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PHY-551

Nuclear Physics and Analytical Techniques

M.Sc. Physics (MSCPHY)

2nd Year Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. Explain liquid drop model and obtain the Bethe-Weizsacker formula and explain the alpha decay with the help of semi-empirical formula.

2. Discuss the Gamow theory of α-decay and how it explains the main features of α-particle emission process. Write the limitations of the theory.

3. Discuss the compound nucleus theory of nuclear reaction. Obtain an expression for the Breit-Weigner formula.

4. Describe the construction, working and applications of scintillation counter and solid state detector.

5. What is Mossbauer effect? Derive the experimental set up to study the Mossbauer effect. How are isomer shift and quadrupole splitting evaluated from Mossbauer spectrum.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Discuss the postulates of Pauli's neutrino hypothesis.

2. Explain the exact conservation laws in particle interactions.

3. Explain the Dirac's theory for Pair production.

4. Discuss the basic ideas in Yukawa's meson theory of the nuclear force.

5. Calculate the binding energy of an α-particle from the following data (Mass of the helium nucleus = 4.002870 u. Mass of proton = 1.007825 u. Mass of neutron = 1.008665 u.)

6. Compute the Q-value of the reaction $Be^{9}(d,n)\ B^{10}$.

(Given masses of Be^{9} = 9.012182 u, B^{10} = 10.012938 u, d = 2.014102 u. n = 1.008665 u.)

7. Discuss Bohr and Wheeler theory of nuclear fission.

8. Briefly describe the working and applications of SEM.
