D 70984 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE (REGULAR) EXAMINATION NOVEMBER 2019

Physics

PHY3C09—QUANTUM MECHANICS—II

(2017 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions, each carries weightage* 1.

1. Describe how Degeneracy is removed in Stark effect.
2. Describe the principle of WKB approximation
3. How does the height and width of the potential barrier affect the probability of penetration of particles through the barrier ?
4. Describe the principle of Variational method.
5. What is dipole moment operator ? What are the rules that are to be satisfied for the transition probability between two states to be non zero ?
6. What is principle of detailed balance ? Explain why the intensity of stimulated emission between two atomic levels is much less than that of stimulated absorption ?
7. Give the properties of Dirac Matrices.
8. Explain hole theory. State the hypotheses which form the basis of the hole theory .
9. Discuss the features of Klein Gordon equation.
10. Describe the principle of canonical quantization of the field ?
11. Distinguish between function and functional with respect to Lagrangian density.
12. The orbital angular momentum of Dirac particle is not constant of motion. Examine the statement.

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions, each carries weightage* 6.

13. Discuss the method of Time independent perturbation theory in the case of degenerate states and apply the same to find the energy states and wave functions to illustrate Zeeman effect in hydrogen atom.
14. Describe briefly the Time dependent perturbation theory and apply it to find the scattering cross section in the first order Born approximation.

Turn over

15. Discuss the plane wave solution of the Dirac equation. Also find the equation of continuity for the Dirac particles.

16. Discuss the quantization of Bosons and Fermions

(2 × 6 = 12 weightage)

Section C

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

17. Apply WKB approximation method to one dimensional bound system to verify Bohr-Sommerfeld quantization rule of the Old Quantum Theory.

18. Apply Variational principle to find the ground state energy for Helium atom.

19. Apply the first order time dependent perturbation theory to find the absorption energy from the field in the case of Harmonic perturbation.

20. Give the Hamiltonian formulation for the field.

21. Discuss spin orbit coupling of Dirac particle. Derive the expression for the corresponding Hamiltonian.

22. From the relativistic expression for the Hamiltonian derive the Klein Gordon equation.

(4 × 3 = 12 weightage)