P-937

MPHY-601

Nuclear Analytical Techniques

M.Sc. Physics (MSCPHY)

3rd Semester Examination, 2023 (June)

Time : 2 Hours]　　　　　　　**[Max. Marks : 35**

Note : This paper is of Thirty Five (35) 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 answer 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 Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only.

(2×9½=19)

1. Explain with the help of Gamow's theory how α- particles with the energies less than the height of the potential barrier are emitted from a radioactive nucleus. What are the special features of α-ray spectra?

2. Explain the different types of β-decays and discuss Fermi theory of β-decay along with the Kurie plot.

3. (a) Write a short note on radiative transitions in nuclei.

(b) Discuss the multipolarity of a gamma transition and explain the selection rules for gamma ray emission process.

4. Discuss the classification of fundamental interactions and their characteristics.

5. Describe the construction and working of scintillation and solid-state detectors with diagram.

SECTION–B
(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. Establish a relationship between range and velocity of alpha particles. Also explain Geiger-Nuttall law.

2. Define parity. Explain the violation of parity conservation during β-decay processes. How this has been experimentally verified?

3. Describe weak interactions of particles. Also give examples of this interaction.

4. Show that whether the following interactions obey conservation of charge, baryon number, isospin, third component of isospin and strangeness and mark them as allowed or forbidden accordingly:

(a) $p + p \rightarrow p + n + K^+$

(b) $p + p \rightarrow \Lambda^0 + K^0 + p + \pi^+$

5. Explain the following terms :

(a) Isospin

(b) Strangeness.

(c) Hypercharge.

(d) Charge Conjugation.

6. Write a short note on the discovery of the elementary particles.

7. Explain the theory of Compton effect.

8. Explain the nuclear emulsion technique to detect the charged particles.

———————