D 91603 (Pages : 2) Name.....

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Reg. No.....

THIRD SEMESTER M.Sc. PROGRAMME DEGREE EXAMINATION DECEMBER 2015

(CUCSS)

Physics

PHY 3C 10—NUCLEAR AND PARTICLE PHYSICS

(2012 Admission onwards)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*
Each has weightage 1.

1. Draw the binding fraction curve and explain its features.
2. What is parity ? Explain its significance.
3. Nucleon-Nucleon force is charge independent. Justify the statement.
4. What are magic numbers ? How will you account it with the help of shell model ?
5. Explain how collective model explain nuclear rotations.
6. Explain Kurie plot.
7. Explain different types of nuclear reactions.
8. Distinguish between exoergic and endoergic nuclear reactions. Define Q value of a nuclear reaction.
9. What are the characteristics of nuclear fission ?
10. Illustrate nuclear fusion process with an example.
11. What is strangeness ? Explain conservation of strangeness.
12. Briefly explain Quarks flavours and colours.

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions.*
Each has weightage 6.

13. Discuss in detail Proton-Proton Scattering at low energies.
14. Derive an expression for the total magnetic moment of the nucleus and explain it with the help of Schmidt diagram.
15. Account parity violation in β decay and describe an experiment to verify it.
16. What is an endoergic reaction ? Derive an expression for the Threshold energy of an endoergic reaction.

(2 × 6 = 12 weightage)

Turn over

Section C

Answer any **four** *questions.*
Each has weightage 3.

17. Compute the total binding energy and binding energy per nucleon for :

    (a) $^{7}\alpha_{i}$.

    (b) ^{20}Ne.

    (c) ^{56}Fe.

    (d) ^{235}u.

18. Predict angular momenta and parities for the ground state of ^{12}C, ^{11}B, ^{17}O and ^{16}N using s model of nucleus.

19. Show that in the β transformation $^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + \bar{\beta} + \bar{\upsilon}$ the Kinetic energy of the recoil nucle given by $E_y = \dfrac{\left(Q + 2m_{\circ} C^2\right) E_m}{2M_y C^2}$.

20. Calculate threshold energy required to initiate the reaction $^{31}P(n, p)\,^{31}Si$. Also calculate maximum energy of β-decay of ^{31}Si + ^{31}P. Given M_p = 1.00814 *amu* Mu = 1.00898 a Mp = 30.98356 and Msi = 30.98515 *amu*.

21. Analyse the following decays or reactions for possible Violation of the basic conservation law

    (a) $K^+ \rightarrow \pi^+ + \pi^+ + \pi^{\circ} + \pi^-$.

    (b) $K^+ \rightarrow \pi^+ + e^+ + \mu^-$.

    (c) $\wedge^{\circ}_{+} p \rightarrow \Sigma^+ + n$.

    (d) $\wedge^{\circ} \rightarrow p + k^-$.

    (e) $\Sigma^+ \rightarrow n + e + \upsilon_e$.

22. Analyse the following decays according to their quark content.

    (a) $\Omega^- \rightarrow \wedge^{\circ} + k^-$.

    (b) $k^+ \rightarrow \pi^+ + \pi^{\circ}$.

    (c) $\equiv^- \rightarrow \wedge^{\circ} + \pi^-$.

    (d) $\wedge^{+}_{c} \rightarrow p + \bar{k}^{\circ}$.

(4 × 3 = 12 weigh