

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2023
(Regular/Improvement/Supplementary)

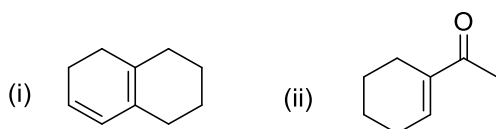
CHEMISTRY
FCHE2C08: MOLECULAR SPECTROSCOPY

Time: 3 Hours

Maximum Weightage: 30

Section A: Short answer questions. Answer any *eight* questions. Each carries 1 weightage.

1. What is meant by Stark effect in microwave spectra?
2. Elaborate on NOE in NMR spectroscopy.
3. Write Mc Connell relation. Explain the terms.
4. How do steric hindrance effects on UV spectral absorption?
5. Why is TMS used as reference molecule in NMR spectroscopy?
6. What are shift reagents? Give any two examples.
7. Calculate the λ_{\max} for the following compounds.



8. What is meant by a rigid rotator? State the selection rule for rotational transitions of a rigid rotator.
9. State and explain Kramer's theorem.
10. Write a short note on Cotton effect in CD spectroscopy.
11. What is anisotropic effect? How does it affect chemical shift in NMR?
12. Distinguish between symmetric and spherical top molecules.

(8 × 1 = 8 weightage)

Section B: Short essay questions. Answer any *four* questions. Each carries 3 weightage.

13. Explain the factors which determine the width and intensity of spectral lines.
14. State Franck – Condon principle. Discuss its importance in understanding the intensity of electronic transitions.
15. Explain axial haloketone rule for determination of absolute configuration of halocyclohexanones.

(P.T.O.)

16. Discuss the combined effect of isomer shift and hyperfine splitting in Mossbauer spectra.
17. Demonstrate the utility of NMR spectroscopy in understanding fluxional behavior of the molecule.
18. Give an account on the principle of HMBC and HMQC spectra.
19. How will you distinguish:
 - a) 1-propanol and 2-propanol using mass spectroscopy.
 - b) 2-pentanone and 3-pentanone using mass spectroscopy.

(4 × 3 = 12 weightage)

Section C: Essay questions. Answer any *two* questions. Each carries 5 weightage.

20. Discuss:
 - a) The quantum theory of Raman spectroscopy and show how the Stokes and anti-Stokes lines appear in the Raman spectrum of a molecule.
 - b) The origin of P, Q, R lines in vibrational rotational spectrum of molecules.
21. Explain:
 - a) The principle of FT-NMR.
 - b) The advantages of FT-NMR over conventional CW-NMR.
22. Give a detailed account on:
 - a) DEPT and INEPT in NMR.
 - b) The factors influencing the sensitivity of ^1H and ^{13}C NMR spectroscopy.
23.
 - a) Discuss the basic principle of EIMS.
 - b) Explain McLafferty rearrangement in mass spectra. Account for the m/z values 41, 42 and 43 in the mass spectra of 1-hexene.
 - (b) Demonstrate the mass spectra of cyclopentanone and acetophenone. Explain how to distinguish them?

(2 × 5 = 10 weightage)