QP CODE: 24806171

24806171

Reg No : .....

Name : .....

# INTEGRATED MSC DEGREE EXAMINATION, DECEMBER 2024

## Fifth Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

## CORE - IPH5CR03 - NUCLEAR PHYSICS - I

2021 Admission Onwards

65FBA9AD

Time: 3 Hours Weightage: 30

### Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What are nuclear electrones?
2. Write a short note on isotopes, isobars, isotones and mirror nuclei.
3. Calculate the mass-energy of the electron at rest.
4. What is mass defect and get the expression for mass defect?
5. What are the achievements and failures of the shell model of the nucleus?
6. What type of statistics is followed by nucleons? Explain.
7. What kind of radiation protection is offered by using thick concrete walls?
8. What is the primary element used in nuclear reactors for energy production?
9. What are the primary components required for inertial confinement fusion experiments?
10. Under what conditions does the carbon-nitrogen cycle occur?

(8×1=8 weightage)

### Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Write on different types of magnetic moments that can be associated with nucleons.
12. What is proton-neutron hypothesis? Give the reasons for the acceptance of this hypothesis.
13. Discuss the meson theory of nuclear forces. Give the main properties of these forces.
14. Derive the Coulomb energy term of the semiempirical mass formula.
15. Discuss the properties of the ground state of the deuterium nucleus.

16. Discuss the Fermi gas model of the nucleus.

17. Explain the radioactive disintegration law and derive the differential equation governing radioactive decay.

18. Discuss the impact of the discovery of nuclear fission on World War II, particularly focusing on the development of nuclear weapons.

(6×2=12 weightage)

## Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Discuss the binding energy curve and deduce the semiempirical mass formula to the nuclei.

20. Discuss Nilsson's model of atomic nucleus.

21. Explain the principles of nuclear fission and how it is utilized in nuclear reactors to generate electricity. Discuss the reactor design, fuel cycle, and safety features.

22. Explain in detail pressurized water reactors (PWRs) and boiling water reactors (BWRs). Discuss their design, operation, safety features, efficiency, and applications. Include a comparison of their performance in terms of operational reliability, safety, and economic viability.

(2×5=10 weightage)