A–0436

MSCPH-511

Master of Science Physics (MSCPH)

Nuclear Physics

Examination, June 2025

Time : 2:00 Hrs.   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   2×19=38

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.

1.   Discuss the collective model of the nucleus. Show that it combines both the liquid drop model and shell model. Discuss the merit of this model.

2. Explain Geiger-Nuttal law. Discuss the quantum theory of alpha decay and explain how far this theory agrees with this law.

3. What are conservation laws for the nuclear reactions? Define Q-value, when a reaction will be exoergic and endoergic. Discuss threshold energy of an endoergic reaction.

4. Elaborate principle and working of synchrotron. Highlight the differences between synchrotron and cyclotron.

5. Write shorts notes on following:

   (i)   Nuclear Angular Momentum

   (ii)   Magnetic dipole moment

   (iii) Electric quadruple moment

   (iv)   Auger Electron

Section–B

Short Answer Type Questions   4×8=32

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.

1. Calculate the binding energies of the following isobars and their binding energies per nucleon :

   $^{64}_{28}$Ni $= 63.9277958\ u$, $^{64}_{29}$Cu $= 63.929759\ u$. Which of these would expect to β-active. Masses of proton and neutron are $1.007825\ u$ and $1.008665\ u$ respectively.

2. Explain nuclear force. Discuss charge symmetry of nuclear force.

3. Describe Fermi's theory of beta decay.

4. Discuss the p-p scattering at 0-10 MeV.

5. Discuss Compton scattering of gamma rays.

6. Discuss Yukawa's meson exchange theory of the nuclear force.

7. What is a compound nucleus? Write down the Bohr's hypothesis of compound nucleus.

8. Write down a short note in Linear accelerator. Give an introduction on particle accelerators in India.

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