(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 9 Sub. Code : 3716

Exam. Code : 0474

M.Sc. Physics 3rd Semester

(2122)

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. Derive the expression for quadrupole in case of ellipsoidal shape. 6

2. (a) Discuss the partial wave analysis of reaction cross-section and derive the expression for total cross-section. 6

   (b) What do you understand by Q-value of a reaction ? What information does it give about a reaction ? Obtain the expression for Q-value. 6

UNIT—II

3. (a) Discuss the Gammow theory of α-decay in detail. 6

   (b) Explain Co-60 experiment to discuss the parity non-conservation in β-decay. 6

4. (a) Explain the Fermi theory of β-decay in detail. 6

   (b) Write a short note on cluster decay. 3

   (c) Explain in brief the helicity of electron. 3

UNIT—III

5. (a) Show that deuteron is barely bound in ground state. 7

   (b) Show that for a square well of depth V_o and range 'b', the scattering length 'a' for a spinless neutron is given by the relation :

   $$K \cot kb = (b-a)^{-1},$$

   where $K = \frac{\sqrt{MV_o}}{\hbar}$. 5

6. (a) Explain neutron-proton scattering at low energy. 8

   (b) Compare n-p and p-p scattering. 4

UNIT—IV

7. (a) Discuss the diffusion of thermal neutrons. Show that neutron density decreases exponentially with increase of distance from source. 7

   (b) Draw and explain the mass and energy distribution of fission fragments of U^{235}. 5

8. (a) Describe the neutron cycle in a thermal nuclear reactor. Also obtain four factor formula. 8

(b) Write a note on spontaneous fission. 4

UNIT—V

9. (a) Draw curie plot in nuclear β-decay.

(b) List three properties of good moderator.

(c) Define scattering length.

(d) Write a short note on internal conversion process.

(e) A nucleus with A = 235 split into two new nuclei, whose mass numbers are in the ratio 2 : 1, find the radii of new nuclei (R_o = 1.2 F).

(f) Define and explain thick target yield. 2×6=12