QP CODE: 24803637

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Reg No : .....

Name : .....

INTEGRATED MSC DEGREE EXAMINATION, JUNE 2024

Fifth Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

CORE - IPH5CR03 - NUCLEAR PHYSICS - I

2021 Admission Onwards

C46AAF20

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Group the following nuclides as isotopes, isotones, and isobars:
$^{12}_{6}C, ^{13}_{6}C, ^{14}_{6}C, ^{14}_{7}N, ^{14}_{8}O, ^{15}_{7}N, ^{15}_{8}O, ^{16}_{6}C, ^{16}_{7}N, ^{16}_{8}O, ^{17}_{7}N, ^{17}_{8}O.$
2. Show that the nuclear density is same for all nuclei.
3. What is proton separation energy? Deduce the expression for proton separation energy.
4. What is Woods-Saxon's potential?
5. Discuss the collective model of atomic nuclei shortly.
6. Discuss the statistics of atomic nuclei.
7. How does radiation affect living organisms?
8. What is the unit of radiation dose absorbed by tissues?
9. Discuss about the primary products of the proton-proton cycle in stars.
10. What international regulations exist to ensure the safe and peaceful use of nuclear fusion technology?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Discuss the stability of nuclei. Give the stability curve of nuclei. Why the number of neutrons tend to exceed the number of protons in stable nuclei?
12. Explain the concept of nuclear quadrupole moment.

13. What is proton-electron hypothesis? Give the reasons for the failure of proton-electron hypothesis.

14. Discuss the correction factors of the Liquid drop model of the nucleus.

15. Discuss the collective model of atomic nuclei.

16. Write a short note on the nuclear energy level scheme and give the explanation of magic numbers based on this scheme.

17. Analyze the impact of radiation on the environment. What are the potential consequences for plants and animals?

18. Analyze the environmental and economic benefits and challenges associated with breeder reactors.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. State the main properties of nuclear forces. Explain the meson or Yukawa theory of Nuclear forces. Also, discuss how Yukawa roughly estimated the mass of hypothetical π-meson.

20. Discuss the Fermi gas model of the nucleus.

21. Describe the decay processes involved in the uranium series. Include the various types of radiation emitted at each stage.

22. Compare and contrast inertial confinement fusion (ICF) as a potential energy source on Earth with the nuclear fusion processes that sustain energy production in stars. Discuss the technological challenges, scientific advancements, and potential future developments in both contexts.

(2×5=10 weightage)