



K24P 3351

Reg. No. :

Name :

III Semester M.Sc. Degree (C.B.S.S.- Supple./Imp.)
Examination, October 2024
(2021 and 2022 Admissions)
PHYSICS
PHY3C12 : Nuclear and Particle Physics

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer both questions (Either **a** or **b**).

1. a) Illustrate semi empirical mass formula with applications.

OR

- b) Describe the internal conversion process and applications.

2. a) Discuss in detail the compound nucleus reaction.

OR

- b) Explain the conservation laws of elementary particles. **(2×12=24)**

SECTION – B

Answer **any four**. (1 mark for part **a**, 3 marks for part **b**, 5 marks for part **c**.)

3. a) What are the characteristic features of nuclear force ?
b) Explain about nucleon-nucleon scattering and scattering length.
c) The differences in the coulomb energy between the mirror nuclei ${}_{24}\text{Cr}^{49}$, ${}_{25}\text{Mn}^{49}$ is 6.0 MeV. Assuming that the nuclei have a spherically symmetric charge distribution, and 1^2 is 1.0 MeV fm, calculate the radius of the ${}_{25}\text{Mn}^{49}$ nucleus.

P.T.O.



4. a) Briefly account on nuclear shell model.
b) What are magic numbers ? Why there are no magic numbers that are odd ?
c) With the help of the shell model, give the expected spin and parity for the ground states of
i) ${}_3\text{Li}^7$ ii) ${}_5\text{B}^{11}$ iii) ${}_6\text{C}^{15}$ iv) ${}_9\text{F}^{17}$
5. a) What do you mean by parity ?
b) Explain parity violation in beta decay.
c) How does neutrino help in the understanding of beta decay ?
6. a) State different types of fission processes.
b) Discuss the characteristics of nuclear fusion.
c) If a fusion process starts with 1000 neutrons, calculate the number of neutrons in the hundredth generation. Given, multiplicative factor, $k = 1.05$.
7. a) Mention the characteristics of different basic forces.
b) Demonstrate the eightfold way in the case of baryon octets.
c) Illustrate the classification of elementary particles with examples.
8. a) What are the experimental evidences in support of quark model ?
b) Write a note on quantum chromodynamics.
c) Are the following reactions allowed or forbidden ? Give reasons for your answers.
i) $\pi^+ + n \rightarrow K^0 + K^+$
ii) $\pi^- + p \rightarrow \Lambda^0 + K^0$
iii) $n^0 \rightarrow p + e^- + \bar{\nu}_e$

(4×9=36)