Reg. No ..... Name **26U643**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2026

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY11 : NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS**

(For Regular 2023 Admission and Supplementary 2022/ 2021 /2020 /2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. Explain supernova explosion.
2. Write the number of neutrons and protons in the nucleus of $^{226}_{88}Ra$.
3. Write the difference between Baryons and Mesons.
4. Explain center of mass cordinate system.
5. Discuss the origin of energy released in nuclear fusion.
6. Symmetry and conservation principle. comment.
7. Explain the concept of half life in Radioactive decay.
8. Comment on the spin magnetic moment orientation, w.r.t the nuclear spin, of a proton and a neutron inside the nucleus.
9. If Δm is the mass defect, how is it related to the binding energy?
10. What are Isomers? Give examples.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Describe the four fundamental interactions between elementary particles, their range, the particles exchanged and their relative strengths.
12. Suns Luminosity is $3.85 \times 10^{26} W$ and its temperature is 6000K, Calculate its radius. Given $\sigma = 5.671 \times 10^{-8}\ W/K^4 m^2$
13. What is the energy required to remove the last tightly bound neutron from $^{40}_{20}Te$. Given mass of $^{40}_{20}Te = 39.962589u$ and mass of $^{39}_{20}Te = 38.970691$ also given that $m_p = 1.00727u$ and $m_n = 1.00867u$.
14. Describe the strangeness quantum number. Write the strangeness quantum number of the quark flavours.
15. If the maximum r.f. voltage applied to a cyclotron is 20kV. Show that a proton has to make 450 revolutions within the cyclotron before achieving one fifth the velocity of light. Given the proton mass $m_p = 1.67 \times 10^{-27} kg$.
16. Calculate the time required for 10% of thorium to disintegrate. Assume the half life to be 14 billion years.
17. A UG student of SH College doing project in observational astronomy at IUCAA, finds the temperature of star WR13 to be 10^5 K and a luminosity of $39100 L_s$. He further observed that star WR142 has a temperature of 21×10^4 K and a luminosity of $38000 L_S$, where L_S is the solar luminosity. What is the ratio of the radii of the stars documented by him in his lab record book.
18. Write a note on the confinement methods.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Explain the following (1) Photon diffusion time (2) white dwarf and black dwarf (3) Chadrasekhar limit (4) Black holes.
20. Explain the working of a Cyclotron. Also calculate the energy attained by the particle. Discuss its limitations.
21. Explain the evolution of stars. Find the final stage volume of a star more massive than the sun.
22. Discuss nuclear fission (with example equation) and its applications.

(10 x 2 = 20)