



QP CODE: 22001780



22001780

Reg No : .....

Name : .....

**M Sc DEGREE (CSS) EXAMINATION, AUGUST 2022**

**Fourth Semester**

M Sc PHYSICS

**Core - PH010401 - NUCLEAR AND PARTICLE PHYSICS**

2019 ADMISSION ONWARDS

AF222F4F

Time: 3 Hours

Weightage: 30

**Part A (Short Answer Questions)**

Answer any **eight** questions.

Weight **1** each.

1. Why atomic magnetism has much larger effects than nuclear magnetism?
2. Mention different methods for the determination of the binding energy of the deuteron.
3. What experimental evidence suggests the existence of non-central nuclear force?
4. Briefly explain the liquid drop model of the nucleus.
5. Explain forbidden beta decays?
6. Classify nuclear reaction mechanisms based on the product nuclei.
7. Distinguish between scattering cross section, reaction cross section, and total cross section.
8. What are Bosons? List the properties of Bosons.
9. Explain the relevance of the Gell-Mann-Nishijima formula.
10. What are Higg's bosons?

(8×1=8 weightage)

**Part B (Short Essay/Problems)**

Answer any **six** questions.

Weight **2** each.

11. Two spherical nuclei have mass numbers 216 and 64 with radii  $R_1$  and  $R_2$ . Evaluate  $R_1/R_2$ .
12. Mass of proton and neutron are 938.27 MeV and 939.56 MeV respectively. Find the binding energy of  ${}^{39}_{19}K$ , given its mass equal to 38.963706487 u (Given  $1u = 931.5$  MeV).





13. Discuss briefly the chief experimental observations that led to the shell model of the nucleus.
14. Explain forbidden decays in beta decay.
15. Compare elastic nuclear scattering of particles and the diffraction of light by an opaque disk.
16. Explain any one method to determine pion mass.
17. Are the following reactions allowed or forbidden? Give reasons for your answers.  
(a)  $n \rightarrow p + \mu^- + \nu_\mu$  (b)  $\pi^- + p \rightarrow \Lambda^0 + \pi^0$  (c)  $n \rightarrow p + e^-$
18. If the probability of  $\alpha$  -particles of energy 10 MeV to be scattered through an angle greater than  $\varphi$  on passing through a thin foil is  $10^{-3}$ , what is it for 5 MeV protons passing through the same foil?  
(6×2=12 weightage)

### Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. Is nuclear interaction spin dependent? Substantiate your answer with proper evidence.
20. Explain Nuclear Vibrations and Nuclear Rotations of the collective structure of the nucleus.
21. Discuss the compound-nucleus and direct nuclear reactions with their applications.
22. Explain the symmetries and conservation laws of elementary particles with examples.  
(2×5=10 weightage)

