TB206535W **Reg. No :.....**

Name :.....

B. Sc. DEGREE (C.B.C.S.) EXAMINATION, MARCH 2023

(2020 Admission Regular, 2019, 2018 Admissions Supplementary)

SEMESTER VI - CORE COURSE (PHYSICS)

PH6B10B18 - RELATIVITY AND SPECTROSCOPY

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. Explain any two evidences of mass energy equivalence.
2. Show that acceleration is invariant under Galilean transformation.
3. Explain proper time and proper length.
4. No two electrons can occupy in the same quantum state. Explain.
5. Distinguish between emission and absorption spectrum.
6. Explain the coupling schemes.
7. Write the expression for Laurent's unit and explain the terms.
8. Why are anti stokes lines less intense than stokes lines?
9. Explain the three types of moment of inertia possessed by a molecule.
10. Explain the effect of isotopic substitution on the rotational spectrum of molecules.
11. Write the expression for Bohr magnetron.
12. Why is ESR called paramagnetic resonance?

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. At what speed a particle is moving, if its mass is equal to four times of its rest mass?
14. Calculate the percentage of contraction of a rod moving with a velocity 0.8c in a direction inclined at 60^o to its own length.
15. What is Rydberg constant? Calculate the Rydberg constant for hydrogen and sodium.
16. Find the change in kinetic energy when an atom is placed in a magnetic field.
17. Derive an expression for the radius of the orbit of electron in an atom and hence estimate the radius of first orbit of hydrogen atom.
18. The HCl molecule gives the vibrrational absorption line of wave length $3.465X10^{-6}m$ Calculate the force constant of the H -Cl bond. Given masses of H = 1.0087u, Cl = 35.453 u and $u = 1.67X10^{-27}Kg$
19. In the near infrared spectrum of HCl molecule there is single intense band at $2885.9/cm$. Assuming that it is due to the transition between vibrational levels, show that the force constant k is 480 N/m. (Given $M_H = 1.68X10^{-27}Kg$).
20. Calculate the vibrational energy levels of an HCl molecule assuming the force constant to be 516 N/m
21. What is the nuclear g factor for Fluorine nucleus which has a magnetic moment of 2.6273 times nuclear magnetron. Nuclear spin quantum number is I=1/2.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Explain Michelson Morley experiment and give its significance.

23. Explain the concepts of vector atom model and also the quantum numbers associated with it.
24. Give an account of quantum theory of Raman scattering. Explain the various parts of a Raman spectrometer.
25. Discuss the theory of NMR spectroscopy.