THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025
(Regular/Improvement/Supplementary)

PHYSICS
FPHY3C10: NUCLEAR AND PARTICLE PHYSICS

Time: 3 Hours   **Maximum Weightage: 30**

Part A: Short answer questions. Answer *all* questions. Each carries *one* weightage.

1. Explain parity violation in beta decay.

2. Discuss energetics of gamma decay.

3. Define internal conversion coefficient and explain its significance.

4. Give an evidence in favour of shell structure in nuclei.

5. What is solar fusion?

6. Discuss the conservation of parity in nuclear reactions.

7. Calculate the isospin and its components of the triplet (π^+, π^0, π^-).

8. Outline Yukava's theory of nuclear forces.

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries *five* weightage.

9. Discuss the deuteron system in detail considering the nucleon-nucleon interaction as a three-dimensional square well potential and deduce an expression for radius of the deuteron.

10. Describe Gamow's theory of alpha decay. Discuss how the theory explains Geiger-Nuttal law.

11. Discuss the working of: i) Proportional counter ii) GM counter.

12. Explain nuclear fission. Discuss its characteristics.

(2 × 5 = 10 weightage)

Part C: Problems. Answer any *four* questions. Each carries *three* weightage.

13. Write a detailed account on the characteristics of nuclear forces.

14. Predict angular momenta and parities for the ground state of ^{12}C, ^{17}O and ^{16}N using shell model of nucleus.

15. Discuss the working of surface barrier detectors.

16. State and explain CPT theorem.

(P.T.O.)

17. Using liquid drop model, find the most stable isobars for mass number A=118.

18. Describe eight-fold way in quark model.

19. State, with reasons, which elementary particle reactions among the following are NOT possible. Write the type of interaction in the possible processes.

(a) $p + p \rightarrow K^+ + \Sigma^+$

(b) $\pi^- + p \rightarrow \pi^0 + \Lambda^0$

(c) $\pi^+ + n \rightarrow K^0 + K^+$

(4 × 3 = 12 weightage)