QP Code: P25C003

Reg. No : ....

Name : ....

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

III SEMESTER (CBCSS-PG) DEGREE EXAMINATIONS, OCTOBER 2025

M. Sc. Chemistry

CHE3C09 : MOLECULAR SPECTROSCOPY

2024 Admission Onwards

Time: 3 Hours **Maximum Weightage: 30**

Section A

Answer **any eight** questions. Weightage **1** for each question. **(8x1 = 8 Weightage)**

1. Discuss the effect of isotopic substitution in rotational spectra.
2. Examine Doppler broadening.
3. Discuss Classical theory of Raman Effect.
4. Analyze Vibrational coarse structure in electronic spectroscopy.
5. Analyze spin-spin relaxation and spin lattice relaxation.
6. Define Zero field splitting and Kramer’s theorem.
7. What is Cotton effect?
8. Examine the effect of steric hindrance in the electronic absorption bands in UVVisible spectroscopy.
9. Write a note on the application of NMR for fluxional molecules.
10. Analyze isotopic peaks in mass spectrum.

Section B

Answer **any six** questions. Weightage **2** for each question. **(6x2 = 12 Weightage)**

11. Discuss rotational spectrum of symmetric top molecule.
12. The pure rotational spectrum of the gaseous molecule CO consists of a series of equally spaced lines separated by 3.7978 cm^{-1}. Calculate the internuclear distance of the molecule.
13. Write a note on quantum mechanical description of energy levels in NMR spectroscopy.
14. Intermolecular and intramolecular hydrogen bonding can be identified using IR spectroscopy. Justify.

Turn Over

15. Discuss the factors influencing carbon chemical shifts.

16. Examine Nuclear Overhauser Effect.

17. Discuss Chemical ionization and Electron Ionization in MS.

18. Examine mass spectrum of aldehyde and alcohol.

Section C

Answer **any two** questions. Weightage **5** for each question. **(2x5 = 10 Weightage)**

19. Evaluate the P, Q, and R branches in vibrating-rotator.

20. Analyse Woodwards rule for enone and dienes using examples.

21. Illustrate (a) Principle of Mossbauer spectroscopy (b) electric quadruple and magnetic hyperfine interactions in Mossbauer Spectroscopy.

22. Discuss the factors affecting spin-spin coupling.

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