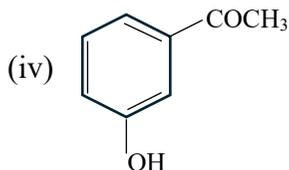
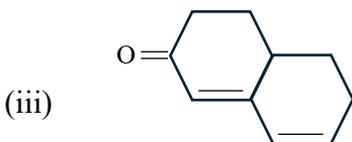
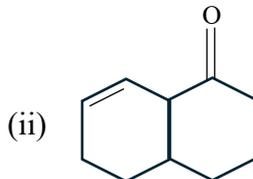
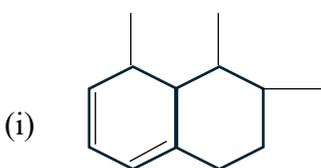


- (b) The hydration of 1, 2-dimethyl cyclo-hexanol (cis or trans) can lead to the formation of three alkenes. Write their structures and explain how IR spectroscopy can be used to differentiate among them. 4
- (c) What is infrared spectrum? Give the wavelength, frequency, and energy ranges pertaining to the normal infrared region of the spectrum. 5

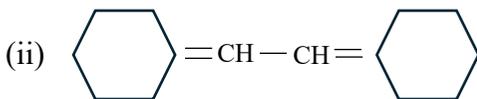
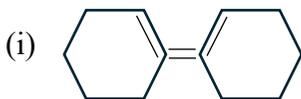
UNIT-II

3. (a) Explain the theory of UV spectroscopy and types of electronic transitions with examples. 6
- (b) Explain the following terms with examples. 2×4=8
- (i) Chromophores
 - (ii) Auxochrome
 - (iii) Bathochromic shift
 - (iv) Hypsochromic shift
4. (a) Calculate the λ_{\max} of the following compounds: 2×5=10



- (v) $(\text{CH}_3)_2\text{C}=\text{CH}-\text{CO}-\text{CH}_3$
- (b) The wavelength of maximum absorption for methyl chloride is λ_{\max} 173 nm while for methyl iodide it is λ_{\max} 253 nm. Give reason. 2

- (c) Why is λ_{\max} for the given compound (i) lower than that of the compound (ii)? 2



UNIT-III

5. (a) Write the factors influencing chemical shift in NMR spectroscopy. 7
- (b) A hydrocarbon contains 85.7 % carbon and 14.3 % hydrogen. It is transparent above 210 m μ in the UV spectrum. In its IR spectrum, bands are formed at 3022, 1676 and 965 cm⁻¹. Two signals appear in its NMR spectrum: a doublet at 8.40 τ and a quartet at 4.45 τ , with the integral ratio 3:1, respectively. Determine the structural formula of the compound. 7
6. (a) An organic compound with a molecular formula C₃H₃Cl₅ gave the following NMR data
- (i) A triplet at $\delta = 4.52$
- (ii) A doublet at $\delta = 6.07$
- Assign a structural formula to the compound consistent with its NMR data. 4
- (b) A nitrogen-containing compound (mol. mass = 73) shows the following signals in the PMR spectrum
- (i) Singlet, (0.60 δ), 1 H, (exchangeable with D₂O)
- (ii) Triplet (1.05 δ) 6 H (III) Quartet (2.61 δ) 4 H
- Propose a structure consistent with the given data. 4
- (c) Explain all the three-relaxation process of non-radiative transition in NMR spectrum. 6

UNIT-IV

7. (a) Explain the terms INEPT, DEPT, and NOESY in brief. 9

- (b) How many signals are expected in ^{13}C NMR spectrum of ortho-, meta- and para-xylenes? Explain. 3
- (c) What is the main difference between PMR and CMR spectra? 2
8. (a) How will you differentiate between the following from ^{13}C NMR spectroscopy? $3 \times 3 = 9$
- (i) Cis- and trans-butane
- (ii) Butanone, butanal and 2-methyl propanol and
- (iii) Butanol and 2-butanol
- (b) Explain the factors affecting chemical shift in ^{13}C NMR spectroscopy. 5

UNIT-V

9. (a) What are the different types of fragmentation observed in mass spectrometry? Illustrate with suitable examples. 6
- (b) How will you distinguish among the isomeric butanols on the basis of mass spectroscopy: 1-butanol, 2-butanol, and 2-methyl-2-propanol? 4
- (c) What is nitrogen rule as applied in mass spectroscopy? Explain with suitable examples its significance in mass spectral analysis. $2+2=4$
10. (a) Suggest the structure of a compound with molecular formula $\text{C}_{10}\text{H}_{12}\text{O}$, whose mass spectrum shows peaks at m/z 15, 43, 57, 91, 105 and 148. 4
- (b) Explain the role of isotopes in mass spectrometry. How does the presence of isotopes, such as chlorine and bromine, affect the mass spectrum of a compound? 6
- (c) Define the following term in mass spectrometry: $2 \times 2 = 4$
- (i) Base peak
- (ii) Metastable ion and peak