C 31289 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2017

(CUCSS)

Physics

PHY 3C 09—QUANTUM MECHANICS-II

(2012 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A (Short Answer type Questions)

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

1. Explain Bohr-Sommerfield quantization theory.
2. Show that the variational method always gives an upper limit to the ground state energy of the system.
3. What is the effect of the application of an electric field in the linear Stark effect ?
4. Write a note on second Quantization.
5. Give the magnitude of the fisrt order perturbation theory.
6. Illustrate the principle of WKB method.
7. What you mean by electric dipole approximation ?
8. Explain Hole theory ?
9. Write KG equation in electromagnetic field.
10. Write the magnetic moment of electron as obtained by Dirac's equation.
11. Explain the Weyl equation.
12. Write weak field interaction Hamiltonian in electromagnetic field.

(12 ×1 =12 weightage)

Section B (Essay type Questions)

Answer any **two** *questions.*
Each question carries a weightage of 6.

13. Outline the variational method used for obtaining the approximation value of the ground state energy of a system. And obtain ground state energy for a hydrogen atom using variational method.
14. Discuss the time independent perturbation theory for a nondegenerate system.

Turn over

15. Discuss the First order time dependant perturbation theory and derive Fermi-Golden Rule 3 ?

16. Derive Dirac's Relativistic wave equation, obtain it from the equation of continuity.

(2 × 6 =12 weightage)

Section C

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

17. Show that :

    (i) Trace $\gamma_\mu = 0$

    (ii) Det $\gamma_\mu = \pm 1$

18. Estimate the ground state energy of a one dimensional harmonic oscillator of mass m and angular frequency ω using a Gaussian trial function.

19. The unperturbed wave functions of a particle trapped in an infinite square well of bottom are $\Psi_n^0 = \left(\frac{2}{a}\right)^{1/2} \sin\frac{n\pi x}{a}$. If the system is perturbed by raising the floor by a constant amount V_0, evaluate the first and second order corrections to the energy eigen values of n^{th} state.

20. Obtain the selection rule for electric dipole transition of a hydrogen atom.

21. Find transmission coefficient using WKB method.

22. Show that the Dirac's particles have spin ½.

(3 × 4 =12 weightage)