

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

M.Sc. DEGREE EXAMINATION, APRIL 2024
BRANCH III - PHYSICS
FOURTH SEMESTER

COURSE : MAJOR CORE
PAPER : NUCLEAR AND ELEMENTARY PARTICLE PHYSICS
SUBJECT CODE : 19PH/PC/NP44
TIME : 3 HOURS **MAX.MAKRS : 100**

SECTION - A **(10 x 3 = 30)**

I. ANSWER ALL QUESTIONS:

1. What is parity? Give the expression for even and odd parity in terms of wave function.
2. What is scattering cross-section? Give the expression for it.
3. Write the expression for binding energy as given by Weizacker. Name the different terms in it.
4. List any three evidences for the existence of magic number of nuclei.
5. What is a nuclear reaction? Give an example.
6. What are nuclear molecules?
7. Give the Fermi and Gamow-Teller selection rule.
8. What is resonance absorption?
9. What is CPT conservation?
10. What is the significance of introducing color quantum number in the quark model for elementary particles?

SECTION – B **(5 x 5 = 25)**

II. ANSWER ANY FIVE QUESTIONS:

11. Discuss the mirror nuclear method of determining the size of a nucleus
12. Explain the Fermi gas model of the nucleus.
13. List the various entities that are conserved in nuclear reaction and explain any five of them giving suitable examples.
14. Explain how parity conservation rule is violated in beta decay.
15. Give a brief account of the fundamental interactions among elementary particles giving suitable examples.
16. Discuss the meson theory of nuclear forces.
17. Discuss the role of spin-orbit interaction in explaining the stability of nuclei with magic number of nucleons.

SECTION – C **(3 x 15 = 45)**

III. ANSWER ANY THREE QUESTIONS:

18. Discuss the ground state of deuteron assuming a square-well shaped nuclear potential.
19. Give an outline of the predictions of the shell model of the nucleus.
20. Derive the Breit-Wigner formula for nuclear reaction.
21. Discuss Gamow's theory of alpha decay.
22. Explain the SU (2) special symmetry group.
