



21000546

QP CODE: 21000546

Reg No : .....

Name : .....

**M Sc DEGREE (CSS) EXAMINATION, MARCH 2021**

**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

6F18F775

Time: 3 Hours

Weightage: 30

**Part A (Short Answer Questions)**

*Answer any **eight** questions.*

*Weight 1 each.*

1. Briefly explain about ORD and CD.
2. Explain briefly about the fingerprint region in IR spectroscopy.
3. Arrange the following in the increasing order of their carbonyl stretching frequencies: cyclohexanone, cyclopentanone, cyclobutanone, cyclopropanone.
4. Explain the term Chemical shift. What is its unit?
5. What is anisotropic effect in NMR?
6. What do you mean by virtual coupling.
7. What are Lanthanide shift reagents? Give example. Write their mechanism.
8. What is the importance of off diagonal peaks in COSY experiment? Illustrate with an example.
9. Explain Nitrogen Rule.
10. A hydrocarbon with molecular mass  $C_7H_{12}$  ( $M^+$  at  $m/e$  96) shows large peaks at  $m/e$  54 and due to  $M-15$ . What structure can be assigned to the compound?

(8×1=8 weightage)





### Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. The  $\pi$ - $\pi^*$  transition of ethylene occurs at 170 nm, while butadiene absorbs at 217 nm. Explain.
12. Write a note on field effect on IR spectrum of organic compounds.
13. Explain AB, ABC and AMX type splitting in NMR.
14. Write a note on dueterioration in NMR spectroscopy?
15. Explain DEPT with Suitable example.
16. Deduce the structure of the molecules from the proton NMR data  
(a)  $C_5H_{10}O_2$ .  $^1H$ NMR data,  $\delta$  4.1(q, J=7Hz), 2.2(q, J=7Hz), 1.1(t, J=7Hz), 1.25(t, J=7Hz)  
(b)  $C_5H_{10}O_2$ .  $^1H$ NMR data,  $\delta$  3.6(s), 2.2(t, J=7Hz), 1.6(m), 0.9(t, J=7Hz)
17. 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
18. State whether the following pairs of compounds could be distinguished by the examination of their IR spectra. Give reasons.  
(a)  $PhCH_2NH_2$  and  $PhCONH_2$   
(b)  $NH_2-C_6H_4-CO_2Me$  and  $Me-C_6H_4-CONH_2$

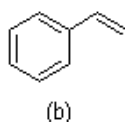
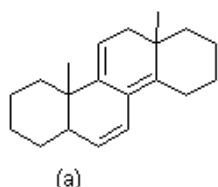
(6×2=12 weightage)

### Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. (a) Systematically write down the procedure to calculate  $\lambda_{max}$  of compounds using Woodward-Fieser Rules.  
(b) Find out the  $\lambda_{max}$  value of the following compounds



20. Write a note on the mechanism of coupling with special reference to Dirac model.





21. Discuss the various ionisation methods used in mass spectrometry.
22. Predict the structure of the compound (MF  $C_{11}H_{20}O_4$ ) which gave the following spectral data.
- UV – No  $\lambda_{max}$  above 200 nm
- IR:  $1740\text{ cm}^{-1}$ .
- $^1\text{H NMR}$ :  $\delta$  4.2 (4H, q), 3.3 (1H, t), 1.9 (2H, q), 1.33 (4H, m), 1.27 (6H, t) and 0.9 (3H, t) ppm.
- $^{13}\text{C NMR}$ :  $\delta$  14.10, 13.81, 22.4, 28.5, 29.5, 52.0, 61.1 and 169.3 ppm.
- Mass:  $m/z$  216 ( $M^+$ ), 171, 160 (100%), 133 and 115.

(2×5=10 weightage)

