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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, July 2023

Physics with Specialization in Nano Science /
Physics with Specialization in Space Physics

PHSP 531/PHNS 531 : ADVANCED QUANTUM MECHANICS

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

SECTION – A

Answer **any five** questions. **Each** question carries **3** marks

1. Explain variational principle.
2. Write the connection formula and explain why the WKB method is valid for system in which the potential is slowly varying.
3. Explain Fermi Golden rule.
4. Prove that the total energy of the system is conserved if the system is invariant under translation in time.
5. Explain partial waves.
6. Explain symmetric and antisymmetric wavefunctions.

P.T.O.

7. Discuss the interpretation of Klein Gordon equation.

8. What do you meant by Lamb shift?

(5 × 3 = 15 Marks)

SECTION – B

Answer **all** questions. **Each** question carries **15** marks.

9. Explain WKB approximation and discuss barrier penetration by particle using WKB method.

OR

10. Discuss time dependent perturbation theory and prove that the transition probability oscillates sinusoidal as a function of time.

11. Derive Hartree equation for an electron move in a spherical symmetric potential.

OR

12. Using partial wave analysis explain scattering by central potential. Obtain the expression for scattering amplitude, scattering cross section.

13. Discuss the quantization of electromagnetic field.

OR

14. Explain

    (a) Addition of angular momenta and

    (b) Clebsh Gordan coefficients.

(3 × 15 = 45 Marks)

SECTION – C

Answer **any three** of the following questions. **Each** question carries **5** marks.

15. Derive Hellmann-Feyman theorem.

16. Obtain the energy values of harmonic oscillator using WKB method.

17. Establish the expansion of plane wave in terms of an infinite number of spherical waves.

18. What is time reversed wane function and prove that the Schrodinger equation satisfied by the time reversed function has also the same form as the original one.

19. Derive the angular momentum matrices for j^2 and j_z and also for $j = 3/2$.

20. Derive the covariant form of dirac equation.

($3 \times 5 = 15$ Marks)