

Reg. No.									
----------	--	--	--	--	--	--	--	--	--

DEPARTMENT OF SCIENCES III SEMESTER M.Sc. (PHYSICS) END SEMESTER MAKEUP EXAMINATIONS, DECEMBER 2023 NUCLEAR PHYSICS - I [6003] (CHOICE BASED CREDIT SYSTEM - 2020)

Time: 3 Hours

Date: 27/12/2023

MAX. MARKS: 50

Note (i) Answer ALL questions

(ii) Draw diagrams, and write equations wherever necessary

Q. No.		Marks	CO	BL
1 (a)	Write down one experimental observation in support of shell model.	2	1	2
1 (b)	How many nucleons can be accommodated in these levels:	2	1	1
	$1f_{7/2}$ and $1h_{11/2}$?			
1 (c)	In figure 1 (on the next page), level scheme of a rotating nucleus is	3	1	3
	shown. Assuming that the rotational model is valid, calculate the			
	excitation energy of states above 2 ⁺ level.			
1 (d)	In Nilsson model, draw the K splitting of g9/2 state. The core is	3	1	4
	assumed as prolate in shape. Explain the diagram.			
2 (2)		0	1	2
2 (a)	What is the extreme single particle shell model?	2	1	3
2 (D)	Write down the equation for nuclear surface.	2	1	1
2 (c)	Show that quadrupole moment of a prolate deformed nucleus is	3	1	3
- (-)	always positive.			
2 (d)	What is $R_2(\pi)$ invariance of an axially symmetric nucleus? What are	3	1	3
	its consequences for nucleus with K=0?			
3 (a)	Write two differences in the interaction of charged and uncharged	2	2	1
	radiation with matter.			
3 (b)	What is energy straggling?	2	2	1
3 (c)	Define stopping power of a charged particle in matter.	2	2	1
3 (d)	Which particle has higher stopping power, given that they have same	2	2	2
	energy, alpha particle or proton?			
3(e)	Draw transmission curve for the alpha particles penetrating the	2	2	2
	matter.			
-				
4 (a)	What is fluorescence, phosphorescence, and delayed fluorescence in	2	2	1
	the scintillation process?			

4 (b)	Explain the reason for different pulse shapes for alpha, neutron, and gamma radiation interaction with organic scintillator	3	2	2
4 (c)	Describe photoemission process from the photocathode of the photomultiplier tube.	5	2	2
5(a)	Explain the reasons for the secondary electron escape from the detector. What changes it induces in the detector response?	5	2	2
5 (c)	Draw the response of a small size and a large size detector to a monoenergetic gamma-ray source if all gamma-ray interaction processes are taking place. Also explain all the features.	5	2	2

Fig. 1

