K-419

Total Pages : 3 Roll No. .....

MSCPH-511

NUCLEAR PHYSICS

M.Sc. Physics (MSCPH)

3rd Semester Examination, 2023 (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. Discuss the collective model of the nucleus. Show that it combines both liquid model and shell model. Discuss the merit of this model.

2. Write short notes on the following :

(a) Electric quadrupole moment.

(b) Parity.

(c) Binding Energy.

(d) Isotropic spin.

3. Give Fermi's theory of β-decay. Explain the violation of parity conservation during β-decay process.

4. Describe the Bohr's theory of compound nucleus to explain the nuclear reaction. Obtain the Briet-Wigner single level formula for nuclear resonance reaction.

5. Give an account of principle, construction and working of a cyclotron. Discuss the limitation and its further improvement.

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. Calculate the binding energy per nucleon of $^{4}_{2}He$ (α – particle). Masses of proton and neutron are 1.007825u and 1.008665u respectively. The mass of $^{4}_{2}He$ is 4.002604u.

2. Discuss Yukawa's meson exchange theory of nuclear forces.

3. Explain the Gamow's theory of α-decay.

4. Derive the Bethe-Weizsacker's Semi empirical mass formula.

5. Define gamma emission and selection rule for gamma decay.

6. Explain the Geiger-Nuttal Law.

7. Obtain the Q-value for the decay $^{214}_{84}\text{Po} \rightarrow {}^{210}_{82}\text{Pb} + \alpha$.

Where binding energy of $^{214}_{84}\text{Po}$, $^{210}_{82}\text{Pb}$ and α particle is 1.66601 GeV, 1.64555 GeV and 28.296 MeV respectively.

8. Explain the basic principle, construction and working of scintillation detectors.
