QP CODE: 25804454

25804454

Reg No : .....

Name : .....

INTEGRATED MSc DEGREE EXAMINATION, OCTOBER 2025

Fifth Semester

INTEGRATED MSc BASIC SCIENCES - PHYSICS

CORE - IPH5CR03 - NUCLEAR PHYSICS - I

2021 Admission Onwards

CF8D7ADC

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Using experimentally measured mass of pion as $140 MeV/c^2$, Estimate the range of nuclear force.
2. What is packing fraction?
3. A proton is present in f state. What will be the total angular momentum of this proton?
4. What is neutron separation energy? Deduce the expression for neutron separation energy.
5. What is proton-electron hypothesis?
6. Write a short note on parity of the nucleus.
7. What is the relationship between decay constant and half-life?
8. Define mean life in the context of radioactive decay.
9. Explain the concept of binding energy and its relevance to nuclear fission.
10. What is the neutron cycle in a thermonuclear reactor?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. What are nuclear electrons? What are the reasons for discarding the concept of nuclear electrons?
12. Write a short note on isotopes, isobars, isotones and mirror nuclei, with examples.
13. State the main properties of nuclear forces. Explain the hypothesis of charge and spin independence of nuclear forces.
14. Discuss Nilsson's model of atomic nuclei.

15. Write a short note on the vibrational states of nuclei.

16. Explain how the shell model of a nucleus accounts for the existence of magic numbers.

17. Explain the principles of radiometric dating.

18. What are the main safety measures in place to protect workers and the environment from radiation hazards?

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Discuss the basic assumptions of the liquid drop model of the nucleus. Explain how the model is used to estimate the semiempirical mass formula. Also, discuss the correction factors of the model.

20. Discuss the shell model of the nucleus. What are its merits and demerits?

21. What are the primary causes of nuclear reactor accidents? Analyze both technical and human factors that can lead to such disasters.

22. Write an essay on nuclear fission and its importnat applications.

(2×5=10 weightage)