



QP CODE: 25047334



25047334

Reg No :

Name :

M.Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2025

Third Semester

M Sc PHYSICS (MATERIAL SCIENCE)

Core Course - PH020303 - ADVANCED QUANTUM MECHANICS

2019 ADMISSION ONWARDS

A0E8604F

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Write down the equations connecting state kets in interaction picture and Schrödinger picture.
2. Explain photo electric effect using the concept of Perturbation?
3. Discuss sudden approximation.
4. Explain hard sphere scattering.
5. What is Resonance scattering?
6. Klein Gordon equation is considered as a relativistic equation for a system of arbitrary number of particles and their antiparticles. Why?
7. What are negative energy states?
8. Dirac equation conserves total angular momentum but does not conserve orbital part of it. What does this imply?
9. Why is a field specified in terms of its amplitude and the dependence of these amplitudes on time?
10. Express the unit of any two physical quantity in Natural system of units.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Obtain the perturbation series expansion for time evolution operator.
12. Explain the concept of detailed balancing using harmonic perturbation.
13. Obtain the expression for scattering amplitude using Born approximation.
14. Discuss the validity conditions for born approximation.





15. What are large and small components? Why are they called so?
16. What are bi-linear coefficients?
17. Define the number operator N_k . For a system of bosons, show that $[N_k, N_l] = 0$.
18. What kind of particle system can be governed by Dirac field? Why?

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

Weight 5 each.

19. Discuss adiabatic approximation with illustrative example.
20. Calculate the differential scattering cross section in the first born approximation for a spherically symmetric potential.
21. Obtain the approximate hamiltonian for an electrostatic problem and explain different terms in it.
22. State and prove Noether's theorem.

(2×5=10 weightage)

