

M.Sc. III Semester Degree Examination, April/May - 2023

INDUSTRIAL CHEMISTRY

DSC 9 : Spectroscopy

(CBCS)

Time : 3 Hours

Maximum Marks : 70

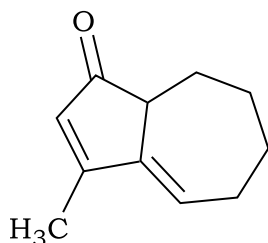
Note : (i) Answer **any five** questions including **Q.No.1**.

(ii) Q.No **1** is **compulsory**.

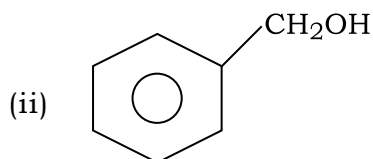
1. (a) Explain the theory of rotational spectra of rigid diatomic molecule. **4+3+3+4**
(b) Write the theory of simple harmonic oscillator.
(c) Explain the isotopic effect on rotational spectra of molecule.
(d) Discuss briefly the instrumentation of Raman spectroscopy with neat labelled diagram.

2. (a) Explain the factors affecting group frequencies and band shapes in IR spectra.
(b) Write the theory of IR spectroscopy and explain the different modes of vibrations in molecules. **5+4+5**
(c) Explain the applications for IR spectra in the analysis of coordination compounds.

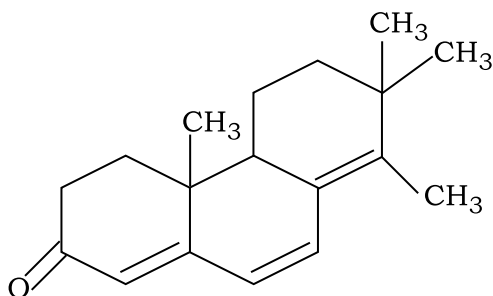
3. (a) Calculate the λ -max for the given molecule. **5+4+5**



- (b) Explain the basic theory of Mass Spectrometry.
(c) Give the fragmentation patterns of :
(i) 1-Chloro propane and



4. (a) Explain the theory of NMR spectroscopy. **5+4+5**
 (b) Explain briefly the instrumentation of NMR.
 (c) Explain the factors affect the chemical shift values in NMR.
5. (a) Write the basic principle of ESR spectroscopy and explain the factors affecting the g value. **5+4+5**
 (b) Explain the ESR spectra of 1,4-benzoquinone and naphthalene anion radical.
 (c) Explain the structures of :
 (i) $\text{Fe}_3(\text{CO})_{12}$
 (ii) Prussian blue and
 (iii) Tin halides using Mossbauer spectroscopy.
6. (a) Explain the instrumentation of FT-IR. **5+5+4**
 (b) Calculate the λ -max for the given molecule.



- (c) Differentiate the molecules using FT-IR spectroscopy :
 (i) Hexane
 (ii) Hexene and
 (iii) Hexyne
7. (a) Explain the formation of prominent peaks at m/e 72, 71, 57 and 43 in the mass spectra of 2-methylbutane. Indicate the ion responsible for the base peak. **5+4+5**
 (b) How will you distinguish 2-pentanone and 3-pentanone using mass spectrometry ?
 (c) How spin-spin interaction splits ^1H NMR Signals ? Explain.
8. (a) Explain the factors affecting Mössbauer spectra. **5+4+5**
 (b) Calculate the g value of methyl radical which shows ESR signal at 0.3290T (3290 G) in spectrometer at 9230 MHz.
 (c) Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.30 T. (3000G).

