647510 **MSC4astC0110** **Seat No :_____**

M.Sc.(Chem.) Semester - 4 (*CBCS*) Examination
August/September -2020 [OLD COURSE]
ADVANCE SPECTROSCOPIC TECHNIQUES (CORE)

Time: 2:00 Hours **Marks: 56**

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any four of the following questions.

Q.1 Answer any seven of the following ten questions. **[14 Marks]**

1. Write full form of COSY, NOESY, HSQC and HMBC.
2. Differentiate between germinal and vicinal coupling.
3. Which types of nuclei NMR active? and why?
4. Define the terms: Frequency and Wavelength.
5. State Lamberts-Beer's Law.
6. Give principle of NMR spectroscopy.
7. Identify the types of protons in the following compounds:
   (a) 2-Butanone (b) n-Propyl Benzene
8. Define the following terms:
   (a) Mass peak (b) Base Peak
9. Give the applications of EPR spectroscopy.
10. What is the application of Near IR Region?

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

1. Discuss any two ionization techniques in mass spectroscopy.
2. Briefly explain instrumentation of IR spectroscopy with schematic diagram.
3. Explain spin-spin splitting in NMR Spectroscopy with suitable examples.

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

1. Explain α-, β- and γ-Effects in CMR spectroscopy.
2. How many types of absorption shift observed in UV spectroscopy? Explain in detail.
3. Discuss instrumentation of Mass spectroscopy with schematic diagram.

OR

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

1. Explain fundamental bands in IR spectroscopy.
2. Discuss Homolytic and Heterolytic cleavage in Mass spectroscopy.
3. Deduce the structure of compound from the given analytical data.

   MF: $C_8H_{11}N$

   PMR: δ 3.5 (6.1 square, brs), 1.0 (9.3 square, d), 2.8 (2.8 square, q), 7.2 (15.5 square, s)

Q.4 Answer any two of the following three questions. **[14 Marks]**

1. Discuss the Mass fragmentation patterns of ethyl benzene.
2. What is Raman Spectroscopy? Give difference between Raman and Infrared spectra.
3. Discuss spin labeling techniques in EPR spectroscopy.

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

1. Discuss ESR spectrum of $K_3Fe(CN)_6$.
2. What is pople notation? How to differentiate 1st order and non-1st order spectrum?

   Explain AMX spin system with suitable example.
3. Differentiate phenyl acetic acid and methyl benzoate by using ^{1}H NMR spectroscopy.
4. Calculate ^{13}C NMR chemical shifts of aromatic C-atoms of benzoic acid and 4-chlorobenzaldehyde. Take base value 128.5 and following incremental shift of aromatic C-atom are given below.

Substituent	C1 (*ipso*)	C2 (*ortho)*	C3 (*meta*)	C4 (*para*)
COOH	+2.9	+1.3	+0.4	+4.3
Cl	+6.4	+0.2	+1.0	-2.0
CHO	+8.2	+1.2	+0.6	+5.8
