



QP CODE: 24018091



Reg No :

Name :

M Sc DEGREE (CSS) EXAMINATION, APRIL 2024

Fourth Semester

Core - PH010401 - NUCLEAR AND PARTICLE PHYSICS

M Sc PHYSICS, M Sc SPACE SCIENCE

2019 ADMISSION ONWARDS

BF55036C

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Explain how the nuclear radius is determined from the energies of mirror nuclei.
2. Describe the concept of parity.
3. Explain why a stable system of di-neutron has not been observed.
4. Give two examples of nuclei that correspond to closed shells and indicate which shells are closed.
5. Explain allowed beta decays.
6. Discuss the different conservation laws applicable to nuclear reactions.
7. What is a compound nuclear reaction?
8. What are fermions? List any three of its properties.
9. Give an example of CP violation.
10. What do you mean by Positron Emission Tomography?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Find the energy released if two 2_1H nuclei can fuse together to form a 4_2He nucleus. The binding energy per nucleon of 2_1H and 4_2He is 1.1 MeV and 7.0 MeV respectively.
12. What are the differences that we have to consider while dealing with p-p interaction that of n-p scattering?





13. The atomic mass of the zinc isotope ${}^{64}_{30}\text{Zn} = 63.929$ u. Obtain its binding energy with semiempirical BE predictions.
Given $a_v = 15.6$ MeV, $a_s = 16.8$ MeV, $a_c = 0.72$ MeV, $a_{\text{sym}} = 23.3$ MeV, $a_p = 34$ MeV.
14. With the help of a diagram explain the low-lying energy levels of ${}^{130}\text{Sn}$.
15. Explain partial wave expansion of the incident wave in nuclear scattering.
16. Explain the production of pions.
17. Explain the quark contents of spin 1 meson octet.
18. Briefly explain the gravitational waves.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. Discuss the nuclear exchange force model for the nucleus.
20. Explain the beta decay with the energy spectrum. Obtain the Fermi theory of beta decay.
21. Discuss resonance reactions. Obtain the Breit-Wigner formula for resonance.
22. Explain the mass determination methods for pions.

(2×5=10 weightage)

