UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Nuclear and Particle Physics **Semester: V**
Program: B. Sc. Physics Honors **Time : 03 hrs.**
Course Code: PHYS 3012 D **Max. Marks: 100**

Instructions: Read all the below mentioned instructions carefully and follow them strictly:
Mention Roll No. at the top of the question paper.

ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the graph between number of neutrons and number of protons.	4	CO1
Q 2	a,The numerical value of the binding energy of tritium is _____. (2) b. The nuclear force is of _____range,_____dependent and _____ independent. (3)	4	CO1
Q 3	A nucleus with A=235 splits with two fragments whose mass numbers are in the ratio 3:2. Find the separation between the fragments at the moment of splitting.	4	CO2
Q 4	Due to an accident in a laboratory, a large amount of radioactive material (Half life=20 days) spreads inside the room. Test showed that the level of radiation was 30 times the permissible level of normal occupancy of the room. Assuming this, after how many days, the room would be safe for occupation?	4	CO3
Q 5	Select all the correct statement: i) The magnetic moment of a neutron is zero as it is charge neutral. ii) The binding energy curve can be used to describe fission and fusion. iii) The top quark is the heaviest quark. iv) Cockcroft Walton accelerator is an electrostatic type accelerator. v)The most abundant element in the universe is iron	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	Explain the CNO cycle describing the hydrogen burning in stars.	10	CO1
Q 7	Draw a chart of the four radioactive decay series.	10	CO2

Q 8	Explain the transient and secular equilibrium in process of radioactive decay.	10	CO3
Q 9	Explain the process of neutron interaction with matter? OR Explain the Fermi- Gas model of the nucleus.	10	CO3

SECTION-C
(2Qx20M=40 Marks)

| Q 10 | (a) What is pair production? Why pair production cannot take place in empty space? (10)

(b) Shows that in Compton Scattering, the recoil angle of an electron is given by $\phi = \tan^{-1}\left(\frac{\sin\theta}{\frac{\lambda'}{\lambda}-\cos\theta}\right)$, where θ and ϕ are scattering angle of scattered photon and electron respectively? (10)

OR

(a) A frequency of 2.4×10^{15} Hz is used on magnesium with work function of 3.7 eV.
    (a)   What is energy transferred by each photon?
    (b)   Calculate the maximum KE of the ejected electrons.
    (c)   The maximum speed of the electrons.
    (d)   The stopping potential for the electrons. (10)

(b) Describe the symmetries and conservation laws of Particle Physics. (10) | 20 | CO4 |
| Q 11 | a) Explain the construction and working of a Geiger-Muller Counter. (10)
b) Explain the construction and working of a Tandem accelerator. (10) | 20 | CO2 |