M. Sc. DEGREE (C.S.S.) EXAMINATION, MARCH 2017
SEMESTER IV – PHYSICS
PH4C12TM - NUCLEAR AND PARTICLE PHYSICS

Time: Three Hours   **Maximum Marks: 75**

PART A

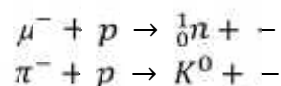 **I.   Answer any five questions. Each question carries 3 marks.**

1.   Discuss exchange force model for nucleon -nucleon interaction.
2.   Briefly explain semi empirical mass formula.
3.   Comment on comparative half lives and forbidden decays.
4.   What do you meant by Fermi Kurie plot?
5.   Briefly explain general aspects of nuclear reactor design
6.   What is meant by activation energy in nuclear fission?
7.   State and explain CPT theorem.

   **(5x3=15)**

PART B

II.   Answer any six questions. Each question carries 5 marks.

8.   Outline the general features of nuclear forces.
9.   Describe the working of mass spectroscope.
10. Explain non conservation of parity in   decay.
11. Compute the Q value for the following   - decays
     i. ^{65}Ni ^{65}Cu (Atomic mass of ^{65}Ni: 64.930086 u, ^{65}Cu: 64.927793 u)
     ii. ^{11}Be ^{11}B (Atomic mass of ^{11}Be: 11.021685 u, ^{11}B: 11.009305 u)
     iii. ^{193}Os ^{193}Ir (Atomic mass of ^{193}Os: 192.964138 u, ^{193}Ir: 192.962917 u)
12. Derive the condition for a nucleus to be stable against symmetric fission.
13. What spins and parities would you predict for the ground state of a) $^{15}O_8$ and b) $^{17}O_8$. Justify your answer on the basis of shell model.
14. Predict the shell model state of the odd nucleon in the following cases. 1) ^{63}Cu$_{29}$ and 2)^{25}Mg$_{12}$. Write down the spin and parity of the ground state.
15. Identify the unknown particle in the reactions given below, using the conservation laws.(IV)

$$\mu^- + p \to {}^1_0 n + \ \_$$
$$\pi^- + p \to K^0 + \ \_$$

16. Analyse the following reactions according to their quark content. (IV)

$$a)\ \pi^+ + p \to \pi^0 + \Delta^{++}$$
$$b)\ K^- + p \to \int{}^+ + K^+ + \ {}^0$$
$$c)\ \Omega^- \to \ {}^0 +)\ \ {}^-$$
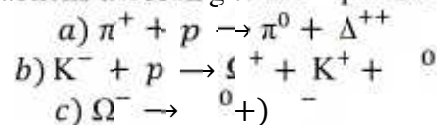
                                                                (6x5=30)

PART C

III. Answer any question, the question carries 15 marks.

17. Discuss the methods to measure nuclear radii by determining distribution of nuclear charge.
18. Explain the energetics of Nuclear reactions.
19. Discuss the liquid drop model. Obtain the semi empirical mass formula.
20. Explain the quark model for particle interactions. Discuss the composition of hadrons based on quark model.

(2x15=30)