

Exam. Code : 103206

Subject Code : 1342

B.A./B.Sc. 6th Semester

PHYSICS

Paper—A (Nuclear Physics)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— Section A is compulsory. Attempt **one** question each from Sections B, C, D and E. All questions carry equal marks. Non-programmable calculator/log tables may be used.

SECTION—A

1. (a) Name and define the property which gives information about the shape of nucleus.
- (b) What is difference between mass defect and packing fraction ?
- (c) What do you understand by electron capture ?
- (d) What is the difference between a photon and a neutrino ?
- (e) What is threshold energy ?
- (f) What is the stripping and pick-up nuclear reaction ?
- (g) What are the limitations of Shell model ? 1×7

SECTION—B

2. (a) Outline the basic features of nuclear forces. Give a quantitative discussion of these forces.
- (b) The mass of deuteron (${}_1\text{H}^2$) nucleus is 2.014103 a.m.u. If the masses of proton and neutron are 1.007825 a.m.u. and 1.008665 a.m.u. respectively. Calculate the mass defect, binding energy and binding per nucleon. 5,2

3. Discuss at least three causes for the failure of proton-electron hypothesis of nuclear constituents. 7

SECTION—C

4. What do you understand by half-life and mean life of a radioactive substance ? Derive expressions for them and establish the relation between them. 7
5. What is β -decay ? Give the important features of β -ray spectra. What led Pauli to postulate the existence of neutrino ? Mention the properties of neutrino. 7

SECTION—D

6. Describe Kinematics of nuclear reaction and obtain expression for its Q-value. 7
7. (a) State and explain the conservation laws that apply to nuclear reactions.
- (b) What is nuclear reaction cross-section ? 3,4

SECTION—E

8. What are basic assumptions of liquid drop model ? Derive semi-empirical mass formula of liquid drop model. 7
9. Outline the basic features of the shell model of the nucleus. How does it account for the existence of magic numbers ? Just explain magic number 2,8,20,28. 7