16P306 (Pages: 2) Name……..

Reg. No……..

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, OCTOBER 2017

(Regular/Supplementary/Improvement)

(CUCSS - PG)

CC15P PHY3 C10 - NUCLEAR AND PARTICLE PHYSICS

(Physics)

(2015 Admission Onwards)

Time : Three Hours Maximum : 36 Weightage

Section-A

(Answer ***all*** Questions. Each question carries weightage one)

1. State the general features of nuclear force.
2. Why there are no odd magic numbers?
3. What is strangeness? Explain the conservation of strangeness.
4. What do you understand by internal conversion?
5. Outline Gamow-Teller selection rules.
6. Briefly explain parity violation in beta decay.
7. What is meant by spin-orbit coupling?
8. Distinguish between fission and fusion.
9. Explain Fermi-Kurie plot. What is its significance?
10. What are the predictions of the shell model?
11. What is thermonuclear reaction? Illustrate with an example.
12. What is compound nucleus. What is its role in nuclear fission?

(12×1=12 Weightage)

Section-B

(Answer *any **two*** questions Each question carries weightage 6)

13. a)What are the characteristics of nuclear force?

    b) Using Partial Wave analysis, derive an expression for the scattering cross section of n-p scattering at low energies.
14. Discuss the shell model of nucleus. Show that the theory explains the magic numbers.
15. Illustrate with examples the conservation laws followed by elementary particle interactions.
16. What is an endoenergic reaction? Derive an expression for the threshold energy of an endoenergic reaction.

(2×6=12 Weightage)

Section – C

(Answer *any* ***four*** Questions. Each Question carries weightage three)

17. The differential scattering cross section (lab) for a given scattering process is $(d\sigma/d\omega) = a+b\cos\theta$. Find σ and $\sigma_{(\text{centre of mass})}$.
18. Show that when a proton and a neutron are just bound, $V_o b^2 = 102\ \text{MeVF}^2$
19. Predict the characteristics of the ground states of ${}_8O^{17}$ and ${}_{16}S^{33}$
20. Calculate the Q value of the reaction:

    ${}_1H^3 + {}_1H^2 \longrightarrow {}_2H^4 + {}_0n^1$

    Masses are 3.01699824u, 2.01473614u, 4.00387274u and 1.00899324u respectively.
21. Calculate the minimum kinetic energy that the neutron should have in order to induce the reaction $O^{16}(n^1, He^4)C^{13}$ in which C^{13} is left in an excited state of energy 1.8 MeV.(Use the masses of O^{16}, n^1, He^4 and C^{13} in amu)
22. Which of the following reactions are allowed and forbidden under the conservation of strangeness, conservation of baryon number and conservation of charge.
    a) $\pi^+ + n \longrightarrow \Lambda^0 + K^+$
    b) $\pi^+ + n \longrightarrow K^0 + K^+$
    c) $\pi^+ + n \longrightarrow K^0 + \Sigma^+$
    d) $\pi^+ + n \longrightarrow \pi^- + p$

(4×3=12Weightage)

****