

(i) Printed Pages : 3 Roll No.

(ii) Questions : 7 Sub. Code :

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B.A./B.Sc. (General) 5th Semester
(2125)

PHYSICS

Paper–C: Nuclear and Particle Physics-I

Time Allowed : Three Hours] [Maximum Marks : 44

Note :— (1) Attempt FIVE questions in all, selecting TWO questions each from Units I and II. Unit III is compulsory.

(2) Use of non-programmable calculator is allowed.

UNIT—I

1. (a) What do you understand by Nuclear magnetic dipole moment and Nuclear electric quadrupole moment? Explain.

(b) The meson theory of nuclear forces assumes the virtual exchange of mesons. If a nucleon emits a virtual meson of mass $270 m_e$, calculate the range of nuclear forces. 6,3

2. (a) Which contradictions lead to the rejection of electrons present inside the nucleus? Explain.

(b) Why do stable nuclei have more neutrons than protons?

6,3

3. Outline the basic features of the shell model of nucleus. Explain how it accounts for the existence of magic numbers. 9

UNIT—II

4. (a) What are beta rays? Explain how the theory of beta decay accounted for the existence of neutrino.
- (b) Explain Geiger-Nuttall law. 6,3
5. (a) Discuss the theory of successive decay of radioactive substance and obtain the conditions for transient and secular equilibrium.
- (b) The half-life of $U-238$ against α -decay is 4.5×10^9 years. Find the activity of 10g of $U-238$. 6,3
6. (a) Explain nuclear reaction cross section. Derive an expression for the number of surviving particle out of N_0 particles incident on a slab of area A and thickness x having n atoms per unit volume.
- (b) Write a note on energy production in stars. 6,3

UNIT—III

7. Attempt any **eight** parts:
- (a) Calculate the energy equivalent of an electron volt.
- (b) What do you mean by charge independence of nuclear forces?
- (c) What is the parity of p-electron?

- (d) What are similarities between nucleus and a liquid drop?
- (e) Calculate the disintegration constant of a radioactive substance having half-life period of 30 days.
- (f) Define pair production.
- (g) What is carbon radioactive dating?
- (h) Why does a chain reaction not occur in uranium mines?
- (i) Why is it difficult to realize a nuclear fusion?
- (j) Define two units of intensity of radioactivity. $1 \times 8 = 8$