21P306 (Pages: 2) Name: .....

Reg.No: .....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY3 C09 - QUANTUM MECHANICS - II

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Section A

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

1. How you will find the first order perturbation energy for a degenerate case?
2. Write a short note on hyperfine splitting in the ground state of hydrogen.
3. Explain Bohr-Sommerfeld quantisation theory.
4. Write and explain the basic equation of first order time dependent perturbation theory.
5. Obtain the expression for total scattering cross section.
6. Show that the effect of the scattering potential is to shift the phase of each outgoing partial wave.
7. Explain Optical theorem in scattering.
8. Briefly explain Hole theory of electron.

(8 × 1 = 8 Weightage)

Section B

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

9. How time Independent perturbation theory can be used to explain Stark effect? The levels undergoing splitting in Stark effect doesn't undergo splitting in Zeeman effect. Comment.
10. Discuss variation method for the evaluation of eigen values. Obtain the ground state energy of Helium atom by variation method.
11. Obtain the expression for total transition probability for unit time when an atom interact with an electromagnetic field.
12. Obtain Klein-Gordon equation. Discuss how the reinterpretation helped to overcome the limitations?

(2 × 5 = 10 Weightage)

Section C

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

13. A perturbation in the form H'=ax is applied to a particle under potential V(x)=0, for $0 \leq x \leq \pi$;V(x)= ∞ otherwise. Calculate the correction in ground state energy.

14. Obtain energy levels of a particle moving under the potential V (x) = k |x| by WKB method.

15. Using WKB method solve the one dimensional potential well given by V(x) = 0 for -a<x<a, V(x)=∞ for x>a

16. Discuss the transititon probability of a system under harmonic perturbation.

17. By using partial wave analysis, obtain the expression for scattering cross section when the size of the scattering center is greater than the wave length of the incident particle. Compare the result with classical scattering cross section.

18. Explain the properties of Dirac matrices.

19. Consider a Dirac particle in an electromagnetic field and obtain the Pauli equation for an electron and show that the Dirac particles (positive energy ones) are electrons.

(4 × 3 = 12 Weightage)

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