M.SC. CHEMISTRY
FOURTH SEMESTER
APPLICATION OF SPECTROSCOPY-II
MSC – 403

[USE OMR FOR OBJECTIVE PART]

SET A

Duration: 1:30 hrs.

Full Marks: 35

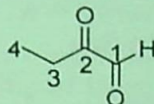(**Objective**)
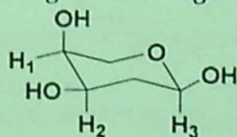
Time: 15 mins.

Marks: 10

Choose the correct answer from the following: $1×10=10$

1. The peak of D_4-1,2-dichloroethane in ^{13}C NMR will be
   - a. singlet
   - b. triplet
   - c. quartet
   - d. quintet

2. Which carbon of the following compound will not show peak in DEPT spectrum

   - a. C1
   - b. C2
   - c. C3
   - d. C4

3. Which one is correct for the following molecule regarding its NMR study?

   - a. H_1-H_2: COSY & H_2-H_3 NOESY
   - b. H_1-H_2: NOESY & H_2-H_3 COESY
   - c. H_1-H_3: COSY & H_2-H_3 NOESY
   - d. H_1-H_3: NOESY & H_2-H_3 COESY

4. Which NMR technique will be suitable to distinguish the followings
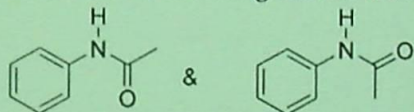
   - a. ^1H-NMR
   - b. DEPT
   - c. COSY
   - d. NOESY

5. If a molecule ($C_xH_yN_z$) shows molecular ion peak in EI-MS m/z = 80, a distinct peak at 2250 cm^{-1} in IR and a singlet (δ = 2.8 ppm, 2H) in ^{1}H-NMR, and DBE = 4, the correct formula will be
   a. $C_4H_8N_2$ b. $C_3H_2N_3$
   c. C_5H_6N d. $C_4H_4N_2$

6. Which ionization technique in mass spectrometry involves bombarding the sample molecules with a high-energy laser to produce ions?
   a. Electron Impact (EI) ionization   b. Chemical Ionization (CI)
   c. Matrix-Assisted Laser Desorption/Ionization (MALDI)   d. Atmospheric Pressure Chemical Ionization (APCI)

7. In mass spectrometry, what does the term (m/z) represent?
   a. The mass of the ion   b. The charge of the ion
   c. The ratio of mass to charge for an ion   d. The size of the ion

8. Which of the following is a TRUE statement
   a. Stability or life time of molecular ion of aromatic compound is greater than hydrocarbons   b. Mass spectrometry does not give any information about the composition of the molecule
   c. FAB technique is a hard ionization technique   d. MALDI is generally done for low and volatile molecular weight compounds

9. The molecular ion peak of the following compound will be found at

$$H_3CO-\!\!\!\bigcirc\!\!\!-COCH_3$$
$$H_3CO$$

   a. m/z = 181   b. m/z = 180
   c. m/z = 179   d. m/z = 182
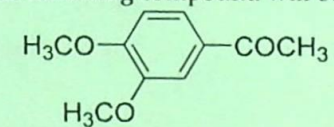
10. MALDI is a
    a. Soft ionization technique   b. Hard ionization technique
    c. Not an ionization technique   d. All of the above

-- --- --

Time : 1 hr. 15 mins.   Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. a. Write the structure of 4-chloroacetophenone and mention how   3+2=5
      many signals will be obtained in the **DEPT-90&DEPT-135**
      spectra of the molecule.

   b. Explain the isotopic effect in mass spectrum taking the example
   of ethane (C_2H_6) molecule.

2. a. Depict the probable ^{13}C NMR (both proton-coupled & proton-   4+6=10
      decoupled) spectra of ethyl acetate with explanation.

   b. How many peaks the following molecule will show in proton-
      decoupled ^{13}C NMR spectrum? Depict the probable DEPT-45,
   DEPT-90, and DEPT-135 spectra of the following compound.
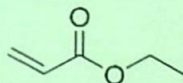
3. a. Draw the proton-decoupled ^{13}C-NMR spectra of the following   4+3+3
      compound   =10

      CHF_2CH_2Cl [Given: $^1J_{(C-F)}$ = 180 Hz, $^2J_{(C-F)}$ = 40 Hz; δ (50 MHz,

      $CDCl_3$, ppm): 90, 50].

   b. If the $^1J_{C-H}$ = 160 Hz, how many signals will be there in the
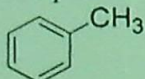   **INEPT 80 & INEPT 120** spectra of the following molecule?
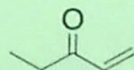
c. Draw the COSY spectrum of the compound given here with its ^{1}H NMR
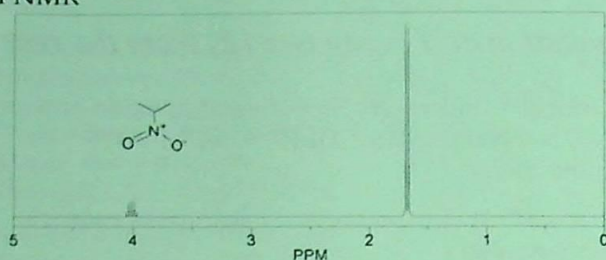
4. **a.** Show the probable fragmentation pattern of 2,2,4-trimethyl pentane and draw the possible mass spectrum.

4+3+3
=10

 b. What is CI method of ionization in mass spectrometry-describe. Why we observe $[M+H]^+$ peak in CI-MS not molecular ion peak - explain.

 c. Show the probable fragmentation pattern of the following compoundsand draw the possible mass spectrum.
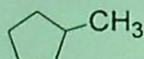
5. **a.** What is TOF analyser-explain.

3+3+4
=10

 b. Draw the schematic diagram of different section mass spectrometry.

 c. Show the probable fragmentation pattern of the following compound. Draw the probable mass spectrum and designate the base peak.

$= = *** = =$

4