are spinors ?
8. Write down Weyl equation for neutrino.

(8 × 1 = 8 weightage)

Section B

Answer any **two** *questions, each question carries weightage* 5.

9. Discuss the fine structure of hydrogen atom. Obtain the complete fine structure formula by considering the relativistic correction and spin orbit coupling.
10. Discuss the time dependent perturbation theory. Derive the transition probability for harmonic perturbation.

Turn over

11. What are Partial waves ? Obtain optical theorem.

12. Write an essay on nonrelativistic limit of an operator in Dirac theory.

(2 × 5 = 10 weightage)

Section C

Answer any **four** *questions, each question carries weightage* 3.

13. Discuss stark effect in hydrogen atom.

14. Optimize the trial wave function e^{-ar} and evaluate the ground state energy of hydrogen atom.

15. What is dipole approximation? Also define electric dipole transition moment.

16. What is scattering amplitude? How is it related to scattering cross section?

17. Derive Klein Gordan equation.

18. Discuss hole theory.

19. Obtain the first order correction to the energy eigen value of an anharmonic oscillator.

(4 × 3 = 12 weightage)