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NY—85—2023

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(CBCS/New Pattern)

PHYSICS

Paper-PH-16

(Nuclear and Particle Physics)

(Thursday, 7-12-2023)

Time : 2.00 p.m. to 5.00 p.m.

Time—3 Hours

Maximum Marks—75

N.B. :— (i) All questions are compulsory and carry equal marks.

(ii) Figures to the right indicate full marks.

1. Discuss the semi-empirical mass formula for binding energy of a nucleus. Explain the significance of each of the term in it. 15

Or

(a) Write a note on the nuclear spin. 8

(b) Explain the concept of mass defect in detail. How does it enable us to quantify the binding energy ? 7

2. Explain principle, construction and working of the G.M. counter in detail. 15

Or

(a) Explain the scheme of classification of elementary particles. 8

(b) Discuss the concept of interaction of charged particles with matter. 7

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3. Write down the shell model configuration and assign the spin and parities to the ground states of nuclei : ${}_{28}\text{Fe}^{57}$, ${}_{30}\text{Zn}^{67}$, ${}_{21}\text{Sc}^{41}$ 15
- Or*
- (a) Explain the characteristics of nuclear forces. 8
- (b) Write a detailed note on the nuclear collective model. 7
4. What are allowed and forbidden β -transitions ? Discuss Fermi and Gamow-Teller selection rules for various transitions in β -decay. 15
- Or*
- (a) Discuss the C-N-O cycle. 8
- (b) Distinguish between the three forms of β -decay giving suitable examples for each of them. 7
5. Attempt any *three* : 15
- (a) Explain mirror nuclei with suitable examples.
- (b) Write a short note on pair production.
- (c) Write a short note on meson theory of nuclear forces.
- (d) What do you mean by nuclear fusion ? Explain it in detail. What are the temperature requirements of these reactions ?