

(i) Printed Pages: 3

Roll No.

(ii) Questions : 9 Sub. Code :

2	6	1	0	9
---	---	---	---	---

Exam. Code :

0	4	7	4
---	---	---	---

M.Sc. Physics 3rd Semester
(2124)

NUCLEAR PHYSICS—I

Paper : PHY-8031

Time Allowed : Three Hours] [Maximum Marks : 60

Note :—Attempt FIVE questions in all, selecting ONE question each from Units I to IV. Unit V is compulsory.

UNIT—I

1. (a) What are different types of electromagnetic methods to determine the nuclear radius ? Describe the mirror nuclei method. 6
- (b) Define electric quadrupole moment associated with nuclei and derive its expression for ellipsoidal shapes. 6
2. (a) Discuss the partial wave analysis of reaction cross-section and derive the expression for total cross-section. 7
- (b) The Quadrupole moment for $^{155}_{64}\text{Gd}$ is 130 Fm^2 . Show that ^{155}Gd nucleus is almost spherical. 5

UNIT—II

3. (a) Discuss the Fermi theory of β -decay in detail. 6
- (b) Define and explain Gieger Nuttal law. 3
- (c) Explain in brief the helicity of neutrino. 3

4. (a) Explain Co-60 experiment to discuss the parity non-conservation in β -decay. 6
- (b) Discuss the Gammow's theory of alpha decay in detail. 6

UNIT—III

5. (a) Prove that no bound state exist for excited state of deuteron. 6
- (b) Show that for a square well of depth V_0 and range b , the scattering length 'a' for a spinless neutron is given by the relation :

$$K \cot kb = (b - a)^{-1}, \text{ where } K = \frac{(MV_0)^{1/2}}{\hbar}. \quad 3$$

- (c) Give a brief description of exchange forces. 3
6. (a) Show that the cross-section for orthohydrogen is greater than the cross-section of para hydrogen. 6
- (b) Show that in n-p scattering at low energy below 10 MeV, 's' wave is predominant. 6

UNIT—IV

7. (a) Describe the neutron cycle in a thermal nuclear reactor. Also obtain four factor formula. 8
- (b) Draw and explain the mass and energy distribution of fission fragments of U^{235} . 4

8. (a) Briefly explain the accelerator based sources for the production of neutron. 5
- (b) Explain slowing down power and moderating ratio of neutrons. 5
- (c) Write a note on spontaneous fission. 2

UNIT—V

9. (a) Define and explain thick target yield.
- (b) List three properties of good moderator.
- (c) Draw a Kurie plot in nuclear β -decay.
- (d) Define laboratory and centre of mass co-ordinate.
- (e) Define scattering length.
- (f) What do you mean by allowed and forbidden transitions in β -decay ? $6 \times 2 = 12$