JAH-003-0493004 Seat No. _____

B. Sc. / M. Sc. (Applied Physics)
(Sem. III) (CBCS) Examination
November – 2019
Paper - XI : Basic Nuclear Physics
(New Course)

Faculty Code : 003
Subject Code : 0493004

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions :

(1) All questions are **compulsory**.

(2) Figures on the **right** indicate marks

1 Attempt any **seven** short questions : (**two** marks each) **14**

1. Define nucleus, isotopes and isomers.
2. What is radioactivity ? Give examples.
3. Explain elastic scattering with example.
4. Explain radioactive dating.
5. Explain radioactive capture with an example.
6. Give difference between research reactor and power reactor.
7. Why fast reactors don't need moderator ?
8. What is the use of coolants in the reactors ? Give examples.
9. Write a note : Positron emission.
10. Complete the following reaction :

i) $^{34}_{17}Cl \rightarrow$ _____ $+ \, ^{0}_{1}\beta$

ii) _____ $\rightarrow \, ^{234}_{90}Th + \, ^{4}_{2}He$

2 (A) Write answers of any **two** : **10**

1. Write a detailed note on magic numbers.
2. Derive an equation for semi empirical mass formula and also define the energy term.
3. Explain nuclear shell model in detail.
4. Explain nuclear size and binding energy in detail with necessary characteristics.

2 Write answer of any **one** : **4**

1. What is unified atomic mass unit ? What is its energy equivalent ? Explain with example.
2. Explain the constituents of the nucleus. What is the effect of number of constituent particles on the stability of a nucleus ?

3 (A) Write answers of any **two** : **10**

1. Write a detailed note on the conservation laws in radioactive decay.
2. Explain radioactive equilibrium in detail.
3. Write a detailed note on alpha decay.
4. Explain Gamma decay in detail.

(B) Write a detailed answer of any **one** : **4**

1. Electron capture.
2. Electron emission.

4 (A) Write answers of any **two** : (**five** marks each) **10**

1. Derive Q value equation for nuclear reaction.
2. Discuss conservation laws for nuclear reaction.
3. Explain in detail nuclear fission and fusion with example.
4. Explain any four nuclear reactions with its respective examples.

(B) Complete any **four** reactions : **4**

1. ${}^{30}_{15}P \rightarrow$ _____ $+ {}^{0}_{1}\beta$

2. ${}^{7}_{3}Li + {}^{4}_{2}He \rightarrow$ _____ $+ \gamma$

3. ${}^{122}_{52}Te + {}^{4}_{2}He \rightarrow$ _____ $+ {}^{124}_{53}I$

4. ${}^{42}_{20}Ca + {}^{1}_{1}H \rightarrow$ _____ $+ {}^{2}_{1}H$

5. ${}^{23}_{11}Na + {}^{1}_{1}H \rightarrow$ _____ $+ {}^{20}_{10}Ne$

6. ${}^{4}_{2}He +$ _____ $\rightarrow {}^{15}_{7}N + \gamma$

5 (A) Write detailed notes on any **two** : **10**

1. Pressurized water reactor.
2. Boiling water reactor.
3. Fast breeder reactor.
4. Heavy water moderated reactor.

(B) Write answer of any **one** : (**four** marks) **4**

1. Explain in detail the need of control materials in the reactors.
2. What is shielding in a nuclear reactor ?
3. Write note on graphite moderated research reactor.
4. Explain production reactor.