M.Sc. Physics 3rd Semester

(2123)

NUCLEAR PHYSICS—I

Paper—PHY-8031

Time Allowed : Three Hours]   [Maximum Marks : 60

Note :— Attempt **FIVE** questions in all, selecting **ONE** question each from Unit I to IV. Question No. **9** is compulsory.

UNIT—I

1. (a) Discuss the various probe of determine the size of the nucleus. Discuss μ-mesonic method in detail.   9

   (b) Define parity. How it is related to symmetry of wave functions of system of particles ?   3

2. (a) Discuss the classical analysis of cross-section. Define reaction cross-section and differential cross-section.   6

   (b) What are direct reaction ? How these reaction differ from compound nucleus reaction ?   3

   (c) Define various nuclear moments of the nuclei.   3

UNIT—II

3. (a) Discuss the Gammow's theory of α-decay and show that there is finite probability of finding α-particle outside the nucleus after the decay process. 6

(b) What is Bragg curve ? Discuss. 3

(c) Define and explain Gieger Nuttal law. 3

4. (a) Write a note on Wu-Ambler experiment and the neutrino helicity. 5

(b) What are the expected types of Gamma-rays transitions between $h_{11/2} \rightarrow d_{5/2}$ states ? 3

(c) Explain the Beta-decay spectrum shape and life-time. 4

UNIT—III

5. (a) Prove that the cross-section for ortho hydrogen is greater than para hydrogen in n-p scattering. What we can conclude from this result about the nuclear force ? 6

(b) Calculate the range of nuclear potential if the depth is equal to 25 MeV. 3

(c) Give the experimental data on deutron's binding energy, magnetic moment, spin and electric quadrupole moment. 3

6. (a) Show that at low energy n-p scattering, S-wave scattering is predominant. 6

(b) Derive effective range theory for n-p scattering. Derive the expression for cross-section in terms of σ_t and σ_s. 6

UNIT—IV

7. (a) Discuss the diffusion of thermal neutrons. Show that neutron density decreases exponentially with increase of distance from source. 6

(b) Write a note on detection of neutrons. 3

(c) Compute de-Broglie wavelength for neutron energies :

(i) E = 0.025 MeV

(ii) E = 1 MeV. 3

8. (a) Explain the terms thermal utilization factor and four factor formula. 6

(b) List three properties of a good moderator. 3

(c) Define the terms spontaneous fission, fast fission, photofission. 3

UNIT—V

9. (a) Estimate the radius of Ni^{64} nuclei. 2

(b) What is binding energy of nucleus ? How it is related to stability of nucleus ? 2

(c) What is internal conversion process ? 2

(d) Define moderating ratio. 2

(e) What do you mean by Gammo-teller transition ? 2

(f) What are prompt and delayed neutrons ? 2