

D 51328

(Pages : 2)

Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)  
EXAMINATION, NOVEMBER 2023**

(CBCSS)

Physics

PHY 3C 09—QUANTUM MECHANICS—II

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**Section A***Answer all questions, each question carries weightage 1.*

1. The WKB is valid for systems in which the potential is slowly varying. Why ?
2. Briefly discuss hyperfine splitting.
3. Briefly explain Rayleigh - Ritz method.
4. What is spin orbit interaction ?
5. The result of variation method always gives an upper limit for the ground state energy of the system. Why ?
6. What are partial waves ?
7. Discuss the validity of Born approximation.
8. Define helicity operator. What are the eigen values of helicity operator ?

(8 × 1 = 8 weightage)

**Section B***Answer any two questions, each question carries weightage 5.*

9. Write an essay on Zeeman effect.
10. Explain WKB approximation. Obtain connection formulae.

**Turn over**

11. Distinguish between spontaneous and stimulated emission. Prove that spontaneous emission is completely a quantum effect.
12. Derive the Dirac equation for a free particle. Find out the Dirac matrices. Obtain the Dirac equation in covariant form.

(2 × 5 = 10 weightage)

### Section C

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

13. Write a note on two fold degeneracy using degenerate perturbation theory.
14. Estimate the ground state energy of a one dimensional harmonic oscillator of mass  $m$  and angular frequency  $\omega$  using a Gaussian trial function.
15. Obtain the transition probability for a constant perturbation.
16. Write a note on stark effect in hydrogen atom.
17. Obtain the Hamiltonian operator for a charged particle in an electromagnetic field.
18. Explain how Klein Gordon equation leads to positive and negative probability density values.
19. What is scattering amplitude ? How is it related to scattering cross section ?

(4 × 3 = 12 weightage)