

Exam Code: 0433
Sub. Code: 25931

2125
M.Sc. Applied Chemistry (Pharmaceutical)
Third Semester
Paper – 304: Spectroscopic Instrumentation Techniques

Time allowed: 3 Hours

Max. Marks: 60

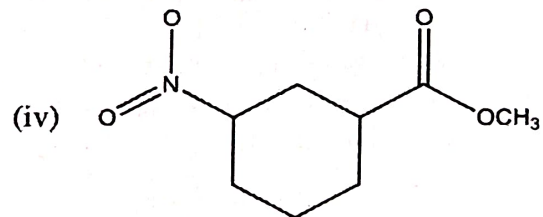
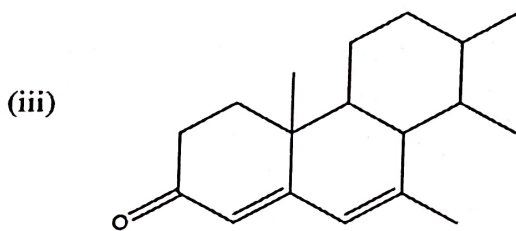
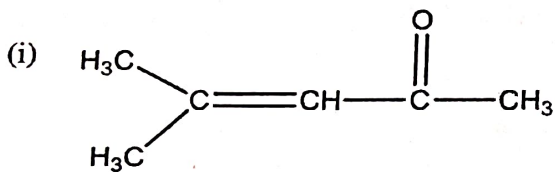
NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting one question from each Unit.

x-x-x

1. a) Differentiate between Turbidity and Nephelometry.
b) What is the effect of hybridization of carbon on the stretching frequency of C-H bonds? Explain.
c) In the mass spectrum of Toluene, strong peaks are formed at m/e 91 and m/e 65 and a broad peak at 46.4. Justify these signals.
d) What are chemical shifts and what do they indicate in NMR spectroscopy? (3x4)

UNIT I

2. a) Explain Lambert-Beer's Law. Derive the mathematical expression and discuss its limitations. (4)
b) Calculate λ_{max} for the following compounds: (8)



3. a) Describe the different types of electronic transitions involved in UV-Visible absorption spectroscopy. (4)
b) Discuss the theory behind Fluorescence and Phosphorescence. (4)
c) Define monochromator resolution. How do prisms and gratings help in improving resolution? (4)

UNIT II

4. a) Explain the basic principle of infrared spectroscopy. What type of molecular vibrations are studied in this technique? (6)

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(2)

- b) Explain the method of sample handling for IR analysis. What are the preferred types of sample cells used? (6)
5. a) Explain how conjugation affects the carbonyl stretching frequency in α,β -unsaturated compounds. (4)
- b) Explain the dispersive IR spectrophotometer in detail. (4)
- c) Effect of hydrogen bonding of solvent on vibrational frequencies, overtones, combination bands. (4)

UNIT III

6. a) Define shielding and deshielding. How do they influence the position of NMR signals? (3)
- b) A compound shows λ_{\max} at 280 nm, a strong IR absorption at 1715 cm^{-1} , and a singlet at δ 2.1 ppm in its NMR spectrum. Suggest a possible structure and justify your answer. (6)
- c) What information can be obtained from the number, position, and splitting of NMR signals in a compound? (3)
7. a) Identify the compound and justify your answer using the given spectral data.
- Molecular ion (Mass spectrum):** m/z (M^+) = 120
- UV (in ethanol):** λ_{\max} = 256 nm (log ϵ moderate)
- IR (neat):** strong absorption at 1685 cm^{-1} , weak bands around 3050 cm^{-1} , and aromatic C–H region bands.
- ^1H NMR (CDCl_3 , 400 MHz):** δ 2.60 (3H, s); δ 7.35–7.90 (5H, multiplet) (8)
- b) What is the effect of deuteration in NMR spectroscopy? Explain its role in structure elucidation. (4)

UNIT IV

8. a) Describe the effect of hybridization and electronegativity on ^{13}C chemical shifts with suitable examples. (6)
- b) Explain the basic principle and working of mass spectrometry. What information can it provide about a compound? (6)
9. a) Explain chemical ionization (CI) and how it differs from electron impact ionization. (4)
- b) Explain the resolution of mass spectrometer. (4)
- c) Describe the principle of a Time-of-Flight (TOF) mass analyzer. (4)