D6BPH2003   17   Reg.No.............................

Name: ....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023
(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. What are the limitations of LINAC?
2. State which quantum number is not conserved in the reaction $n \rightarrow p + e$. Write the correct equation
3. What are the methods for magnetic confinement in fusion reactor?
4. What is the role of control rods in nuclear fission reactor? Give any two materials that can be used as control rods.
5. Describe how ionization chamber is used for neutron counting.
6. Explain the principle of scintillation counter.
7. What are magic numbers? Give its relevance.
8. A μ^- particle collides with a proton, and a neutron plus another particle are created. What is the other particle?
9. What is a betatron? Mention its application.
10. What are mesons? Give any two examples.
11. Beta decay is always accompanied by neutrino emission. Why?
12. What is meant by parity conservation of particles?

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

13. Explain the working of GM counter. What is the relevance of the plateau of the curve
14. An animal bone fragment found in an archaeological site has a carbon mass of 400g. It registers an activity of 16 days/s. What is the age of the bone?
15. Briefly explain the meson exchange theory of nuclear forces? List out the properties of nuclear force
16. Draw the binding energy curve for nuclei. Calculate the binding energy of Ne^{20} (in MeV). Given that m(Ne^{20})=19.992u, m(n)=1.00866 u, m(p)=1.00728 u
17. Which of the following reactions can occur? State the conservation laws violated by others

    a) $e^+ + e^- \rightarrow \mu^+ + \pi^-$ b) $\pi^+ + p \rightarrow \Lambda^0 + \pi^0$

    c) $\Lambda^0 \rightarrow \pi^+ + \pi^-$ d) $p + \bar{e} \rightarrow n + \mu^+$
18. Explain the working of a Wilson Cloud chamber.
19. Briefly explain the quark model of hadrons. Give the quark model of neutron and π^- meson.

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

20. Explain nuclear fusion. Discuss the different fusion cycles for the origin of stellar energy. Explain why fusion is more economical than fission.
21. Describe the construction and working of cyclotron. What are its limitations?

$(1 \times 10 = 10$ Marks)