MANIPAL INSTITUTE OF TECHNOLOGY
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VII SEMESTER B. TECH.(Chemical Engg.) END SEMESTER EXAMINATIONS

Nov/Dec 2023

ANALYTICAL TECHNIQUES AND INSTRUMENTATION (CHM 4053)

Date:05/12/2023 Time: 2.30 to 5.30 PM Max. Marks: 50

Note: Answer all five full questions. Draw a neat diagram and equations wherever necessary.

Q1A. Write any four differences between atomic and molecular spectroscopy and calculate the frequency, wave number and energy of the EMR radiation having wavelength of 50 μm. Given: h = 6.626×10^{-34} J s and velocity of light = 3×10^{8} m/s (5) CO1 BL4

Q1B. Write various types of electronic transitions involved in Aniline and Cyclohexene. Discuss their UV activity? (3) CO1 BL 2

Q1C. What is meant by electromagnetic spectrum? Describe the different regions of IR (2) BL1

Q2A. Discuss the Instrumentation involved in Raman technique write any four requirements of a spectrograph (5) CO2 BL 1

Q2B. Give reasons for the following: (3) CO2 BL2

i) Symmetric stretching vibration of CO_2 is IR inactive.
ii) Beer's law not applicable to the colloidal solution.
iii) ^{1}H-NMR spectrum of ethyl alcohol shows 3 peaks however ethane shows only one peak.

2C. Describe how the aliphatic and aromatic amines can be distinguished by using IR spectroscopy? (2) CO2 BL4

Q3A. Distinguish between rigid and non-rigid rotational spectra of a diatomic molecule. Calculate the energy in the first excited rotational level of the CO molecule having the internuclear distance of 0.113 nm. The atomic masses are $^{12}C = 1.99 \times 10^{-26}$ kg; $^{16}O = 2.66 \times 10^{-26}$ kg. (5) CO3 BL4.

Q3B. Identify the equivalent and non-equivalent protons in n-Propyl bromide and discuss the splitting pattern of it (3) CO3 BL5

Q3C. A sample was excited by the 435 nm line of mercury. A Raman line was observed at 444 nm. Calculate the Raman shift in cm^{-1} and anti-stoke line in nm (2) CO3 BL6

Q4A. Discuss the various types of chromatography based on the mobile and stationary phases. Write two similarities and two dissimilarities between GLC and HPLC (5M) CO4 BL2

Q4B. Describe the process of determining the retention factor (R_f) of a solute by TLC (3M) CO4 BL2

Q4C. Give reason. Helium is a better carrier gas in GLC when DTC detector is used (2M) CO4 BL4

Q5A. Write the basic principles of conductometric titrations and discuss the following conductometric titrations with a suitable chemical equation and a neat graph for each: (5M) CO5 BL1

i) Strong Acid versus weak base
ii) Mixture of strong acid and weak acid versus strong base

Q5B. Describe the various graphical methods used to determine the end point in the potentiometric titrations (3M) CO5 BL

Q5C. What are the advantages of conductometric titration over volumetric titration? (2M) CO5 BL3

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