Roll No. ------------------

**PHY-551**

**Nuclear Physics and Analytical Techniques**

M.Sc. Physics (MSCPHY)

2nd Year Examination 2024 (Dec.)

**TIME: 2 Hours Max Marks: 70**

Note: This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.***

**SECTION – A**

**Long-answer - type questions**

**Note: Section ‘A’ contains Five (05) long-answer-type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only. (2×19=38)**

1. What are the fundamental differences between the liquid drop model and the shell model of the nucleus? Describe shell model and give the main assumptions of it.
2. Explain the principle, theory, and applications of NMR spectrometers in detail.
3. Derive Fermi’s four factor formula with significance of each term in the formula. Explain how the Fermi’s four factor formula is used in designing a nuclear reactor.
4. Give the classification of fundamental interactions, elementary particle and conservation laws.
5. Define the term nuclear cross section. Derive an expression for the number of particles passing through a slab of finite thickness.

**SECTION – B**

**Short – answer – type questions**

**Note: Section ‘B’ contains eight (08) short- answer type questions of Eight (08) marks each. *Learners are required to answer any Four (04) questions only.* (4×8=32)**

1. What is neutron? How do you classify the neutrons as fast and slow neutrons based on their energy range?
2. Explain the principle and working of a scintillator detector with a diagram.
3. Explain Yukawa's theory of meson exchange and its role in describing the nuclear force.
4. Outline the main features of nuclear forces.
5. Discuss Geiger Nuttal law and Gamow's theory of α decay.
6. Explain Gell-Mann-Nishijima relation and Feynman diagrams.
7. Explain liquid drop model.
8. Define internal conservation, Mossbauer Effect and its application.