15P305 (Pages:2) Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION,NOVEMBER 2016

(CUCSS - PG)

(Physics)

CC15P PHY3 C09 - QUANTUM MECHANICE-II

(2015 Admission)

Time : Three Hours Maximum : 36 Weightage

PART-A

Answer **all** questions

All questions carry 1 weightage

1. How time independent perturbation theory can be used to calculate eigen values.
2. In WKB approximation, why we need connection formula?
3. Discuss the validity of time independent perturbation theory.
4. How time dependent perturbation theory can used for explaining working of LASER.
5. What are the selection rules for dipole approximation.
6. Show that the functional defined as

$$E[|\psi\rangle] = \frac{\langle\psi|\hat{H}|\psi\rangle}{\langle\psi|\psi\rangle}$$

is always greater than the ground state energy E_0.

7. What are the drawbacks of Klein-Gorden equation.
8. How we can say that Dirac particles are spin half particles.
9. What are bilinear covariants.
10. Why we cannot use spin for neutrinos.
11. Why we should quantize the field.
12. Write down the expression for Lagrangian density of Schrödinger field and obtain Schrödinger equation.

PART B

Answer any **two** questions
Each question carry 6 weightage

13. How time independent perturbation theory can be used to explain Stark effect. Levels undergoing splitting in Stark effect doesn't undergo splitting in Zeeman effect. Comment.
14. Obtain the expression for total transition probability for unit time when an atom interact with an electromagnetic field.
15. Obtain Weyls equation for neutrinos.
16. From Dirac equation obtain Paulis equation for electron. Explain spin orbit interaction.

PART-C

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

17. Calculate the first order correction to the eigen values of a quartic oscillator.
18. For a particle moving under the potential

$$V(x) = \begin{cases} \infty & \text{for } x \leq 0 \\ Kx & \text{for } x > 0 \end{cases}$$

calculate ground state energy by variation method. Use trial function $\psi = A\, x \exp\left(-\alpha x^2\right)$

19. Obtain energy levels of a particle moving under the potential V (x) = k |x| by WKB method.
20. Obtain Klein-Gorden equation from Dirac equation.
21. Show that $(\gamma\mu\ \gamma\nu + \gamma\nu\ \gamma\mu) = 2g\mu\nu$. Where γ are the Dirac matrices and gμν is the metric tensor.
22. Show that $\overline{\psi}\gamma^{\mu}\ \gamma^{\nu}\psi$ behaves as a second rank anti symmetric tensor under Lorentz transformation.

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