JAX-003-020301   Seat No. _____

M. Sc. (Sem. III) (CBCS) Examination

December – 2019

Physics : CT - 09

(Nuclear & Particle Physics) (Old Course)

Faculty Code : 003
Subject Code : 020301

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions :

(1) Attempt **all** questions.

(2) All questions carry **equal** marks.

1   Answer in brief : (any **seven**)   **14**

1. Define the terms : Nucleon and Nuclides.

2. Define the separation energy of a nuclear particle.

3. Estimate the density of the nuclear matter.

4. Calculate the nuclear radius of ^{64}Cu (R_o =1.1 fm)

5. Write the condition for spontaneous emission of β^+ decay.

6. What is internal conversion process and internal pair production process ?

7. Define linear attenuation coefficient. What is its unit ?

8. What do you mean by the term Nuclear Reaction ?

9. What is transfer reaction ? Give one example.

10. In which four groups one can classify the elementary particles ?

2   Answer the following questions : (any **two**)   **14**

(a) Discuss time independent properties in detail.

(b) Define the terms : Isotopes, Isobars and Isotones. Classify the following nuclides based on them : ^{11}C, ^{12}C, ^{13}C, ^{13}N, ^{14}N, ^{15}N.

(c) Define the total binding energy of a nucleus. Calculate the total nuclear binding energy for the following nuclides : ^{2}H, ^{4}He.

$[M_H = 1.007825$ u, $M_n = 1.008665$ u, $M(^2H) = 2.014102$ u, $M(^2He) = 4.002603$ u$]$

3 Answer the following questions :   **14**

(a) Derive the semi-empirical mass formula and discuss each term in detail.

(b) Write the essential assumptions of a spin orbit coupling model. Find the nuclear spins and particles for the following nuclides : ^{4}He, ^{1}H, ^{13}C, ^{16}O.

OR

(a) Which mechanisms take place, when gamma radiations interact with matter ? Discuss the Photoelectric Effect.

(b) Discuss the internal conversion process of gamma decay.

4 Answer the following questions : (any **two**)   **14**

(a) Derive nuclear reaction Q equation. Mention its special case.

(b) Discuss the nuclear reaction according to (i) energy of the bombarding particle and (ii) type of target.

(c) Discuss in detail : Nuclear cross-section.

5 Write short notes on : (any **two**)   **14**

(a) Liquid drop model of nuclear fission.

(b) Elementary particle quantum numbers.

(c) Strange particles and strangeness quantum number

(d) Resonance in particle physics.

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