(Pages : 3) **V – 5442**

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree Examination, June 2025

Physics/Physics with Specialization in Nano Science/ Physics with Specialization in Space Physics

PH 242/PHNS 541/PHSP 541 : NUCLEAR AND PARTICLE PHYSICS

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Differentiate stripping and pick up reactions.
2. Briefly explain the collective model of nuclear structure.
3. Explain the Lawson criterion.
4. Explain the principle behind cyclotron accelerators.
5. What is the importance of the parameter called 'multiplication factor' in nuclear fission?
6. Explain the Breit Wigner resonance formula for nuclear reactions.
7. Explain quark confinement with the help of an elementary particle reaction.
8. What is meant by Quantum Chromo Dynamics?

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** the questions. Each question carries **15** marks.

9. (a) What is meant by reaction cross section?

   (b) Explain the partial wave analysis of nuclear reaction cross section.

OR

10. (a) Explain the features of liquid drop model of nuclear structure.

   (b) Explain the Bethe-Weizsacker empirical formula.

11. (a) Explain the classification of Nuclear reactors.

   (b) Explain the structure of a nuclear fission reactor.

OR

12. (a) What is meant by nuclear fusion? Explain.

   (b) Explain the nuclear reactions which are responsible for the energy production in stars.

13. Explain the principle and working of semiconductor detectors.

OR

14. Explain the conservation laws of elementary particles.

(3 × 15 = 45 Marks)

PART – C

Answer any **three** questions. Each question carries **5** marks.

15. Assume 1 amu = 1.66×10^{-27} kg, estimate the density of nuclear matter (A = 40).

16. Calculate the electrostatic potential energy between two equal nuclei produced by the fission of $_{92}U^{235}$ ($_{92}U^{235} + {}_0n^1$) at the moment of separation.

17. Check whether the reaction is possible or not $p + p \rightarrow p + \wedge^0 + \Sigma^+$

18. A self-quenched G-M counter operates at 1000 volts and has a wire diameter of 0.2 mm. The radius of the cathode is 2 cm and the tube has a guaranteed lifetime of 10^9 Counts. What is the maximum radial electric field?

19. A reactor is developing energy at the rate of 3000 kW. How many atoms of U^{235} undergo fission per second? How many atoms of U^{235} would be used in 1000 hours of operation assuming that on an average energy of 200 MeV is released per fission?

20. Calculate the binding energy of an α-particle and express the result in MeV (m_p = 1.007276u and m_n =1.008665 u, m_α = 4.001506 u).

(3 × 5 = 15 Marks)
