Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2024

Course: Nuclear and Particle Physics — **Semester: IV**

Program: B.Sc. (H) Geo + Math + Chemistry — **Time: 03 hrs.**

Course Code: PHYS2012G — **Max. Marks: 100**

Instructions: Read the instructions carefully and follow them strictly.

i) **Mention roll no. at the top of the question paper.**

ii) **Attempt all the parts of a question at one place only.**

SECTION A (Attempt all the questions)

(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Show that the nuclear density is independent of the mass number.	**4**	**CO1**
Q 2	Explain the assumptions made in liquid drop model.	**4**	**CO2**
Q. 3.	A photon of energy 1.02 MeV is scattered through 90^0 by a free electron. Calculate the energy of photon and electron after interaction.	**4**	**CO2**
Q.4.	Explain the various characteristic properties of radioactive elements.	**4**	**CO3**
Q.5.	What are fermions? How will you differentiate between leptons and baryons?	**4**	**CO4**

SECTION B (Attempt all the questions. Question 9 has internal choice)

(4Qx10M= 40 Marks)

Q 6	Define and explain the mass defect and binding energy. Derive expression for binding energy per nucleon.	**10**	**CO1**
Q.7	What do you mean by nuclear magic numbers? What evidence can you give in support of the existence of these numbers?	**10**	**CO2**
Q.8	Describe Bohr's formula for the energy loss of heavy charged particles moving through matter.	**10**	**CO2**
Q.9	Explain compound nucleus theory of nuclear reactions. What do you mean by cross-section of a nuclear reaction? OR Calculate the minimum energy of γ-rays necessary to disintegrate a deuteron into a proton and a neutron.	**10**	**CO3**

SECTION-C (Attempt all the questions. Question 11 has internal choice) **(2Qx20M=40 Marks)**			
Q 10	a) The radii of Oxygen and lead are found to be 3 fermi and 7 fermi respectively. Their masses are 2.7 X 10^{-26} kg and 3.4 X 10^{-24} kg respectively. Determine their densities. b) Briefly discuss the qualitative features of tunnel theory of alpha decay.	**10** **10**	**CO1** **CO3**
Q. 11	a) Explain the principle, construction and working of a G.M. counter. What do you mean by quenching of a G. M. counter? b) An α-particle is stopped in an ionization chamber in which it is produced 15 X 10^4 ion pairs. Each time the α-particle produces an ion pair, it loses 35 eV of energy. What is the kinetic energy of the particle? Calculate the amount of the charge collected by each plate. OR a) Discuss in detail the principle, construction and working of a cyclotron. What are its limitations? b) A G.M. counter collects 10^8 electrons/discharge when the counting rate is 500 counts/min. What will be the average current in the circuit?	**15** **5** **15** **5**	**CO4**

Values of constants:

Constant	Standard Values
Rest mass of an Electron	9.11 x 10^{-31} Kg
Charge of electron	1.6 x 10^{-19} C
Speed of light	3 x 10^8 ms^{-1}
Plank's constant	6.63 x 10^{-34} Js
Mass of Proton/Neutron	1.66 x 10^{-27} kg