

(i) Printed Pages : 3

Roll No.

(ii) Questions : 7

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B.A./B.Sc. (General) 5th Semester
(2123)

PHYSICS

Paper-C (Nuclear & Particle Physics-I)

Time Allowed : Three Hours]

[Maximum Marks : 44

Note :— Attempt **five** questions in all, including Q.No. VII (Unit-III) which is compulsory and selecting **two** questions each from Unit-I and Unit-II. Use of calculator is allowed.

UNIT—I

I. (a) Explain the different properties of nucleus :

(i) Nuclear Size

(ii) Wave Mechanical

(iii) Density.

5

(b) Describe a property of nucleus which gives the information about the shape of it. Derive suitable expression.

4

- II. Describe the nuclear shell model and obtain magic numbers from it. 9
- III. (a) What are nuclear forces ? Explain their main properties. 5
- (b) Find the binding energy per nucleon of ${}^8_2\text{O}^{16}$. Given mass of ${}^8_2\text{O}^{16} = 16.000$ amu, mass of neutron = 1.00898 amu and mass of proton is 1.00727 amu. 4

UNIT—II

- IV. (a) Discuss the successive decay of radioactive substance and obtain the condition for secular equilibrium. 5
- (b) Explain proton-proton and carbon nitrogen cycle of nuclear fusion in Sun and star. 4
- V. (a) Discuss Gamow's theory of α - decay qualitatively. 5
- (b) Discuss the three modes of Beta decay. 4
- VI. (a) Show that Rutherford Scattering cross section of α - particle is given by :

$$\sigma_{sc}(\theta) = \frac{1}{4} \left[\frac{ze^2}{n\epsilon_0 E} \right]^2 \frac{1}{\sin^4 \theta/2} \quad 6$$

- (b) Calculate the mass and radius of ${}_{13}\text{Al}^{27}$.

Given 1 a.m.u. = 1.67×10^{-27} kg and $R_0 = 1.2 \times 10^{-15}$ m.

3

UNIT—III

VII. Attempt any **eight** parts :

- (i) What is mass defect ?
- (ii) What is atomic mass unit ?
- (iii) Give two similarities between a nucleus and liquid drop model.
- (iv) Give two experimental evidences of magic numbers.
- (v) What is carbon radioactive dating ?
- (vi) What is internal conversion ?
- (vii) Give two power reactors and two research reactors available in India.
- (viii) What are units of length, area of cross section in nuclear Physics ?
- (ix) Name the four radioactive series with their end products.
- (x) What do you mean by even-even, even-odd and odd-odd nuclei ?
 $1 \times 8 = 8$