Reg. No…….. Name……

B. Sc. DEGREE END SEMESTER EXAMINATION - APRIL 2021

SEMESTER –6: PHYSICS (CORE COURSE)

COURSE: 15U6CRPHY10 – NUCLEAR AND PARTICLE PHYSICS

(Common for Regular 2018 admission & Improvement 2017/Supplementary 2017 /2016 /2015 admissions)

Time: Three Hours Max Marks: 60

PART A (Very short answer questions)

Answer all questions, Each question carries 1 Mark

1. The energy equivalent of 1 atomic mass unit is ……..MeV.
2. Give an example of mirror nuclei.
3. List the first four magic numbers in the nuclear shell model.
4. Does a neutron possess a magnetic dipole moment?
5. What is Geiger-Nuttal law?
6. Define a curie.
7. What is internal conversion?
8. Are protons elementary?
9. What are the gauge particles of weak forces?
10. What is the main component of primary cosmic rays? (1 x 10 = 10)

PART B (Short answer questions)

Answer any Seven questions, Each question carries 2 Marks

11. What are isotopes? Give an example.
12. Comment on the nuclear stability using an N vs. Z plot.
13. Discuss the principle of radiocarbon dating. Mention its application.
14. List the different radioactive series. Mention the parent element in each case.
15. Explain the confinement method used in a Tokamak.
16. What are transuranic elements? Give two examples.
17. What is the strange behavior of kaons and hyperons?
18. What are the fundamental interactions in nature?
19. Outline the azimuth effect on cosmic particles. (2 x 7 = 14)

PART C (Problem/Derivations)

Answer any Four questions, Each question carries 4 Marks

20. Estimate the binding energy of $^{12}_{6}C$ nucleus. Also determine its density.
21. Outline the proton-neutron hypothesis of nuclear composition.

22. With the help of a neat diagram, explain the working principle of an ionization chamber.
23. The half life of radon is 3.8 days. After how many days will only one twentieth of a radon sample be left over?
24. Discuss the carbon-nitrogen cycle of energy production in stars.
25. Obtain the energy released by fission of 1 kg of ^{235}U, if the energy released per fission is 200 MeV.

(4 x 4 = 16)

PART D (Long answer questions)

Answer any Two questions, Each question carries 10 Marks

26. What are nuclear forces? List their properties. Discuss the meson theory of nuclear forces.
27. Discuss the Gamow's theory of alpha decay.
28. Discuss the quark model. Give the features of the different quarks. What is the quark composition of $\pi^+, K^+ \text{and } \Omega^-$?
29. Using a suitable figure, explain the working principle of a nuclear fission reactor. Discuss the functioning of a breeder reactor.

(10 x 2 = 20)

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