N. B.
1) All questions are **compulsory**.
2) Figures to the right indicate full **marks**.
3) Draw the neat **diagram** wherever necessary.

Q 1. Attempt any **Two** of the following.   (12)
   (a) State and explain basic nuclear properties - charge, mass, size and shape
   (b) What is packing fraction of a nucleus? State the meanings of positive and negative packing fractions.
   (c) Explain the Heterogeneous reactor with diagram.

Q 2. Attempt any **Two** of the following.   (12)
   (a) Explain the term binding energy of a nucleus. Draw the binding energy curve and state its outstanding features.
   (b) State law of radioactive decay. Derive an expression for it.
   (c) What is successive disintegration? Derive an expression for the ratio of activity of daughter to the activity of parent.

Q 3. Attempt any **Two** of the following.   (12)
   (a) Derive an expression for the conventional Q-value of nuclear reaction using conservation of energy and momentum.
   (b) What is fission? Explain how energy is liberated during fission process. Give a suitable example.
   (c) What is nuclear reactor? Explain the essential components of the nuclear reactor.

Q 4. Attempt any **Three** of the following.   (12)
   (a) Explain the scintillation counter with diagram.
   (b) Calculate the disintegration constant of a certain radioactive substance whose half life is 20 days.
   (c) What is Q-value in nuclear reaction? Explain its physical significance.
   (d) What are exoergic and endoergic reactions? Explain

Q 5. Attempt any **Four** of the following.   (12)
   (a) State the properties of Gamma rays.
   (b) Define specific activity. Derive an expression for it.
   (c) What is mass defect? Explain.
   (d) Explain the concept of parity.
   (e) Describe the applications of radioactivity.
   (f) What is fusion? Explain.

*   *   *   *