

(i) Printed Pages : 3

Roll No. ....

(ii) Questions : 9 Sub. Code : 

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Exam. Code : 

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M.Sc. Physics 3<sup>rd</sup> Semester  
(2125)

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. Unit-V is compulsory.

### UNIT—I

1. (a) Explain electron scattering method to calculate the size of nucleus. 6
- (b) Define electric quadrupole moment associated with nuclei and derive its expression for ellipsoidal shapes. 6
2. (a) Chlorine-33 decays by positron emission with a maximum energy of 4.3 MeV. Calculate the radius of nucleus from this. 5
- (b) Discuss the partial wave analysis of reaction cross-section and derive the expression for total cross-section. 7

## UNIT—II

3. (a) Discuss Wu-Ambler experiment to explain the parity non-conservation in  $\beta$ -decay. 6
- (b) Discuss the Gamow's theory of alpha decay in detail. 6
4. (a) Write a short note on Q-values in  $\beta$ -decay. 5
- (b) Explain the Fermi theory of  $\beta$ -decay in detail. 7

## UNIT—III

5. (a) Show that the ground state wave function of deuteron is predominantly in the  $3_{S1}$  state with a small mixture of  $3_{D1}$ . 7
- (b) Calculate the total cross-section for n-p scattering at neutron energy 2 MeV.

Given  $a_t = 5.38$  F,  $a_s = -23.7$  F,  $r_{ot} = 1.70$  F, and  $r_{os} = 2.40$  F. 5

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

## UNIT—IV

7. (a) Explain slowing down power and moderating ratio of neutrons. 4
- (b) Describe the neutron cycle in a thermal nuclear reactor. Also obtain the four factor formula. 8

8. (a) Discuss the diffusion of thermal neutrons. Show that neutron density decreases exponentially with increase of distance from source. 8
- (b) Draw and explain the mass and energy distribution of fission fragments of  ${}^{235}\text{U}$ . 4

### UNIT—V

9. (a) Define scattering length.
- (b) Draw a Kurie plot in nuclear  $\beta$ -decay.
- (c) What do you mean by allowed and forbidden transitions in  $\beta$ -decay?
- (d) What is internal conversion process?
- (e) Explain in brief the helicity of electron.
- (f) Define Laboratory and Centre of Mass co-ordinate.

6×2=12