**16P305** (Pages: 2) Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE EXAMINATION, OCTOBER 2017**
(Regular/Supplementary/Improvement)
(CUCSS - PG)
**CC15P PHY3 C09 - QUANTUM MECHANICS - II**
(Physics)
(2015 Admission Onwards)

Time : Three Hours Maximum : 36 Weightage

**PART-A**
Answer **all** questions
All questions carry 1 weightage

1. Obtain the condition for validity of WKB approximation.
2. In WKB approximation, why we need connection formula.
3. Obtain the expression for transition probability when a system is perturbed by a potential $v(x,t)$.
4. What is dipole approximation.
5. Obtain Schrödinger equation from Ritz variation principle.
6. Discuss how we can get correct eigen value by Ritz variational principle.
7. Show that Schrödinger equation is not Lorentz invariant.
8. Obtain the expression for Dirac matrices.
9. Discuss the stability of Dirac vacuum.
10. Why we say about the helicity of neutrinos instead of its spin.
11. What is meant by second quantization. Why it is called second quantization?.
12. Obtain the expression for canonical momentum of the Schrödinger field.

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

13. Discuss variation method for the evaluation of eigen values. Obtain the ground state energy of helium atom by variation method.
14. Use WKB method to calculate transmission and reflection coefficient for a particle penetrat-ing through an arbitrary potential V (x).

15. Obtain the expression for Fermi's Golden rule.
16. Obtain Klein-Gorden equation. Discuss how the reinterpretation helped to overcome the limitations

**PART-C**

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

17. Calculate eigen values of a matrix by perturbation method.

$$\begin{pmatrix} 1 & 0 & 3 \\ 5 & 2 & 1 \\ 0 & 6 & 3 \end{pmatrix}$$

18. In the functional defined as

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

if $|\psi\rangle$ is orthogonal to ground state $|\psi_0\rangle$, show that $E\left[|\psi\rangle\right] > E_1$, the first excited state.

19. Obtain Schr¨odinger equation from Dirac equation.
20. Obtain Bohr- Sommerfeld quantization condition from WKB method.
21. Show that $\{\gamma\mu\ ,\gamma\nu\ \} = 2g\mu\nu$ . Where $\gamma$ are Dirac matrices.
22. Show that $\left(\psi\gamma^{\mu}\gamma^{5}\psi\right)$ behaves like a axial vector under Lorentz transformation.

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