GV – 11

B.Sc. (Semester – V) Examination, October/November 2016
PHYSICS (Paper – III)
Nuclear Physics

Duration : 2 Hours Max. Marks : 80

Instructions : *1)* ***All*** *questions are* ***compulsory.***
2) Figures to the ***right*** *indicate* ***full*** *marks.*
3) ***Use*** *of non-programmable calculators is* ***allowed.***

1. Answer **any four** out of the following : **(4×4=16)**

   A) What is meant by packing fraction ? Draw the graph of packing fraction with mass number. Discuss the stability of the nucleus based upon it's packing fraction.

   B) Explain radiocarbon dating technique.

   C) What is Geiger Nuttal law ? Draw graphical representation. What is it's importance in α-decay ?

   D) Write any four similarities between the liquid drop and the nucleus.

   E) What is neutron induced fission ? Why do some of the heavy nuclei undergo fission with thermal neutrons whereas some require fast neutrons ?

   F) Briefly explain Photographic emulsions to detect nuclear radiations.

2. Answer **any four** out of the following : **(4×4=16)**

   A) Using Heisenberg's uncertainty principle. Show that mass of the meson is 227 times that of electron.

   B) Give a brief account of different radioactive. Series in which radioactive elements having atomic number from 81 to 92 are grouped.

   C) Discuss in brief Gamow's theory of alpha decay.

   D) Using mass parabolas how will you find the charge and the mass of most stable odd-A isobar.

   E) Write any four predictions of the shell model of the nucleus.

   F) Explain mass yield distribution in low-energy fission reaction.

P.T.O.

3. A) P) Explain Yukawa potential in short and draw graph of V versus γ. 3

Q) Calculate binding energy per nucleon of O^{16}. Given $m_p = 1.0078$ a.m.u., $m_n = 1.0086$ amu $M(O^{16}) = 16$ a.m.u. 3

OR

A) X) Discuss meson theory of nuclear force. 3

Y) Obtain binding energy in MeV of nitrogen nucleus. 3

$M(N^{14}) = 14.0030$ a.m.u.

$M_p = 1.0078$ a.m.u.

$M_n = 1.0086$ a.m.u.

B) Considering successive radioactive disintegration of $A \rightarrow B \rightarrow C$ type, where C is the stable element derive expression for number of atoms of A and B at any instant of time t. 6

4. A) P) Derive the conditions required for +Ve β decay and K-capture to be energetically favourable. 3

Q) The half life of CO-60 is 5.3 years. In how many years will 1 gm of isotope be reduced to 1 centigram ? Determine it's mean life time. 3

OR

A) X) Derive expression for Q-value of α-decay. 3

Y) 1 gram of radium has an activity of 1-curie. Determine it's half life. 3

(Atomic mass of radium = 226, Avogadro's Number = 6.022×10^{23}).

B) Explain why neutrino hypothesis is necessary to explain β-decay. 6

5. A) P) Explain in brief (qualitatively) nuclear fission on liquid drop model. 3

Q) Discuss coulomb energy term and volume energy terms in Weizsacker's semi-empirical mass formula. 3

OR

A) X) Discuss pairing energy term and surface energy term in Weizsacker's semi empirical formula. 3

Y) Show how 20 nucleons of nucleus are filled in different nuclear energy levels according to Jensen-Meyer scheme. 3

B) Derive condition for spontaneous nuclear fission. 6

6. A) P) What do you mean by dead time of Geiger Muller Counter ? Draw Volt current characteristics of Geiger Muller Counter and show its operating region and continuous discharge region. 3

Q) Write a reaction to indicate fission of U^{235} nuclei and explain how this fission process can lead to the principle of atom bomb. 3

OR

A) X) What is a breeder reactor ? What are its advantages ? 3

Y) Explain in short how nuclear chain reaction can be used for peaceful purposes. 3

B) Derive four factor formula. 6
