INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – MAY 2021

IV SEMESTER - INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS (ICH-241)

Time: 3Hrs **Date: 21 May 2021** **Max. Marks: 50**

- ✓ **Answer ALL the questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. Describe how the change in position and intensity of absorption takes place in the UV-Visible spectroscopy with a suitable example for each. (4)

1B. With a neat diagram describe the instrumentation of Raman spectroscopy? (4)

1C. Calculate the energy in Joules and electron volts of photons of wavelength 400 nm. (2)

2A. Derive mathematical expression for fundamental, first overtone and second overtone frequencies using an harmonic oscillator model. (4)

2B. Differentiate between the following:

i) Atomic and molecular spectroscopy
ii) Dispersive and FTIR spectrometer
iii) Instrumental and wet methods of analysis
iv) Rotational and Vibrational spectroscopy (4)

2C. Calculate the Raman shift in cm^{-1} and the wavelength in which anti-Stokes line will appear, if a sample was excited by the 420 nm line of mercury and a Raman line was observed at 450 nm. (2)

3A. Deduce Lambert's law. List any four chemical deviations of Beer's law. (4)

3B. Define the following terms and write their significance.
i).Coupled vibrations ii) Raman shift iii) Bathochromic shift iv) EM spectrum (4)

3C. Give reason for the following:

i) Spherical top molecules are microwave inactive.
ii) Glass sample holders can't be used in the UV-spectrophotometers. (2)

4A. With a Schematic diagram explain the working of GLC. What are the characteristics of the ideal detector for GLC? (4)

4B. Briefly explain i) Column packing in HPLC ii) Advantages of HPLC over other chromatographic techniques. (4)

4C. What are differences between the TGA and DTA. (2)

5A. Describe the experimental procedure of thin layer chromatography. Give any application of TLC. (4)

5B. The following data were obtained by gas-liquid chromatography on a.30-cm packed column:

Compound	t_R, min	$W_{1/2}$,min
Air	1.9	-
Methylcyclohexane	10.1	0.74
Methylcyclohexene	10.9	0.83
Xylene	13.4	1.06

Calculate a) an average number of plates from the data.
b) an average plate height for the column. (4)

5C. Draw and explain the thermograms of mixture calcium oxalate monohydrate. (2)

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