D 11688 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2021

(CBCSS)

Physics

PHY 3C 09—QUANTUM MECHANICS—II

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*
4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

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

1. What is the difference between the Zeeman correction to energy in weak magnetic field and in strong magnetic field ?
2. Explain why non degenerate time independent perturbation theory cannot be applied to degenerate cases.
3. Describe the principle of Variational method.
4. Describe the connection formulae for WKB approximation.
5. What is meant by Dyson's series ?
6. What is optical theorem ? What does it imply ?
7. What are the properties of Dirac matrices ?
8. What is Weyl equation ? Give its significance.

(8 × 1 = 8 weightage)

Turn over

Section B

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

9. Discuss time independent degenerate perturbation theory and apply the same to explain th structure of the Hydrogen atom due to the relativistic correction.

10. Describe the method of WKB approximation. Apply it to find the wave function and energy a potential well with two vertical walls.

11. Deduce the expression for transition probability for induced emission for an atom placed electromagnetic field.

12. Discuss the method of partial waves with respect to the scattering by central potential. Fi total scattering cross section.

(2 × 5 = 10 weig

Section C

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

13. Find the wave function and energy levels of anharmonic oscillator.

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

15. Apply Time dependent perturbation theory to find the absorption energy from the field in t of Harmonic perturbation.

16. For scattering by square well potential show that the scattering cross section is indepen energy and scattering angle.

17. Derive the Klein Gordon equation. Find the corresponding probability density.

18. Show that the total angular momentum is a constant of motion for Dirac particles.

19. Using time independent perturbation theory find the first order correction to the energy state of hydrogen atom in the presence of electric field.

(4 × 3 = 12 weig