D 140216 **(Pages : 2)** **Name.....**

Reg. No.....

SIXTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION
APRIL 2026

Physics/Applied Physics

PHY6B12/APH6B12—NUCLEAR PHYSICS AND PARTICLE PHYSICS

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences, each correct answer carries a maximum of* 2 *marks.*

1. Define nuclear binding energy and its significance.
2. Explain the concept of the liquid drop model.
3. What are the key features of the shell model of the nucleus ?
4. Describe the conservation laws in radioactive decay.
5. What is the Mossbauer effect ? Give an example of its application.
6. Differentiate between nuclear fission and nuclear fusion.
7. Explain the role of neutron activation analysis in nuclear applications.
8. What are the working principles of a Geiger-Muller counter ?
9. Describe the function of a Wilson Cloud Chamber in particle detection.
10. What is the purpose of a betatron ?
11. Briefly explain the four fundamental forces in nature.
12. Define the term “quark” and list the six types of quarks.

(Ceiling-20)

Turn over

Section B (Paragraph / Problem Type)

Answer **all** *questions in a paragraph of about* **half a page** *to* **one page**, *each correct answer carries a maximum of* 5 *marks.*

13. Derive the expression for the energy released in an alpha decay process. Also obtain the expression for the Kinetic energy of alpha particle.

14. Explain how nuclear reactors work, and discuss the differences between a fission reactor and a fusion reactor.

15. Describe the working principle of a scintillation counter and its applications.

16. Explain the function of a cyclotron and how it accelerates charged particles.

17. Discuss the Standard Model of particle physics and its components.

18. Radius of the nucleus of a ^{12}C atom is 2.7fm. Determine its nuclear density. Also determine the nuclear radius of ^{238}U.

19. Describe the concept of resonance particles and their role in particle interactions.

(Ceiling - 30)

Section C (Essay Type)

Essays - Answer in about **two pages**, *any* **one** *question.*
The question carries 10 *marks.*

20. Discuss in detail the different types of radioactive decay (alpha, beta, and gamma) and the governing principles behind each.

21. Explain the quark model of particle physics and how it contributes to our understanding of elementary particles.

(1 × 10 = 10 marks)