STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019 – 2020 and thereafter)

SUBJECT CODE : 19PH/PC/QM34

M.Sc. DEGREE EXAMINATION NOVEMBER 2022
PHYSICS
THIRD SEMESTER

COURSE : MAJOR CORE
PAPER : QUANTUM MECHANICS - I
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION - A

ANSWER ALL QUESTIONS: **(10x3=30)**

1. Give any three postulates of quantum mechanics.
2. What does Dirac notation represent?
3. What is an operator? Write operator associated with momentum and energy.
4. What do you mean by spinors?
5. Define degeneracy. What is meant by degree of degeneracy?
6. What is start effect?
7. State any three commutation relations.
8. Write a short note on angular momentum operator.
9. Define Scattering amplitude.
10. Define central potential.

SECTION – B

ANSWER ANY FIVE QUESTIONS: **(5x5=25)**

11. State and prove Heisenberg uncertainty principle.
12. Explain hydrogen atom problem in detail and find its energy level.
13. Explain the magnetic moment due to the spin of an electron.
14. Discuss the time dependent perturbation theory to obtain the expression for the amplitude of first order transition.
15. Write down the Eigen value equation of the angular momentum operator and solve it to obtain its Eigen functions.
16. Discuss the partial wave analysis of scattering theory.
17. Explain briefly the transformation solution of a laboratory and centre of mass system.

SECTION – C

ANSWER ANY THREE QUESTIONS: **(3x15=45)**

18. Solve for the Eigen value problem for one dimensional quantum harmonic oscillator.
19. Show that the unitary transformation to go from Schrodinger to Heisenberg representation in time evolution.
20. Explain the formation of hydrogen molecule using variation method.
21. Solve the Eigen values and the Eigen functions of L^2

21. Explain the method to calculate the scattering differential cross section and Born approximation.
22. What are fermions? Explain how they are distributed among various energy levels.

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