Reg. No.															

M.Sc. DEGREE EXAMINATION, MAY 2022

Fourth Semester

18PPH401 – NUCLEAR AND PARTICLE PHYSICS

(For the candidates admitted during the academic year 2018-2019 onwards)

Time: Three hours Max. Marks: 100

PART – A (5 × 5 = 25 Marks)

Answer **ANY FIVE** Questions

1. Define magnetic moments of nucleons. How is magnetic moment of proton different from magnetic moment of an electron? Explain.
2. Define separation energy of a proton. Calculate binding energy per nucleon of ^{4}He. [Given: m(^{4}He)=4.002602u, m_p=1.007825u, and m_n=1.008665u]
3. Identify the various possibilities of deuteron angular momentum and parity. [Given: I=1 and parity is even].
4. Explain that nuclear forces are spin dependent and have tensorial character.

5.i. What are magic numbers? State.

ii. How spin-interaction term in nuclear physics explains magic numbers? Describe.

6.i. State two applications of each of the following detector:

(a) Solid state detectors

(b) Scintillator detectors

ii. Define Cerenkov radiation.

7. List all the four fundamental forces and write their mediating bosons.

8. Define the following quantum numbers with examples:
   (a) Strangness
   (b) Color

PART – B (5 × 15 = 75 Marks)

9. a. What is liquid drop model of nucleus? Describe all the terms appearing in semi-empirical mass formula.

(OR)

b.i. Derive the expression for the nuclear form factors for spherically symmetric charge distribution. (12 Marks)

ii. Define nuclear radius and derive the expression to represent it. (3 Marks)

10. a.i. Explain various properties of nuclear forces. (10 Marks)

ii. Write the expression for tensor character of nuclear force and explain with appropriate example. (5 Marks)

(OR)

b. Explain the exchange force model of Yukawa theory. List all the reactions involved in exchange.

11. a.i. Discuss evidences in support of shell structure of nucleus. (7 Marks)

ii. Describe qualitative features of shell model. (8 Marks)

(OR)

b.i. Describe the process of internal conversion. (3 Marks)

ii. Differentiate between internal conversion and β-decay. (4 Marks)

iii. Derive an expression for coefficient of internal conversion. (4 Marks)

iv. Distinguish between Gamow – Teller and Fermi transitions of β-decay. (4 Marks)

12. a. Describe construction and working of scintillator detectors.

(OR)

b. Write the qualitative features of

(i) Cerenkov detectors (8 Marks)

(ii) Calorimeters (7 Marks)

13. a.i. What are hadrons? Describe their classifications. (5 Marks)

ii. Draw the neat diagram of SU(3) baryon octel and meson octet. Also, list the quark contents of baryons and mesons in the octets. (10 Marks)

(OR)

b.i. What are quakrs? Write their classification based on heavy and light. List their quantum numbers. (8 Marks)

ii. Derive Gell-Mann- Nishijima formula. Define the quantum numbers: strangeness and isopsin. (7 Marks)

* * * *