QP CODE: 25022300

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Reg No : .....

Name : .....

M.Sc DEGREE (CSS) SPECIAL REAPPEARANCE EXAMINATION, APRIL 2025

Third Semester

M.Sc PHYSICS

CORE - PH010303 - ATOMIC AND MOLECULAR PHYSICS

2019 ADMISSION ONWARDS

FA194A0F

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Define gyro-magnetic ratio.
2. The ground state of Chlorine is $^2D_{3/2}$. Find its spin, orbital and total angular momentum.
3. Discuss the factors affecting the width of the spectral lines.
4. What are skeletal vibrations?
5. State mutual exclusion principle.
6. Explain the structure determination of AB_3 type molecule using Raman and IR.
7. What is dissociation energy and dissociation products?
8. Explain proton magnetic resonance.
9. What is magnetic resonance imaging?
10. What is ESR ?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Draw the energy levels including spin-orbit interaction for n=3 and n=2 states of hydrogen atom and indicate the possible transitions.
12. Illustrate the j-j coupling for the pd electron configuration. Examine whether it would give same number of J values for the L-S coupling.
13. Write notes on (i) Atomic mass (ii) Nuclear quadrupole moment derivable from rotational spectra.

14. Fundamental and 1st and 2nd overtones of spectrum of HCl molecule are 2886 cm^{-1}, 5668 cm^{-1}, 8347 cm^{-1} respectively. Find the vibrational frequency and anharmonicity constant.

15. The first three Rotational Raman lines of a linear triatomic molecule are at 3.56, 9.52 and 10.55 cm^{-1} from the exciting line. Estimate the rotational constant B and the moment of inertia of the molecule?

16. How we can explain the intensity distribution of electronic vibrational transitions?

17. The four lines from an AX spectrum are observed at δ= 5.8, 5.7, 1.1, 1.0. What are the chemical shift positions in δ scale of the A and X nuclei and the coupling constant in Hertz between them.

18. Explain with a block diagram a Mossbauer spectrometer.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Discuss the theory of spectra of alkali metal vapours.

20. Explain the rotational spectrum of a linear diatomic molecule and also discuss the effect of isotopic substitution on the spectrum.

21. Explain in detail the hyper Raman effect and discuss the classical treatment to explain it.

22. Explain hyperfine structure in the case of ESR spectroscopy.

(2×5=10 weightage)