

D 52340

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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2018

(CUCSS—PG)

Physics

PHY 3C 09—QUANTUM MECHANICS—II

(2017 Syllabus Year)

Time : Three Hours

Maximum : 36 Weightage

Section A

Answer all questions, each question carries weightage 1.

1. Describe the connection formulae for WKB approximation.
2. Find the energy levels which become non-degenerate under the influence of electric field under first order corrections.
3. Describe the principle of WKB approximation.
4. Describe the principle of Variational method.
5. Give the criteria for choosing the trial wave function for excited states for the Variational method.
6. What is electric dipole approximation ?
7. Which of the following transitions is electric dipole allowed ?
(i) $1s \rightarrow 2s$. (ii) $1s \rightarrow 2p$. (iii) $2p \rightarrow 3d$. (iv) $3s \rightarrow 5d$.
8. Explain large and small components of solutions of Dirac equation.
9. Is spin angular momentum is constant of motion with respect to Dirac Hamiltonian ?
10. What is Weyl equation ? Give its significance.
11. Explain functional derivatives.
12. What is Hamiltonian and Hamiltonian density of the field in the continuum limit ? Explain the symbols.

(12 × 1 = 12 weightage)

Turn over

Section B

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

13. Describe the principle of WKB approximation. Apply the method to find the transmission coefficient through a potential barrier.
14. Discuss the plane wave solutions of Dirac equation.
15. Deduce the expression for transition probability for induced emission for an atom placed in an electromagnetic field.
16. Derive Euler - Lagrange equation for the fields.

(2 × 6 = 12 weightage)

Section C

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

17. Apply time independent perturbation theory to find the first order correction for energy levels and for wave function of the Anharmonic Oscillator.
18. Use the Variational method to estimate the ground state energy of the hydrogen atom.
19. Apply Time dependent perturbation theory to find the absorption energy from the field in the case of Harmonic perturbation.
20. Derive the Hamiltonian form of Klein Gordon Equation.
21. Find the conserved current due to Dirac equation.
22. Discuss the quantization of fermions.

(4 × 3 = 12 weightage)