

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

SUBJECT CODE : 19PH/PC/NP44
M.Sc. DEGREE EXAMINATION, APRIL 2023
BRANCH III - PHYSICS
FOURTH SEMESTER

COURSE : MAJOR CORE

PAPER : NUCLEAR AND ELEMENTARY PARTICLE PHYSICS

TIME : 3 HOURS

MAX.MAKRS : 100

SECTION - A

(10 x 3 = 30)

I. ANSWER ALL QUESTIONS:

1. What is meant by nuclear electric quadrupole and nuclear magnetic dipole moments?
2. What is a meson? How does it give rise to exchange forces?
3. Write the assumptions of Fermi gas model.
4. Brief on magic numbers? Give any two evidence for the existence of magic numbers.
5. State any two conservation laws that can be applied to a nuclear reaction.
6. Write a note on nuclear molecules.
7. State the assumptions of Fermi's theory of β – decay.
8. What is meant by internal conversion?
9. How are elementary particles classified?
10. What are quarks? Give the quark structure of proton and neutron.

SECTION – B

(5 x 5 = 25)

II. ANSWER ANY FIVE QUESTIONS:

11. Explain Meson theory of nuclear forces.
12. Derive Weizacker's semi-empirical mass formula on the basis of liquid drop model.
13. What is meant by nuclear reaction cross section? Show that $N = N_0 e^{-\lambda t}$
14. Explain the violation of parity conservation during β -decay process.
15. Discuss the fundamental interactions among the elementary particles.
16. Explain the theory of ground state of deuteron.
17. Analyze the eight-fold way SU(3) symmetry.

SECTION – C

(3 x 15 = 45)

III. ANSWER ANY THREE QUESTIONS:

18. Describe the principle of various methods employed to study nuclear size.
19. Give an account of shell model of the nucleus. Explain how the shell model can be used to predict the angular momenta and magnetic moments of odd A-nuclei in the ground state.
20. What is resonance scattering? Derive Breit Wigner single-level formula for absorption cross section of neutrons.
21. Discuss in detail Gamow's theory of α -decay.
22. a. Analyze the symmetries and conservation laws of elementary particles.
b. Derive Gellman - Okubo mass formula for octets and decuplet hadrons.
