

D 31198

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Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)
EXAMINATION, NOVEMBER 2022**

(CBCSS)

Physics

PHY 3C 10—NUCLEAR AND PARTICLE PHYSICS

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer all questions.

Each question carries weightage 1.

1. Sketch and explain the salient features of binding energy curve.
2. How the singlet and triplet potential existed in a nucleus ?
3. How did neutrino help in understanding of beta decay ?
4. Illustrate nuclear fusion process with example.
5. Explain the term quadrupole moment of a nucleus.
6. What is dead time in the GM counter ?
7. Classify particle based on interaction.
8. Briefly explain Grand Unified Theory.

(8 × 1 = 8 weightage)

Section B

Answer any two questions.

Each question carry weightage 5.

9. Outline the simple theory of deuteron structure using a square well potential of finite width and depth. Obtain the relation between the well parameters and binding energy. Show that the deuteron wave function is an admixture of S and D state.
10. Explain briefly the energetics of β decay reaction. Discuss the Fermi theory of β decay.
11. With a neat block diagram explain the working of a GM counter.
12. Discuss the fabrication and working of a controlled fusion reactor. State the application.

(2 × 5 = 10 weightage)

Turn over

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Section C

Answer any **four** questions.
Each question carry weightage 3.

13. Determine the mass difference between two mirror nuclei which have N and Z differing by one unit and the same odd value of A.
14. Using semi empirical mass formula, find the most stable isobar for a nucleus having $A = 43$. Give coulomb energy coefficient $a_c = 0.583$ MeV and asymmetry energy coefficient $a_{\text{sym}} = 19.3$ MeV.
15. Briefly compare the different type of gas detectors.
16. Explain Quark model for Spin Zero and Spin $3/2$ hadrons.
17. Give an account of nuclear rotational energy levels.
18. Consider the following decay ${}^{17}\text{F} \rightarrow {}^{17}\text{O} + \beta^+ + \nu_e$. Find the maximum kinetic energy of positron if the atomic masses of ${}^{17}\text{F}$ and ${}^{17}\text{O}$ are 17.0076 u and 17.0045 u respectively.
19. Draw a schematic diagram of nuclear fission reactor. Explain briefly a) Moderator b) Control rod.
(4 × 3 = 12 weightage)