M Sc DEGREE (CSS) EXAMINATION, APRIL 2022

Third Semester

Faculty of Science

CORE - CH500303 - SPECTROSCOPIC METHODS IN CHEMISTRY

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

2019 ADMISSION ONWARDS

C0FA425C

Time: 3 Hours   Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What is Circular Dichroism?

2. How will you distinguish between the inter molecular and intra molecular hydrogen bonding?

3. Explain the vibrational coupling in IR spectroscopy.

4. Explain how shielding and deshielding affects Chemical shift values.

5. Draw and explain Karplus curve.

6. What are Lanthanide shift reagents? How do they help in simplifying the complex nmr spectra?

7. In the NMR spectrum of CF_3-CH_2-OH the CH_2 group does not appear as a singlet. Why?

8. Explain the twchnique DEPT in NMR.

9. What are the fragments of phenol in mass spectroscopy.

10. Explain the following (a) Nitrogen Rule (b) Mc Lafferty rearrangement

(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. Oxidation of secondary alcohol to ketone can be followed using IR spectroscopy. Justify using an example

13. Comment on the term magnetic anisotropy in NMR.

14. Explain the theory of AX$_2$ coupling. Draw the splitting pattern for CHCl$_2$CH$_2$Br.

15. Explain HETEROCOSY.

16. Following are the NMR data of 3 isomers, of an ester with molecular formula C$_7$H$_{14}$O$_2$, all derived from Propanoic acid. Predict the structure

      a. C$_7$H$_{14}$O$_2$ δ = 0.9 (d), 1.1 (t), 3-3 (q), 3.9(d), 1.1 (m)
      b. δ = 1.1 (t), 1.5 (s), 2.2 (q)
      c. δ= 0.9(t), 1.1(t), 1.4 (Sextet), 1.6 (quintet), 2.3 (q), 4.1 (t).

17. Discuss the various fragmentation products of the following compounds: (i) 2- pentene, (ii) 1- butanol and (iii) 3-pentanone.

18. An organic compound with molecular weight 60 on heating with Sodium hypo bromite gives out nitrogen with effervescence. In NMR, it shows a band 2.5 τ. In UV it absorbs at 222 nm ε_{max} 62. The bands observed in the IR spectrum are 3490 cm^{-1} (b), 1675 cm^{-1}(s). Determine the structure.

(6×2=12 weightage)

Part C (Essay Type Questions)
*Answer any **two** questions.*
*Weight **5** each.*

19. *Explain Octant rule and its applications in detail. Write a short note on Axial haloketone rule.*

20. Explain Spin- Spin Splitting of AX, AX$_2$, AX$_3$,A$_2$X$_3$ and AMX type compounds.

21. Write note on a) SIMS   b) FAB   c) CA   d) MALDI   e) TOF   f) Field desorption

22. An organic compound A with molecular formula C$_3$H$_9$N shows the following peaks in the IR Spectrum :- 3012 cm^{-1} (m), 3423 cm^{-1} & 3396 cm^{-1} (b) and 1615 cm^{-1} (m). When compound A is treated with HNO$_2$, we get a compound B (MF = C$_3$H$_8$0) which shows a broad peak at 3430 cm^{-1}. what are A and B? Explain your reason.

(2×5=10 weightage)