


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Nuclear and Particle Physics Program: M.Sc. (Physics) Course Code: PHYS 7021		Semester: II Time: 03 hrs. Max. Marks: 100	
Instructions: <ul style="list-style-type: none"> All questions are compulsory (Q9 and Q11 have an internal choice) Scientific calculators can be used for calculations. 			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Give the various coupling rules of the nucleus inside a nucleus.	4	CO1
Q 2	Explain the assumptions made in liquid drop model.	4	CO2
Q. 3.	Calculate the minimum energy of γ -rays necessary to disintegrate a deuteron in to a proton and a neutron.	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 (4Qx10M= 40 Marks)			
Q 6	Prove from statistical angular momentum and wave mechanical consideration that electron cannot exist in the nucleus.	10	CO1
Q.7	What do you mean by the nuclear magic numbers? What evidences can you give in support of existence of these numbers?	10	CO2
Q.8.	Explain Nuclear Reaction cross-section. Obtain an expression for the yield of nuclear reaction in terms of cross-section for a slab of infinitesimally small thickness.	10	CO2
Q.9	Derive the Classical formula for stopping power (loss of energy per unit length) of a charged particle during its passage through matter.	10	CO3
OR			
An X-ray of wavelength) 0.1 angstrom is scattered by an electron. What			

	are the maximum and minimum wavelengths of the scattered photon? Calculate the angle corresponding to the scattered photon of wavelength 0.11 angstrom.		
SECTION-C (2Qx20M=40 Marks)			
Q .10	a) Write short notes on; (i) Internal pair production (ii) Geiger Nuttal law and its importance b) What are strange particles? Explain the concept of strangeness and the principle of associated production.	10	CO3
		10	CO4
Q.11	a) Predict the characteristics of the ground state of ${}_8\text{O}^{17}$ and ${}_{29}\text{Cu}^{62}$. b) What are the various types of nuclear reactions? Give at least one example for each case. <p style="text-align: center;">OR</p> a) A count rate meter is used to measure the activity of a radioactive sample. At a certain instant the count rate was recovered as 4750 counts per min. Five minutes later the count rate showed as 2700 counts per min. Compute (i) the decay constant and (ii) the half-life for the sample. b) Write short notes on; (i) Artificial radioactivity, and (ii) compound nucleus theory of nuclear reactions.	10	CO2
		10	CO2
		10	

Values of constants:

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