D6BPH2303 **Reg. No.....**

Name: .....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2026

(Regular/Improvement/Supplementary)

PHYSICS

GPHY6B12T: NUCLEAR PHYSICS AND PARTICLE PHYSICS

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 marks)

1. Define Mossbauer effect.
2. What is hypercharge?
3. How is a tandem Van de Graff accelerator different from an ordinary Van de Graff accelerator?
4. Draw the diagram of an ionization chamber and label its parts.
5. List out the characteristic features of nuclear force.
6. What are strange particles? Why are they called so?
7. State Yukawa's theory of nuclear force.
8. What is a nuclear fission reaction? Give an example.
9. Write down the expression for maximum energy of a particle accelerated using a cyclotron and explain the terms.
10. State the role of moderators in nuclear reactors. Give examples.
11. What is Lawson's criterion?
12. Explain the term enriched uranium.

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 marks)

13. Find the energy released in the fission reaction:

$$^{235}U + n \rightarrow {}^{93}Rb + {}^{141}Cs + 2n.$$

Given that m(^{93}Rb) = 92.922039u and m(^{141}Cs) = 140.920045u

14. Define the binding energy of a nucleus. Calculate the binding energy of Ne^{20} nucleus, given its mass =19.992 u and Z=10.
15. Describe the practical applications of nuclear physics.
16. Are the following reactions possible? Explain giving reason.
    a) $\Lambda^0 \rightarrow p + K^-$
    b) $\Omega^- \rightarrow \sum^- + \pi^0$
17. Discuss the proton – proton cycle that occurs in stars and calculate the Q value of the reaction.
18. With the help of a neat diagram explain the working of a linear accelerator.
19. Describe how a proportional counter works.

SECTION C: Answer any *one* question. The question carries *ten* marks.

20. State the conservation laws of radioactive decay. A freshly prepared radon source loses half of its activity in 3.86 days. Calculate the time in which the activity would be reduced to 5 %.
21. Explain the quark model for hadrons.

(1 × 10 = 10 Marks)