

[1]

ROLL NO.....

CHE. 204/21

II SEMESTER EXAMINATION, 2021

M.Sc. (CHEMISTRY)

PAPER-IV

THEORY AND APPLICATIONS OF SPECTROSCOPY –II

TIME: 3 HOURS

MAX.- 80

MIN.- 16

Note: The question paper consists of three sections A, B & C. All questions are compulsory.

Section A- Attempt all multiple choice/answer in one word questions.

Section B- Attempt one question from each unit.

Section C- Attempt one question from each unit.

SECTION 'A'

$2 \times 8 = 16$

Multiple Choice Questions/ Answer in one word

1. Rotational transition is which $\Delta J = -2$ is known as -
(a) Q - type (b) O - type
(c) R - type (d) S - type
2. Which out of benzene (colourless) or quinone (yellow) has more easily promoted electrons.
3. What is the range of infra-red radiations?
4. On what factors the vibrational stretching frequency of diatomic molecule depends -
(a) Atomic population (b) Force constant
(c) Temperature (d) Magnetic field

[2]

5. Separations of ions in mass spectrometer take place on the basis of which of the following -
- (a) Mass (b) Charge
(c) Molecular weight (d) Mass to charge ration
6. The signal at m/e 31 appears in large abundance in the mass spectrum of -
- (a) Tertiary alcohol (b) Secondary alcohol
(c) Primary alcohol (d) None of the above
7. Which carbon of hex-3-en-2-one shows the largest (most downfield) chemical shift in the C-13 NMR spectrum? -
- (a) C-1 (b) C-2 (c) C-4 (d) C-6
8. Correct order of tau value of hybrid orbitals holding the proton is -
- (a) $sp > sp^2 > sp^3$ (b) $sp^3 > sp > sp^2$
(c) $sp > sp^3 > sp^2$ (d) $sp^2 > sp > sp^3$

SECTION 'B'

$4 \times 6 = 24$

Short Answer Type Questions (Word limit 200-250 words.)

UNIT-I

- Q. 1. Write a note on rotational fine structure of electronic vibrational spectra.

OR

Discuss the shift in absorption ($n - \pi^*$) and ($\pi - \pi^*$) when a more polar solvent is used.

[5]

OR

Determine the structure of the compounds whose m/e values in mass spectrum are 100,85,71,57,43,(base), 41,29 and 27.

UNIT-IV

- Q. 4. What are the factors which affect the chemical shift? Explain with examples.

OR

Is spin-spin coupling between ^{13}C - ^{13}C nuclei observed in C-13 NMR spectra? Discuss some techniques for simplification of ^{13}C NMR spectra.

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[3]

UNIT-II

Q. 2. What do you mean by fundamental vibrations and overtones?

OR

Distinguish between the following pair of compounds with the help of IR technique-

- (i) Propanal and propanone (ii) Cis and trans cinnamic acid

UNIT-III

Q. 3. What is metastable ion or peak? What is its importance?

OR

Write some important features of mass spectra of aromatic compounds.

UNIT-IV

Q. 4. Write a note on Nuclear Magnetic Double Resonance.

OR

Explain the effect of substituents on C-13 chemical shifts.

SECTION 'C' **4 × 10 = 40**

Long Answer questions (Word limit 400-450 words.)

UNIT-I

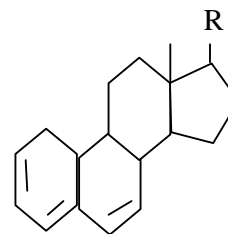
Q. 1. What is a chromophore? Explain different types of chromophores?

What do you mean by distortion of the chromophore?

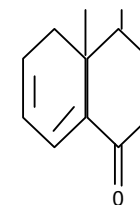
[4]

OR

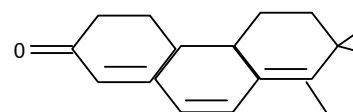
Calculate λ_{max} for the following compounds –



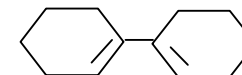
(I)



(II)



(III)



(IV)

UNIT-II

Q. 2. Discuss in detail the various factors which influence the vibrational frequency of a particular group.

OR

Discuss in detail the Fourier Transform Infra-red spectroscopy and its advantages.

UNIT-III

Q. 3. Explain general fragmentation modes in organic compounds in detail.