CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN, NUVEM - GOA.

SEMESTER END EXAMINATION, JULY 2021

Semester: VI of B.Sc.   Physics PYD106   Nuclear Physics

Total Marks: 30   Date: 17/7/2021   Duration: 2 Hours

Instructions: 1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Symbols have their usual meaning unless specified.
4. Use of nonprogrammable calculator is permitted.
5. Draw neat diagrams wherever necessary.

Q1. Answer any **five** of the following: **5 x 2=10**

a. Half-life of a radioactive element is given by 3000yrs, how many years will be required by 1gm of radium to lose 1mgm?

b. Find the spin and parity of $^{15}O_8$ and $^{16}N_7$ using the Jensen & Mayer scheme.

c. Estimate the binding energy per nucleon of ^{120}Sn with Z=50. Mass of ^{120}Sn atom = 119.902199 a.m.u, mass of proton=1.007825am.u, mass of neutron is 1.008665 a.m.u.

d. Calculate the activity of 500gm of $_{92}U^{238}$ if its disintegration constant is 4.8×10^{-18}/sec.

e. Explain the term nuclear cross section. State its units.

f. Name two merits and two limitations of liquid drop model

g. Give the three-stage nuclear programme for India. What was the purpose of adopting this plan?

h. State any two different types of nuclear radiation detectors with their uses

Q2. Answer **any four**: 5x4=20

a) Briefly explain the meson theory of nuclear forces and estimate the mass of meson using Heisenberg Uncertainty Principle.

b) Derive the Weizsacker's semi-empirical mass formula for the nucleus, given by liquid drop model.

c) What is a breeder reactor? What is the multiplication constant k? what happens to the chain reaction when k>1, k<1, k=1.

d) Describe the Beta decay spectrum with help of graph. Name the two violations of conservations laws that led to the Pauli's Neutrino Hypothesis.

e) From the mass parabolas, predict the β –decay stability of an isobar family of odd-A nuclei. What is the charge of the most stable nucleus of this family?

f) Plot the fission yield curve for U^{238}, briefly explain any two of its features. What changes do you observe in the curve if the neutron energy increases? What is the probability that the fission will be symmetric?

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