TM254456C

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2025

2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY

SEMESTER IV - CORE COURSE PHYSICS

PH4C12TM20 - Nuclear and Particle Physics

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Distinguish between π-mesic X rays and muonic X rays.
2. Briefly discuss the spin and parity of deuteron.
3. Write on comparative half life and its significance.
4. Explain any three types of nuclear reactions and conservation laws.
5. Discuss the basic assumptions of the liquid drop model.
6. Explain electroweak theory.
7. Explain the need for colour quantum number in describing quarks.
8. Do experiments support the existence of quarks? Explain
9. Explain how stars like our sun maintain the equilibrium phase.
10. Give a short note on LIGO.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. Based on semi-empirical mass formula find the expression for minimum value of Z
12. Deduce the differential cross section of Rutherford Scattering.
13. Describe the collective model of the nucleus and how it could successfully describe the nuclear properties.
14. Derive the condition for a nucleus to be stable against symmetric fission.
15. Find which of the following reactions are forbidden and justify your answer.

$\pi^+ + p \rightarrow p + p + \bar{n}$ ($\bar{n}$ is antineutron)

$\Sigma^+ \rightarrow n + e^+ + \nu_e$

$K^+ \rightarrow \pi^+ + e^+ + e$

16. Explain the standard model in Particle physics.
17. Discuss the neutron capture mechanism observed in nuclei with A > 60.
18. Describe the LHC experiments and the subsequent discovery.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Discuss the deuteron system in detail considering it as a rectangular square well potential and deduce an expression for the radius of deuteron.
20. Discuss the experimental efforts on the evidences of parity non conservation in beta decay.
21. Discuss the liquid drop model. Obtain the semi empirical mass formula.
22. Describe the stellar nucleosynthesis for those elements with A>60.