



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**M.Sc. DEGREE EXAMINATION - PHYSICS**

**FOURTH SEMESTER – NOVEMBER 2013**

**PH 4808 - NUCLEAR PHYSICS**

Date : 08/11/2013  
Time : 1:00 - 4:00

Dept. No.

Max. : 100 Marks

**PART - A**

Answer **ALL** questions

(10 x 2 = 20)

1. Write a short note on non central force.
2. Find the mass number of the nucleus whose radius is 3.1Fm.
3. Explain Heisenberg operator.
4. How can fast neutrons be produced?
5. What is the uniqueness of single particle shell model?
6. Give examples of hypernuclei production and decay.
7. What is the relation between hypercharge and Isospin?
8. Discuss the reaction  $p+p \rightarrow p+p+\pi^0$  for conservation of Isospin.
9. What are mirror nuclei? Give an example.
10. What is the similarity between (nn) and (pp) forces?

**PART - B**

Answer any **FOUR** questions

(4 x 7.5 = 30)

11. Find an expression for the scattering cross section for  $l=0$  in the case of n-p scattering at low energies.
12. Derive Geiger -Nuttal law. Briefly explain Gamow theory of alpha decay.
13. Explain Levy's mass formula and comment on it.
14. What are neutron stars? Explain energy release in neutron stars.
15. Predict the characteristics of the ground state of  ${}^9_8\text{O}^{17}$ ,  ${}_{16}\text{S}^{33}$  and  ${}_{83}\text{Bi}^{209}$ .

**PART - C**

Answer any **FOUR** questions

(4 x 12.5 = 50)

16. a) Give a detailed account on spin orbit interaction in shell model and discuss its merits.  
b) Explain the significance of magic numbers.
17. Obtain Breit -wigner single level formula ( $l=0$ ) and hence discuss the absorption cross section at high energies.
18. Show using magnetic moment calculation, that deuteron is mostly in the singlet state.
19. Discuss in brief, Fermi's theory of  $\beta$  decay, and gamow Teller selection rule.
20. a) Classify Elementary Particles.  
b) Discuss briefly SU(2) and SU(3) multiplets.

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