Seat No. _____

HAK-003-0493004

B. Sc. / M. Sc. (Applied Physics) (Sem. III)
(CBCS) Examination
May - 2023
Paper - XI : Basic Nuclear Physics
(New Course)

Faculty Code : 003
Subject Code : 0493004

Time : $2\frac{1}{2}$ / Total Marks : **70**

Instructions :

(1) All questions are compulsory.
(2) Numbers in the right figures indicate marks.

1 (A) Answer the following questions : **4**
(1) What are heavier nuclei?
(2) What is the dimenstion of a nuclei?
(3) What is atomic number and atomic weight?
(4) What are the isotopes? Write some examples.

(B) Answer the following questions in brief : (any one) **2**
(1) Write a brief note : Magic numbers
(2) What is alpha decay?

(C) Answer the following questions : (Any one) **3**
(1) Explain nuclear shell model.
(2) Explain the rate of radioactive decay.

(D) Answer the following questions : (Any one) **5**
(1) Explain in detail; Binding energy of nuclei.
(2) Derive an equation for half-life of radioactive materials.

2 (A) Answer the following questions : **4**
(1) What is radioactivity?
(2) What is mass number(A)?
(3) Which materials are used as nuclear fuel in nuclear reactors?
(4) What are different type of radioactivity?

(B) Answer the following questions in brief : (Any one) **2**

(1) Name the places where nuclear reactors are placed in India.

(2) What are the applications of radioisotopes?

(C) Answer the following questions : (Any one) **3**

(1) Explain the principle of carbon dating method.

(2) Explain the conservation laws in radioactive decay.

(D) Answer the following questions : (Any one) **5**

(1) What are the applications of nuclear reactor?

(2) Explain the theory of alpha decay.

3 (A) Answer the following questions : **4**

(1) How the nuclear fission is initiated by the impact of neutron?

(2) Which materials are used as a control in nuclear power plants?

(3) What kind of nuclear reactions take place in the Sun?

(4) Explain the electron capture 'process.

(B) Answer the following questions in brief : (Any one) **2**

(1) Explain in short: types of nuclear reactions.

(2) The half-life of radon is 3.8 days, after how many days will only one twentieth of Radon sample is left?

(C) Answer the following questions : (Any one) **3**

(1) Explain: Nuclear reaction kinetics.

(2) Derive Q value equation for nuclear reaction.

(D) Answer the following questions : (Any one) **5**

(1) Classify nuclear reactors and explain any one of them.

(2) Explain in detail: Beta decay.

4 (A) Answer the following questions. 4

(1) What type of radiations are emitted in radioactive disintegration?

(2) What is the unit of radioactive disintegration?

(3) In which type of decay process atomic number of an element remains the same?

(4) What is the relation between energy and mass?

(B) Answer the following questions in brief : (Any one) **2**

(1) What are the gamma rays? How they are produced?

(2) How electricity is generated using nuclear power plant?

(C) Answer the following questions : (Any one) **3**

(1) Radioactive disintegration constant (λ) of Radium is 1.13 X lO-9 Sec-1. How much time a give sample would take to reduce 1/10 of its original value?

(2) 1 gm radioactive material having half-life of 2 years is kept in store for a duration of 4 years. Calculate how much remains unchanged.

(D) Answer the following questions. (Any one) **5**

(1) Explain: Nuclear fission reaction.

(2) Explain: Pressurized water reactor.

5 (A) Answer the following questions : **4**

(1) ${}^{3}_{7}Li + \_\_\_\_\_ = {}^{4}_{2}He + {}^{4}_{2}He$

(2) $\_\_\_\_\_ = {}^{13}_{6}C + {}^{0}_{1}\beta$

(3) ${}^{27}_{13}Al + {}^{1}_{0}n = \_\_\_\_\_ + {}^{4}_{2}He$

(4) ${}^{20}_{42}Ca + {}^{1}_{1}H = \_\_\_\_\_ + {}^{2}_{1}H$

(B) Answer the following questions in brief : (Any one) **2**

(1) Why neutrons are selected to break the chain in nuclear reaction?

(2) What are the differences between artificial and natural radioactivity?

(C) Answer the following questions : (Any one) **3**

(1) What is radioactive equilibrium?

(2) Compare the properties of Alfa, Beta and Gamma radiation.

(D) Answer the following questions : (Any one) **5**

(1) Explain in detail; nuclear fusion reactor.

(2) Explain boiling water reactor.
