

$\delta$  5.0(singlet, 2H) and  $\delta$  7.2 (singlet, 5H), IR bands intense at  $740\text{ cm}^{-1}$ . (4,5,6)

7. (a) Describe the various fragmentation modes for the benzophenone whose peaks in the mass spectrum appear at  $m/z$  120, 105, 91 and 77.  
 (b) Explain the principal and application of  $^1\text{H}$ -NMR and  $^{13}\text{C}$ -NMR spectroscopy in structure elucidation.  
 (c) Explain the quantitative NMR (qNMR). What are the principles of qNMR? (4,5,6)
8. (a) Discuss the role of 2D-NMR in identifying molecular structure.  
 (b) What are the terms magic angle spinning (MAS) and cross-polarization (CP-MAS) in solid-state NMR  
 (c) Discuss the factors affecting accuracy in qNMR measurements (relaxation time, pulse angle, acquisition time).

(4,6,4)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7025

K

Unique Paper Code : 2172544701

Name of the Paper : DSC: Advanced Instrumental Methods-1

Name of the Course : B.Sc. (Prog.) Analytical Chemistry

Semester : VII

Duration : 3 Hours

Maximum Marks : 90

### Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
  - Attempt any 6 questions.
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- (a) Define the terms EI and API of mass spectrometry.  
 (b) Discuss the quadrupole and ESI in mass spectrometry.

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- (c) Explain the terms isotopic mass peaks & doubly/multiply charged ions in mass spectrometry.  
(3,6,6)
2. (a) What are the natural abundance, resolution and multiplicity of  $^{13}\text{C}$  NMR and  $^1\text{H}$  NMR in decoupling spectroscopy?  
(b) Explain the ortho effect and nitrogen rule in mass spectrometry.  
(c) Explain to analyze fragmentation and base peak of n-butylamine and acetophenone to loss of  $\text{CH}_3$  and formation of benzoyl ion ( $m/z = 105$ ).  
(6,4,5)
3. (a) Explain the working and importance of NOESY & ROESY terms in 2D-NMR.  
(b) How can do distinguish between 3-methyl cyclohexene and 4-methyl cyclohexene on the basis of mass spectroscopy?  
(c) Do the following nuclei have zero/non-zero magnetic moment? (Give reasons)  
 $^2\text{H}$ ,  $^{14}\text{N}$ ,  $^{13}\text{C}$ ,  $^{16}\text{O}$ ,  $^{19}\text{F}$ ,  $^{32}\text{S}$  (4,5,6)

4. Write short notes on **ANY THREE** (5,5,5)  
(a) FT-ICR (Fourier Transform Ion Cyclotron Resonance)  
(b) Matrix-Assisted Laser Desorption Ionization (MALDI)  
(c) Fast Atom Bombardment (FAB)  
(d) Solid-state NMR spectroscopy
5. (a) What are general fragmentation rules of mass spectrometry?  
(b) Explain the McLafferty rearrangement of 2-pentanone and 1-pentene. Draw the transition state of both molecules.  
(c) What is the difference of noise decoupling and broad band decoupling? (3,6,6)
6. (a) What is diastereotopicity? How does it affect NMR spectra.  
(b) Discuss the exchange spectroscopy (ESXY) and magic angle spinning (MAS).  
(c) Determine the structure of an organic compound of molecular formula  $\text{C}_9\text{H}_{10}\text{O}_2$  showed three peaks in the  $^1\text{H}$  NMR as given  $\delta$  1.96 (singlet, 3H),