Reg. No ..... Name **22U631**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2022

SEMESTER 6 : PHYSICS

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

(For Regular - 2019 Admission)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. Write the order of magnitude of nuclear radius. What is the unit used to write it?
2. Comment on the spin of the nuclei which have even atomic number and even neutron number.
3. If Δm is the mass defect, how is it related to the binding energy?
4. Plot the average binding energy per nucleon vs atomic mass number A.
5. The sun light you see outside this room was originated from the center of the sun before Homo sapiens first learned to cook food, comment.
6. What are Higgs Bosons?
7. Name the two massive quark flavors.
8. Describe altitude effect?
9. Give two long term biological effects of nuclear radiations.
10. Describe inner zone of Van Allen Belt?

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. How much energy in eV does a mass of 1u (unified atomic mass units) correspond to? Prove your answer.
12. A neutron star has a density similar to that of an atomic nucleus. Compute the radius of a neutron star whose mass is equal to $1.99 \times 10^{30} kg$. Given $m_n = 1.6749 \times 10^{-27}$.
13. In a distant galaxy two stars were identified with one star having 1.5 times the temperature of the second star. Find the ratio of their radii.
14. What are leptons? write a note on the interactions that effect the leptons and give three examples.
15. An astronomical object named Cygnus X-1, a strong X-ray source, is found to radiate like a black body with peak wavelength at 1.45 nm. Calculate its temperature. Assume that the constant for Wien's displacement law is equal to $2.9 \times 10^{-3} mK$.
16. Suns Luminosity is $3.85 \times 10^{26} W$ and its temperature is 6000K, Calculate its radius. Given $\sigma = 5.671 \times 10^{-8}\ W/K^4 m^2$
17. The half life of radium is 1590 years. In how many years will 1g of pure element be reduced to one centigram.
18. Calculate the time required for 20% of thorium to disintegrate. Assume the half life to be 1.05 micro seconds.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Write 4 properties of a nucleus, write a short note on the nuclear spin and classify the nucleus by giving examples on the basis of the number of nucleons.
20. How are elementary particles classified into leptons and hadrons?
21. Explain the following (a) Photon diffusion time (b) white dwarf and black dwarf (c) Chadrasekhar limit (d) Black holes.
22. Explain nuclear fission and fusion, with example reactions. What are its applications.

(10 x 2 = 20)