

**B. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023****SEMESTER 6 : PHYSICS****COURSE : 19U6CRPHY10 : RELATIVITY AND SPECTROSCOPY***(For Regular - 2020 Admission and Supplementary - 2019 Admission)*

Time : Three Hours

Max. Marks: 60

**PART A****Answer any 8 (2 marks each)**

1. What is meant by length contraction?
2. What is time dilation?
3. Write the Galilean transformation equations.
4. Represent the Zeeman splitting of an unpaired electron in a magnetic field B.
5. In Raman spectra, stokes lines are more intense than anti stokes lines. Why?
6. Why Stokes lines and Anti Stokes lines are equally spaced from Rayleigh line?
7. Define rotational constant of a molecule.
8. What is the significance of Stern - Gerlach experiment
9. What are the short comings of Bohr's theory on atom model
10. Give the features of Rutherford's atom model

**(2 x 8 = 16)****PART B****Answer any 6 (4 marks each)**

11. The length of a spaceship is measured to be exactly half its proper length. What is i) the speed of the spaceship relative to the observer on earth? ii) the dilation of the spaceship's unit time?
12. What is principle of equivalence and gravitational red shift?
13. Electron spin resonance is observed for atomic hydrogen with an instrument operating at 8GHz. If the g value for the electron in the hydrogen atom is 2.0026, what is the magnetic field applied? Bohr magneton  $\mu_B = 9.274 \times 10^{-24} \text{ JT}^{-1}$ .
14. Discuss NMR imaging.
15. Describe the working of ESR spectrometer with the help of a block diagram.
16. Define the three principal moments of inertia of a rotating molecule.
17. Explain the relativistic variation of mass of an electron in Sommerfeld atom model
18. Explain the fine structure of Sodium D lines on the basis of Sommerfeld atom model

**(4 x 6 = 24)****PART C****Answer any 2 (10 marks each)**

19. Using the relativity theory arrive at the expression for variation of mass with velocity.
20. Discuss the theory of rotational spectrum of a diatomic molecule treating it as a rigid rotator.

21. Explain the principle of NMR. Also calculate the strength of the magnetic field required to give a precessional frequency of 90 MHz for  $^{17}\text{O}$  nucleus.  $g_N = -0.757$ ;  $\mu_N = 5.051 \times 10^{-27} \text{ JT}^{-1}$ ;  $I = 5/2$
22. What is Paschen Back effect? Discuss its theory and deduce the expression for strong field quantum number.

**(10 x 2 = 20)**