

M.Sc. Semester - 4 (CBCS) Examination
March/April- 2019
ADVANCE SPECTROSCOPIC TECHNIQUES
(CORE)

Time: 2:30 Hours

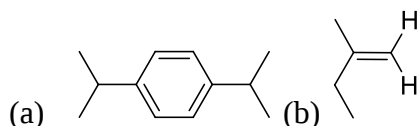
Marks: 70

Instructions:

1. All questions are compulsory.
 2. Figures to the right indicate marks.
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Q.1 Answer any seven of the following ten questions.**[14 Marks]**

1. How many types of protons are there in following compounds?



2. Write full form of COSY, NOESY, HSQC and HMBC.
3. Explain Stevenson's Rule with example in mass spectroscopy.
4. Differentiate between geminal and vicinal coupling.
5. Draw the schematic diagram of Mass spectroscopy.
6. Why ester shows absorption peak at high wave number than ketone?
7. Give the applications of EPR spectroscopy.
8. State Lamberts-Beer's Law.
9. Give principle of Raman spectroscopy.
10. Differentiate 1-propanol and 2-propanol by CMR spectroscopy.

Q.2 Answer any two of the following three questions.**[14 Marks]**

1. Discuss Chemical ionization and Electron ionization techniques in mass spectroscopy.
2. Explain fundamental bands in IR spectroscopy.
3. How many types of absorption shift observed in UV spectroscopy? Explain in details.

Q.3 Answer the following questions.**[14 Marks]**

1. Explain different methods of sample handling in IR spectroscopy.
2. Discuss the Mass Fragmentation patterns of Pentane.
3. Deduce the structure of compound from the given analytical data.
MF: $C_7H_5NO_3$
PMR: δ 7.8 (1H, t), 8.3 (1H, d), 8.5 (1H, d), 8.7 (1H, s), 9.85 (1H, s).
CMR (Proton noise decoupled): 7 signals

OR

Q.3 Answer the following questions.**[14 Marks]**

1. Discuss instrumentation of IR spectroscopy with schematic diagram.
2. Explain α -, β - and γ -Effects in CMR spectroscopy.

Q.4 Answer any following questions.**[14 Marks]**(a) Answer any **two** out of three questions:

1. Discuss McLafferty rearrangement with at least two examples.
2. Give application of UV Spectroscopy.
3. Give difference between Raman and Infrared spectra.

(b) Answer any **one** out of two questions:

1. Discuss spin labelling techniques in electron paramagnetic resonance spectroscopy.
2. Differentiate phenyl acetic acid and methyl benzoate by using ^1H NMR spectroscopy.

Q.5 Answer any two of the following four questions.**[14 Marks]**

1. What is pople notation? How to differentiate 1st order and non-1st order spectrum? Explain AMX spin system with suitable example.
2. Deduce the structure of compound from the given analytical data and explain it.
MF: $\text{C}_{11}\text{H}_{14}\text{O}_2$; **IR:** 1715 cm^{-1} ; **PMR:** δ 2.1 (3H, s), 2.6 (2H, t), 2.8 (2H, t), 3.8 (3H, s), 6.8 (2H, d, $J = 8.5\text{ Hz}$), 7.1 (2H, d, $J = 8.5\text{ Hz}$). **CMR** (Off-resonance decoupled): two quartet, two triplet, two doublet and three singlet.
3. Explain non-fundamental bands in IR spectroscopy.
4. Calculate ^{13}C NMR chemical shifts of aromatic C-atoms of 3-nitrobenzoic acid and 2-chlorobenzaldehyde. Take base value 128.5 and following incremental shift of aromatic C-atom are given below.

Substituent	C1 (<i>ipso</i>)	C2 (<i>ortho</i>)	C3 (<i>meta</i>)	C4 (<i>para</i>)
COOH	+2.9	+1.3	+0.4	+4.3
NO ₂	+19.6	-5.3	+0.9	+6.0
Cl	+6.4	+0.2	+1.0	-2.0
CHO	+8.2	+1.2	+0.6	+5.8
