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R – 6582

Reg. No. :

Name :

Fourth Semester M.Sc. Degree Examination, July 2023

Physics

PH 242 : NUCLEAR AND PARTICLE PHYSICS

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer any **five** questions. Each question carries **3** marks.

1. (a) Explain the general form of non-central force.
- (b) Write any three evidences to show the existence of shell structure with in nuclei.
- (c) Write any six conservation laws in nuclear reactions.
- (d) Write a short note on endoergic reactions.
- (e) Explain fission reaction using semi empirical mass formula.
- (f) Explain briefly the working of G M Counter.
- (g) Discuss briefly the cyclotron accelerators.
- (h) Briefly explain Quark hypothesis of elementary particles.

(5 × 3 = 15 Marks)

P.T.O.



SECTION – B

Answer **all** questions. Each question carries **15** marks.

2. (a) Explain (i) Messon theory of nuclear force and (ii) exchange force and its implications.

OR

- (b) Explain shell model of nuclear structure and outline the features of magic number of nuclei.
3. (a) Discuss Bohr and Wheelers theory of nuclear fission.

OR

- (b) Discuss nuclear fusion process and explain controlled nuclear fusion reactors.
4. (a) Discuss the construction and working of (i) G M Counter and (ii) Synchrotron.

OR

- (b) Explain the classification of elementary particle and conservation laws of elementary particles.

(3 × 15 = 45 Marks)

SECTION – C

Answer any **three** of the following questions. Each question carries **5** marks.

5. (a) Derive the expression for the phase shift & for low energy neutron — proton scattering.
- (b) Calculate the Q value of the reaction (i) ${}^6\text{Li} + p \rightarrow {}^4\text{He} + {}^3\text{He}$ (ii) ${}^{59}\text{Co} + p \rightarrow n + {}^{59}\text{Ni}$ and (iii) ${}^{59}\text{Co} + \alpha \rightarrow n + {}^{62}\text{Ni}$
- (c) Prove that the spontaneous fission should be energetically possible for $A > 90$ and $Z > 40$.



- (d) Given that activation energy of ^{236}U is 6.2 MeV, What is the minimum energy alpha particle that can produce fission following bombardment of a ^{232}Th target.
- (e) Analyze the following decays according to their quark content.
 (i) $K^- + p \rightarrow \Omega^- + K^+ + K^0$ (ii) $K^- + p \rightarrow \Xi^- + K^+$ (iii) $\pi^- + n \rightarrow \Lambda^0 + \Sigma^0$
- (f) Assuming a magnetic field of 1.4T, compute the maximum energy of protons and deuterons, that can be obtained from a cyclotron of 75 cm radius.

(3 × 5 = 15 Marks)

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