

**A-1182**

Total Pages : 3

Roll No. ....

**MSCPH-511**

**M.Sc. Physics (MSCPH)**

**Nuclear Physics**

Examination February, 2026

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.

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( 1 )

P.T.O.

1. Discuss liquid drop model and obtain the Bethe-Weizsacker formula. Explain the alpha decay with the help of semi-empirical formula.
2. Explain  $p-p$  scattering. Experimentally the study of  $p-p$  scattering is capable of much higher accuracy than  $n-p$  scattering. Why ? What are the similarities of  $n-n$  and  $p-p$  forces ?
3. Derive the Q-value equation for a generic nuclear reaction and explain how it is related to binding energies and reaction thresholds. Distinguish between exothermic and endothermic reactions, and discuss the significance of threshold energy and the role of mass-energy equivalence in reaction energetics.
4. Derive the working principle of a linear particle accelerator (linac). Discuss its construction and various types. Compare linacs with circular accelerators like cyclotrons and synchrotrons.
5. Write shorts notes on following :
  - (i) Quadrupole moment
  - (ii) Yukawa's meson exchange theory
  - (iii) Gas-filled counters
  - (iv) Geiger-Nuttal law

## 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. Explain importance of the nuclear shell model.
2. Explain Fermi theory of  $\beta$ -decay and parity violation in  $\beta$ -decay.
3. In a uranium ore, the amount of  $^{206}\text{Pb}$  is found to be 0.5 kg per kilogram of  $^{238}\text{U}$ . Assuming that all of  $^{206}\text{Pb}$  has been produced from  $^{238}\text{U}$  by radioactive disintegration calculate the life of ore.
4. Explain Breit-Weigner resonance dispersion formula.
5. Derive the relation between potential depth  $V_0$  and separation  $r$  for nucleon pair, sketching the curve and discussing bound states.
6. What are thermo nuclear reaction ? Explain controlled thermo nuclear reaction.
7. Describe neutron-proton scattering at low energy.
8. Write a short note on semiconductor detectors.

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