LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FOURTH SEMESTER – **APRIL 2016**

PH 4811 - NUCLEAR PHYSICS

(12th Batch Onwards)

Date: 18-04-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

PART – A

Answer ALL questions. **(10 x 2 = 20 marks)**

1. Define Heisenberg exchange force.
2. Find the energy released when two $_1H^2$ nuclei fuse together to form $_2He^4$ nucleus. The BE per nucleon of ^2H and ^4He is 1.1 MeV and 7 MeV respectively.
3. What are magic numbers?
4. Mention any two similarities between the liquid drop and the nucleus.
5. What is level width of a compound nucleus?
6. How are particles classified based on their energy?
7. Write down the three modes of β decay.
8. What are neutron stars?
9. Verify whether baryon number is conserved in the reaction: $\pi^+ + n \rightarrow \pi^- + p$.
10. What are strange particles? Give examples.

PART –B

Answer ANY FOUR questions. **(4 x 7.5 = 30 marks)**

11. Discuss the meson theory of nuclear exchange.
12. Enlist the analogies drawn out between the nucleus and the liquid drop.
13. Give an outline of the various types of nuclear reactions with examples.
14. Write a short note on Pauli's neutrino hypothesis and list the properties of the neutrino.
15. Write a short note on classification of elementary particles.
16. Obtain Levy's formula for determination of atomic masses.

PART –C

Answer ANY FOUR questions. **(4 x 12.5 =50 marks)**

17. Discuss in detail the two-nucleon potential analysis and hence obtain expressions for the range and depth of the potential.
18. Derive the semi-empirical mass formula proposed by Weizsacker and discuss it in detail.
19. Elucidate the basic aspects of a nuclear reactor.
20. Describe the important features of the Fermi's theory of beta decay and hence deduce the Fermi and Gamow-Teller selection rules for beta transition.
21. Elaborate on the principle of CPT invariance in elementary particles.
22. Discuss the Gamow's theory of alpha decay in detail with necessary diagrams.

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