QP Code: U25B048

Reg. No : .....

Name : .....

ST MARY'S COLLEGE (AUTONOMOUS), THRISSUR-20

II SEMESTER (FYUGP) DEGREE EXAMINATION, MARCH 2025

B.A/B.Sc/B Com/BSW

PHY2MN102 : MODERN PHYSICS AND NUCLEAR PHYSICS

2024 Admission Onwards

(Credits: 4)

Time: 2 Hours **Maximum Marks: 70**

Section A

*Answer **all**. Each question carries **3** Marks* ***(Ceiling: 24 Marks)***

1. Describe the electromagnetic spectrum. [BTL1]
2. Distinguish between pair production and pair annihilation. [BTL1]
3. Find the velocity of the electron in a stable orbit. [BTL2]
4. What factors influence the characteristic of spectral lines? [BTL2]
5. How does Bohr's quantization of electron orbits ensure atomic stability? [BTL3]
6. Which nucleus is more stable, $_5B^{11}$ or $_6C^{11}$? Why? [BTL3]
7. What is the stability curve? How does the neutron-to-proton ratio change with increasing mass number? [BTL3]
8. What is the significance of electric quadrupole moments in nuclear physics? [BTL4]
9. Describe how neutrinos interact with matter. [BTL4]
10. Explain how supernova explosions contribute to the formation of elements and the universe. [BTL5]

Section B

*Answer **all**. Each question carries **6** Marks* ***(Ceiling: 36 Marks)***

11. What is the significance of Planck's quantum hypothesis in resolving the ultraviolet catastrophe? [BTL1]
12. Explain the photoelectric effect and its experimental study. [BTL1]
13. Name the different spectral series of hydrogen and specify their corresponding wavelength regions. [BTL2]

Turn Over

14. How magic numbers arise in nuclei based on the shell model? [BTL3]

15. How is radiocarbon dating used to determine the age of ancient artifacts and what are its limitations? [BTL3]

16. How do stars synthesize elements heavier than helium and what limits this process? [BTL4]

17. Find the longest wavelength present in the Balmer series of hydrogen, corresponding to the H_α line. Given $R=1.097\times10^7\ m^{-1}$. [BTL5]

18. The binding energy of the neon isotope ${}_{10}Ne^{20}$ is 160.647 MeV. Find its atomic mass. Given $m_p = 1.00759$ u, $m_n = 1.008$ u. [BTL5]

Section C

*Answer **any one**. Each question carries **10** Marks* ***(1x10=10 Marks)***

19. Discuss how Rutherford scattering experiment led to the concept of the distance of closest approach. [BTL3]

20. Discuss the liquid drop model of the atomic nucleus and how it accounts for nuclear binding energy. [BTL4]

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