V Semester B.Sc. Degree (CBCSS- Reg./Sup./Imp.) Examination, November-2019

(2014 Admn. Onwards)

Core Course in Physics

5B 10 PHY: ATOMIC, NUCLEAR & PARTICLE PHYSICS

Time : 3 Hours

Max. Marks : 40

Write answers in English only.

SECTION - A

Answer **All** - Very short answer type - each question carries **1** mark.

(4×1=4)

1. What is the SI unit of radioactivity?

2. Which element is used to date the objects of biological origin?

3. ----------- is the antiparticle of the electron.

4. When the spin of an element is ½ then we obtain ------------ state.

SECTION - B

Answer any **SEVEN** - short answer type - Each question carries **TWO** marks.

(7×2=14)

5. Write a note on spin-orbit coupling.

6. Write a note on atomic structures.

7. Explain the eightfold way of classification of hadrons.

8. What is Franck-Hertz experiment?

9. How emission and absorption spectral lines originate.

10. Obtain the relationship between the cross section and beam intensity? Also find the relation between the surviving particles and slab thickness.

11. Give brief account of half-life of the radioactive element.

12. What are stable nuclei?

13. Explain the correction in the binding energy formula obtained using liquid drop model.

14. Brief account of Lasers.

SECTION - C

Answer any **FOUR** - short essay/problem - Each question carries **THREE** marks.

(4×3=12)

15. Find the possible values of the total angular - momentum quantum number J under LS coupling of two atomic electrons whose orbital quantum numbers are $l_1 = 1$ and $l_2 = 2$.

16. Show that the following decays conserves the lepton numbers L_e and L_μ

    a) $\Pi^- \to \mu^- + \bar{v}_\mu$

    b) $\mu^- \to e^- + v_\mu + \bar{v}_e$

    c) $\gamma \underrightarrow{e^- + e^+}$

17. Experiments indicate that 13.6 eV is required to separate a hydrogen atom into a proton and an electron. i.e. its total energy is E = 13.6 eV. Find the orbital radius and velocity of the electron in a hydrogen atom.

18. The atomic ratio between the uranium isotopes ^{238}U and ^{234}U in a mineral sample is found to be 1.8×10^4. The half life of ^{234}U is $T_{1/2}(234) = 2.5 \times 10^5 y$. Find the half-life of ^{238}U.

19. The binding energy of the neon isotope $^{20}Ne_{10}$ is 160.647 MeV. Find its atomic mass $\left(m\left({}_1^1 H \right) = 1.007825 u, m(n) = 1.008665 \right)$.

20. Find the longest wavelength present in the Balmer series of hydrogen corresponding to the H_α line.

SECTION - D

Answer any **TWO** - Long essay type - Each question carries **FIVE** marks.
$(2\times5=10)$

21. Write a note on electron spin.

22. What is shell model?

23. Write a note on Quarks.

24. Explain nuclear fusion in stars.

_____