Reg. No. ....   (Pages: 2)   **K4530**

Name. ....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION

MAY/JUNE – 2006

Branch II - PHYSICS

PH 242 – SUBATOMIC PHYSICS

Time: 3 Hours   Max. Marks: 75

PART - A

Answer any five questions. Each question carries 3 marks.

I. a.   What is nuclear isomerism?

b.   What are neutrinos? Explain their important properties.

c.   What is Q-value of a nuclear reaction? Illustrate it with a simple example.

d.   What are Schmidt lines? Explain.

e.   Explain curie plots in radioactivity.

f.   What are prompt and delayed neutrons in fission..

g.   What are quarks? What are the quantum numbers associated with them.

h.   Explain CPT theorem.

(5 x 3 = 15 Marks)

PART – B

Answer all questions. Each question carries 15 marks.

II. A.   What is the importance of neutrino in nuclear beta decay? Describe the Fermi theory of beta decay.

OR

II. B.   What are mirror nuclei? Why is its study important in nuclear physics? Explain a simple method used for the determination of nuclear radius of a pair of mirror nuclei.

(15 Marks)

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III. A. State the important properties of nuclear force. Discuss the simple theory of the ground state of deuteron.

OR

III. B. Describe in detail the partial wave analysis of nuclear reaction cross-section.

(15 Marks)

IV. A. Give a short account of nuclear fission. Discuss the Bohr-Whealer theory of nuclear fission.

OR

IV. B. Discuss the Su (3) classification of elementary particles. Give an account of Su (3) colour symmetry.

(15 Marks)

(3 x 15 = 45 Marks)

PART - C

Answer any three questions. Each question carries 5 marks.

V. a. Calculate the maximum energy of the beta particle in eV emitted when $^3H_1$ decays to $^3He_2$. (Given mass of $^3H_1$ = 3.01605 amu and mass of $^3He_2$ = 3.01603 amu)

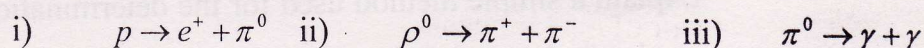b. Estimate the minimum energy for a proton to penetrate the coulomb barrier of a light nucleus.

c. The nucleus $^{27}_{14}si$ decays to its mirror nucleus $^{27}_{13}Al$ by positron emission. Their mass difference is 6 Mev. Calculate their radius.

d. Assuming shell model of the nucleus find the spin and parity of the ground state of $^{13}_{7}N$.

e. Calculate the threshold energy for the reaction.

i) $\bar{e} + P \rightarrow n + \upsilon_e$ ii) $\bar{\upsilon}_e + P \rightarrow e^+ + n$

f. Check out for the occurrence of the following decay processes and specify the conservation law when allows / forbids their occurrence.

i) $p \rightarrow e^+ + \pi^0$ ii) $\rho^0 \rightarrow \pi^+ + \pi^-$ iii) $\pi^0 \rightarrow \gamma + \gamma$

(3 x 5 = 15 Marks)