Reg. No ..... Name **25U623**

B.Sc DEGREE END SEMESTER EXAMINATION - MARCH 2025

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY10 : RELATIVITY AND SPECTROSCOPY**

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

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. What are the short comings of Bohr's theory on atom model
2. Write the Lorentz transformation equations.
3. What is the resonance condition for NMR?
4. In Raman spectra, stokes lines are more intense than anti stokes lines. Why?
5. Briefly explain bending of light in a gravitational field.
6. Explain Lande g facor.
7. Give examples for Oblate symmetric top molecules.
8. Distinguish between fluorescence and phosphorescence.
9. What are the important features of Vector atom model.
10. Briefly explain inertial frame of reference.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. State the intensity rules for spectral lines.
12. How fast must an unstable particle move to travel 20m before it decays? The mean lifetime of the particle at rest = 2.6×10^{-8}s
13. Explain the fine structure of Sodium D lines on the basis of vector atom model.
14. Explain the principle of NMR.
15. What is the nuclear gN factor for ^{19}F nucleus which has a magnetic moment of 2.6273 μ_N. Nuclear spin quantum number I =1/2.
16. Calculate the length of a rod moving with a velocity 0.8c in the X-Y plane in a direction inclined at 60^0 to the X - axis. Proper length of the rod is 1m.
17. Describe the working of ESR specrometer with the help of a block diagram.
18. Calculate the strength of the magnetic field required to give a precessional frequency of 100MHz for ^{17}O nucleus. g_N = -0.757; $\mu_N = 5.051 \times 10^{-27}$ JT^{-1}; I = 5/2

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Derive Einstein's mass energy relation.
20. What is Raman Effect ? Discuss the quantum theory of Raman effect.
21. Discuss the theory of rotational spectrum of a diatomic molecule treating it as a rigid rotator.
22. Distinguish between normal Zeeman Effect and anomalous Zeeman effect. Explain anomalous Zeeman effect on the basis of vector atom model.

(10 x 2 = 20)