



QP CODE: 25047484



25047484

Reg No :

Name :

M.Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2025

Third Semester

Core Course - CH500303 - SPECTROSCOPIC METHODS IN CHEMISTRY

M.Sc CHEMISTRY, M.Sc ANALYTICAL CHEMISTRY, M.Sc POLYMER CHEMISTRY, M.Sc
APPLIED CHEMISTRY, M.Sc PHARMACEUTICAL CHEMISTRY

2019 ADMISSION ONWARDS

2E0F2CDB

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Explain the single and multiple cotton effect curves?
2. How will you estimate ring strain in IR spectra? Illustrate with an example.
3. How will you differentiate cis and trans stilbenes using IR spectroscopy?
4. Draw and explain the NMR splitting in A_2X_3 and AMX molecules.
5. Explain the following (a) Off resonance decoupling (b) lanthanide shift reagents.
6. Write a note on deuterium exchange in NMR spectroscopy.
7. Explain the theory and applications of COSY.
8. Predict the structure of the organic compound with molecular formula $C_4H_8O_2$ whose 1H NMR data is d 1.23 (3H, t), d 4.06 (2H, q), d 1.97 (3H, s)
9. What are the different fragments shown by the aldehydes and ketones?
10. What is 4+2 cycloaddition? Analyse the reaction using IR and proton NMR spectroscopy.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Explain the effect of solvent and effect of conjugation in uv-visible spectroscopy.
12. How will you distinguish between (a) maleic acid and fumaric acid and (b) propiophenone and phenylacetone by IR spectroscopy?
13. Comment on the factors affecting chemical shift.





14. Explain Chemical equivalence and magnetic and non-magnetic equivalence with example.
15. Explain the technique - spectral editing - with special mention on DEPT.
16. Deduce the feasible structures for the compound whose mass spectra have ions at the following M/Z values. Base peak first. Discuss the fragmentation pattern.
 $C_{10}H_{20}O$ m/z 57, 81, 67, 56, 82, 83, 41, 123, 99
17. Determine the structure of the compound which shows m/e peaks at 88, 70, 55, 42, 31 (much intense) and 29.
18. An organic compound with molecular formula $C_4H_8O_3$ gives the following spectral data. Deduce the structure.
IR spectrum - 1120, 1705 cm^{-1}
 1H NMR - δ 12.1 (1H, s), 4.15 (2H, s), 3.6 (2H, q, J=7Hz) and 1.3 (3H, t, J=7 Hz) ppm.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. What is Cotton effect? Write down the applications. What is the importance of Cotton curves and plain curves.
20. Write a note on the mechanism of coupling with special reference to Dirac model.
21. Write note on different soft ionization methods in mass spectrometry.
22. An organic compound with molecular formula $C_6H_{11}O_2X$ (X is a halogen) shows the spectral details as follows:
IR: 1735, 1250 cm^{-1} .
 1H NMR: δ 4.1 (2H, q, J= 7.5 Hz), 3.8 (2H, t, J= 7 Hz), 2.4(2H, t, J = 7.2 Hz) 1.8 (2H, m) and 1.25 (3H, t, J = 7.5 Hz) ppm.
Its mass spectrum shows two equal intensity peaks at m/z 194 and 196. Predict the structure.

(2×5=10 weightage)

