

M. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2026**SEMESTER 4 : PHYSICS****COURSE : 24P4PHYT14 : NUCLEAR AND PARTICLE PHYSICS***(For Regular 2024 Admission)*

Time: Three Hours

Max. Weights: 30

PART A**Answer any 8 questions****Weight: 1**

1. Briefly describe Q – value of a nuclear reaction. (U)
 2. With the help of a schematic diagram on scattering, comment of the variation in scattering angle with impact parameter. (A)
 3. When electron is not an integral part of a nucleus, how do we justify the emission of electrons from nucleus in β -decay. (A)
 4. What are leptons? Briefly describe the properties of leptons. (U)
 5. What do you understand by nuclear spin and nuclear magnetic moment? Describe briefly. (An)
 6. Define mass defect and binding energy. Briefly explain its significance. (R)
 7. Show that in the process of beta decay the conservation of angular momentum breaks down. (A)
 8. Stable light nuclei have equal number of protons and neutrons whereas the heavy nuclei have excess of neutrons. Explain the reason. (An)
 9. Briefly explain two experimental evidences which support the existence of magic numbers in nuclei. (U)
 10. Describe briefly standard model? (U)
- (1 x 8 = 8)**

PART B**Answer any 6 questions****Weights: 2**

11. The Meson theory of nuclear force assumes the virtual exchange of pions. If a nucleon emits a virtual pion of rest mass $270 m_e$, show that the range of nuclear force is 1.43fm. (An)
12. What are the different processes of beta decay? Show that the negatron (β^- - decay) emission occurs if the mass of the parent atom is greater than the daughter atom. (A)
13. Find the distance of closest approach of a 2 MeV proton to a gold nucleus. How will you compare the distance with those for a deuteron and an alpha particle? (E)
14. Plot a graph showing the number of scattered particles vs square of the atomic number of the scatterer (Coloumb scattering). (An)
15. Describe beta ray spectrum. Illustrate how the continuous beta spectrum is explained. (A)
16. What are quarks? The quark components of Λ^0 , Σ^+ , and π^0 are given as $\Lambda^0 = u + d + s$ $\Sigma^+ = u + u + s$ and $\pi^0 = d + d$ What are their charges? (E)

17. What is electrical quadrupole moment of a nucleus? What is its role in nuclear physics? (E)
18. Describe the composition of hadrons according to quark model. (U)
(2 x 6 = 12)

PART C

Answer any 2 questions

Weights: 5

19. Discuss the symmetries and conservation laws associated with fundamental particles? (An)
20. Give an account of Fermi's theory of beta decay. Compare the theoretical predictions with experimental findings. (U)
21. Write an essay on direct reactions and compound nucleus reactions. (An)
22. Outline the theory of partial wave analysis and apply it to low energy n-p scattering. (A)
(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
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Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;