

Roll No.

Total Pages : 4

CMDQ/D-23

5121

NUCLEAR PHYSICS-I

Paper-PHY-303-B

Time Allowed : 3 Hours]

[Maximum Marks : 60

Note : Attempt **five** questions in all, selecting **one** question from each Unit. Question No. **1** is compulsory. All questions carry equal marks.

Compulsory Question

1. Answer the following questions :

- (a) In which way split anode ionization Chamber is advantageous over semiconductor detectors based $\Delta E - E$ telescope? Explain. 3
- (b) What are the factors that control time accuracy in time measurements during time of flight spectroscopy? Explain. 2
- (c) What do you mean by Pulse splitter and attenuator? 3
- (d) What is the role of SF_6 in Tandem accelerator? Explain. 2

- (e) What is the basic principle of Neutron detection? Explain. 2

UNIT-I

- 2. (a) Explain the basic principle and working of Hybrid detector telescope for particle identification. What are its advantages? 6
- (b) Which detector system can be used to identify low energy $^{10}B^+$ ions? Explain. 3
- (c) Why the Stacking of thin detectors is better than the use of Single detector of large thickness for identification of High energy charged particles? Discuss. 3
- 3. (a) For the analysis of a High energy proton induced nuclear reaction, which Identification System can be used? Discuss the basic principle and methodology involved Event by Event in such a system. 9
- (b) Describe power law formulation for particle identification. 3

UNIT-II

- 4. (a) What is charge sensitive pre amplifier? What do you understand by the Sensitivity of a charge sensitive pre-amplifier? Explain it by giving suitable examples. 8

- (b) What do you mean by pole zero cancellation in nuclear spectroscopic measurements? Discuss. 3
- (c) Describe the method of CR-RC pulse shaping in the amplifier. 4
- 5. (a) What do you understand by Slow and Fast coincidence techniques? Explain their use in nuclear spectroscopic measurements with suitable block diagram. 6
- (b) What is Single Channel Analyzer? How does it work? Explain by giving suitable examples. 6

UNIT-III

- 6. (a) How $^{56}\text{Fe}^{+9}$ ions can be accelerated to 100 MeV? Discuss in detail how it can be achieved. 8
- (b) What are Negative ions? How will you generate the Negative ions using RF ion source. 4
- 7. (a) N^+ , B^+ and N_2^+ ions each with 100 keV are implanted in Aluminum targets. Discuss which out of these will have more projected range. 4
- (b) Discuss the process of Ion beam channeling. Explain this phenomenon using suitable diagram. What are its advantages? 5
- (c) Describe various kinds of ion ranges. What is the significance of projected range? 3

UNIT-IV

- 8. (a) Calculate the critical Mass and Critical size of a reactor using ^{235}U . 5
- (b) What are prompt and delayed neutrons? What is the role of delayed neutrons in the control of reactors? 5
- (c) How can gamma rays be discriminated from neutrons? Explain. 2
- 9. (a) Describe the concept of a Fusion reactor. Describe the various fusion reactions. Is there any fusion reactor in India. 6
- (b) Explain the basic principle of a Breeder reactor using a block diagram. 3
- (c) Discuss four factor formula for a Reactor. What is the significance of Neutron multiplication factor? 3