

Exam. Code : 103205

Subject Code : 1341

B.A./B.Sc. 5<sup>th</sup> Semester

PHYSICS

Paper—B

(Nuclear Physics)

Time Allowed—3 Hours] [Maximum Marks—35

**Note** :— Attempt *five* questions in all, selecting at least *one* question from each section. The **fifth** question may be attempted from any section. All questions carry equal marks.

**SECTION—A**

1. Give Proton-Electron hypothesis and give reasons for non existence of electron inside the nucleus. 7
2. (a) What is binding energy and binding energy per nucleon ? Discuss the variation of binding energy per nucleon with mass number A.  
(b) Calculate the energy liberated in MeV when a single helium nucleus is formed by fusion of two deuterium nuclei :

Given Mass of  ${}_1\text{H}^2 = 2.01478$  a.m.u.

Mass of  ${}_2\text{He}^4 = 4.0088$  a.m.u. 5,2

**SECTION—B**

3. (a) What are radioactive decay laws ? Define half life and mean life. Derive the expression for half life and mean life.  
(b) One gram of radioactive radium 226 decays with a half life of 1620 years. Calculate decay constant and mean life. 5,2
4. Write short notes on :
  - (1) Gieger Nuttal Law
  - (2) Artificial radioactivity and its applications. 3,4

**SECTION—C**

5. Define Q-value of a nuclear reaction. Obtain an expression for it and derive an expression for threshold energy for a nuclear reaction. 7
6. Explain the term nuclear reaction cross-section and what are its units ? Derive an expression for nuclear reaction cross section. Also define and explain the term differential cross-section. 7

**SECTION—D**

7. Briefly give assumptions on which liquid drop model is based. Derive semi-empirical mass formula of liquid drop model. 7
8. (a) Outline the basic features of the shell model of the nucleus. How does it account for the existence of magic numbers ?  
(b) Give the successes of shell model. 4,3