BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025
2018, 2019, 2020, 2021 ADMISSIONS SUPPLEMENTARY
SEMESTER VI - CORE COURSE (PHYSICS)
PH6B11B18 - Nuclear, Particle and Astrophysics

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. Illustrate the concept of isotopes with examples.

2. Graphically illustrate the binding energy per nucleon versus the mass number curve.

3. Explain the term packing fraction.

4. Write a short note on different units of radioactivity.

5. Define the range of α-particle.

6. Briefly explain protostar.

7. Write a short note on surface temperature of a star.

8. Explain the function of control rods in nuclear reactors.

9. Give any two uses of nuclear reactors.

10. Name any two particles which are their own antiparticles.

11. State the interactions in which the strangeness quantum number is conserved.

12. Explain the term helicity.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. A nucleus with mass number 235 splits into two nuclei whose mass numbers are in the ratio 2:1. Determine the radii of the two nuclei.

14. Explain (a) nuclear magnetic dipole moment (b)electric quadrupole moment.

15. Establish that the ratio of radii of nuclei $^{27}_{13}\text{Al}$ and $^{125}_{52}\text{Te}$ is approximately equal to 6:10.

16. Half life of radon is 3.825 days. What fraction of the given sample of radon will disintegrate in 1 day?

17. Explain the Hertzsprung-Russel diagram.

18. In a reaction $^{2}_{1}\text{H} + ^{2}_{1}\text{H} \rightarrow ^{3}_{2}\text{H} + ^{1}_{0}\text{n} + Q$, the energy released is 3.26 MeV. Determine the mass of neutron. Given that the mass of deuterium and tritium as 2.0141 amu and 3.0160 amu.

19. Calculate the approximate mass of Uranium which must undergo fission to produce the same energy as is produced by the combustion of 10 kg of coal. The energy released per fission of uranium is 200 MeV. Heat of combustion of coal is 8000 kcal/kg. (1 cal= 4.2 J).

20. Discuss the need for the quantum number 'color' in quarks.

21. Write down the quark composition of π^{+} and π^{-} mesons. Also obtain the charge, spin and baryon number of these particles.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Specify the salient features of nuclear forces. Describe the meson theory of nuclear forces.

23. Discuss in detail the classification of stars and evolution of low mass star.

24. Discuss in detail the stellar evolution.

25. Discuss in detail the fundamental interactions in nature.