S.NO: 6969 P 16 PY 22

(For candidates admitted from 2016-2021 Batch)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Physics

QUANTUM MECHANICS

Time: Three hours **Maximum: 75 marks**

SECTION A - (10 × 2 = 20)

Answer ALL the questions.

1. State the physical meaning and conditions on the wave function.
2. What is meant by Hilbert space?
3. Fine the expectation value <X> of the position of a particle trapped in a box L wide.
4. Write a note on Zero point energy of a linear harmonic oscillator.
5. State stark effect.
6. What is meant by sudden approximation?
7. Define scattering cross –Section.
8. Write a note on spin angular momentum
9. Explain negative energy states.
10. Give a brief note on spin – orbit coupling.

SECTION B - (5× 5 = 25)

Answer ALL the questions, choosing either, (a) or (b)

11. (a) Explain the properties of Hermian operators.

(or)

(b) Show that $i\hbar\frac{d}{dt}< A_s> = [A_s,H]$ in Schrodinger representation.

12. (a) Obtain the energy Eigen value of a rigid rotator.

(or)

(b). Deduce the formula for the energy of n^{th}level of a particle in a box.

13. (a) Explain WKB approximation and apply it to tunneling problem.

(or)

(b) Deduce Fermi's golden rule in harmonic perturbations.

14. (a) How will you calculate the differential scattering cross-section by using Green's function?

(or)

(b) State and explain the properties of L and L^2.

15. (a) Derive the Kelvin Gordon equation for a free particle and give it's solution.

(or)

(b) Write about charge and current densities.

SECTION C - (3× 10 = 30)

Answer any THREE questions.

16. Derive Schrodinger equation and give its plane wave solution

17. Deduce the energy Eigen value of a linear harmonic oscillator using abstract operator method.

18. With necessary theory explain the time independent perturbation theory of first order.

19. Explain Born approximation and derive Rutherford's scattering formula for a screened Coulomb potential.

20. Obtain the Dirac equation for a free particle and deduce the Dirac matrices.

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