THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19PCHE3C09 - MOLECULAR SPECTROSCOPY

(Chemistry)

(2019 Admission onwards)

Time : 3 Hours   Maximum : 30 Weightage

Section A

Answer any *eight* questions. Each question carries 1 weightage.

1. What is transition moment integral?

2. How many ESR hyperfine lines are observed for p-nitro benzoate dianion molecule? Explain.

3. Define normal mode of vibration.

4. What is the use of Fortrat diagram in electronic spectroscopy?

5. Aniline absorbs at 280 nm in UV-Visible spectra. But its acidic solution shows a bathochromic shift to 208 nm. Explain.

6. In general IR absorption peaks of O-H group of phenols and alcohols are broad, why?

7. What are the salient features of a first order NMR spectrum?

8. What is meant by DEPT? How is it useful in structure illucidation?

9. Discuss FAB in mass spectrometry.

10. Account for m/z= 58 in the mass spectrum of 1-pentene.

11. Explain the relative intensity of isotopic peaks of the molecules containing Br.

12. Account for m/z=65 in the mass specturm of toluene.

(8 × 1 = 8 Weightage)

Section B

Answer any *four* questions. Each question carries 3 weightage.

13. The rotational spectrum of CO shows a series of equidistant lines separated by 3.84325 cm-1. Calculate bond length.

14. Explain why NMR signal for protons in benzene is observed much downfield in comparision to that for protons in acetylene.

15. What do you mean by the number of fundamental vibrations? How will you detect the type of hydrogen bonding involved in a perticular compound by IR spectrum?

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17. Predict the number of proton NMR signals in N, N Dimethyl formamide at room temperature. Explain.

18. Discuss: Off-resonance and broad band decoupled spectra in NMR.

19. Explain McLafferty rearrangement in mass spectra. Account for the m/z values 41, 42 and 43 in the mass spectra of 1-hexene.

(4 × 3 = 12 Weightage)

Section C

Answer any *two* questions. Each question carries 5 weightage.

20. Dicuss: (i) The classification of molecules on the basis of moment of inertia with examples.

    (ii) Derive an expression for Jmax for the rigid rotor at which there is maximum population.

21. Explain Mossbauer Effect. Explain the application of Mossbauer spectroscopy for the structural determination of iron complexes.

22. (i) Discuss quantum theory of Raman scattering.
    (ii) The spacing between two consecutive S-branch lines of the rotational raman spectrum of hydrogen gas is found to be 243.2 cm-1. Calculate bond length of hydrogen

23. (a) How does the magnetic anisotropy affect the chemical shift? Discuss the magnetic anisotropy in the NMR spectrum of acetopheneone molecule.
    (b) Give a detailed account on methods to simplify the non-first order NMR spectra.

(2 × 5 = 10 Weightage)

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