

Dr. K K Sharma

16/11/2022 (2)

Roll No.....

Department of Physics & Photonics Science, NIT Hamirpur (HP)

End Semester Examination, Nov., 2023

Subject: Nuclear Science & Engineering (PH-331)

Class: B. Tech. 3<sup>rd</sup> Year

Time: 3 hrs

Semester: 5<sup>th</sup>

Max. Marks: 50

Note: All questions are compulsory.

Q.1 (a) Discuss Lawson criterion.

(b) What is nuclear angular momentum? Explain nuclear angular momentum of even-even, even-odd and odd-odd nuclei.

(c) Explain asymmetry energy and surface energy.

(d) Derive a formula for the atomic number of the most stable isobar of a given mass number and use it to find the most stable isobar of mass number 25. (given Coulomb constant  $a_c=0.66\text{MeV}$ , asymmetry constant  $a_n=19\text{MeV}$ ).

(e) What is radioactive equilibrium? Explain about secular equilibrium.

(f) What is binding energy? Discuss binding energy per nucleon curve.

(g) What is the multiplication factor? Explain its importance. Discuss about the critical size for maintenance of a chain reaction.

(3x7=21)

Q.2 Discuss carbon dating. A carbon specimen found in a cave contained  $1/8^{\text{th}}$  as much as an equal amount of carbon in living matter. Calculate the appropriate age of the specimen. Half-life period of  $\text{C}^{14}$  is 5568 years. (4)

Q.3 Define one Gray. Discuss biological effects of nuclear radiation. Discuss various radiation protection methods. (4)

Q.4 Discuss construction and working of scintillation counter. (4)

Q.5 Discuss the principle, construction and working of the linear accelerator. What are its advantages and limitations? (4)

Q.6 Discuss the construction and working of a fast breeder reactor. (4)

Q.7 Explain the need to work on fusion reactor technology. Mention various types of possible fusion reactions. Discuss three conditions that must be met by a successful fusion reactor. (4)

Q.8 What are the assumptions of shell model? Discuss how it could explain the magic numbers using Wood's Saxon potential and inclusion of spin-orbit interaction? Discuss its achievements and failures. (5)