

(i) Printed Pages: 3

Roll No.

(ii) Questions : 7

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

(2122)

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 Units-I and II.

UNIT—I

- I. (a) Explain the binding energy and its variation with mass number. Also explain the various zig-zags in binding energy/nucleon curve. 6
- (b) Using shell model, find spin and parity of ${}_8\text{O}^{17}$ and ${}_{20}\text{Ca}^{47}$ nucleus. 3
- II. (a) On the basis of spin orbit coupling, explain the nuclear shells closed at magic numbers. 6
- (b) How will you explain the wave mechanical properties of nucleus ? 3

- III. (a) Which contradiction leads to the rejection of electron to be present inside the nucleus ? 6
- (b) What is :
- (i) Nuclear size
 - (ii) Nuclear volume
 - (iii) Nuclear density. 3

UNIT—II

- IV. (a) Which conservation laws are violated in β -decay ? How these lead to neutrino hypothesis. Explain the experimental evidence for neutrino. 6
- (b) What do you mean by nuclear fission and nuclear fusion ? 3
- V. (a) What is Gamow's theory of alpha decay ? How does it explain the emission of alpha particle from nucleus ? 6
- (b) Write down Geiger Nuttal law and what is its physical significance ? 3
- VI. (a) Which quantities are conserved in nuclear reactions ? 3
- (b) If $b = \frac{ze^2}{4\pi\epsilon_0 T} \cot \frac{\theta}{2}$ then find differential scattering cross section starting from this relation. 6

UNIT—III

VII. Attempt any **eight** questions :—

- (i) What is saturation of nuclear forces ?
- (ii) Which quantity tells us the shape of nucleus ?
- (iii) Why ${}_2\text{He}^4$, ${}_6\text{C}^{12}$, ${}_{20}\text{Ca}^{40}$ are more stable ?
- (iv) If the electrons are not present inside the nucleus then how β -decay is possible ?
- (v) If nuclear shell closes at magic numbers then at which numbers electrons shell closes ?
- (vi) If ${}_3\text{Li}^8$ decays to ${}_4\text{Be}$ then which radioactive emission/decay takes place.
- (vii) What are units of cross section ?
- (viii) For which value of Q nuclear reaction is exoergic ?
- (ix) Name the two power reactors in India.
- (x) What do you mean by carbon dating ? 8×1=8