Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: ANALYTICAL TECHNIQUES AND INSTRUMENTATION

[CHM 4001]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Draw diagrams and write equations wherever necessary.

1A. What are the two different modes of HPLC? Name the type of mobile and stationary phases used in it.

1B. Explain with a suitable example the precipitation titrations by potentiometric method. The resistance of a 0.02 N solution of an electrolyte was found to be 200 ohm at 25 °C. Calculate the equivalent conductance of the solution at 25 °C if the cell constant is 80 m^{-1}.

1C. Distinguish between adsorption and partition chromatography techniques. Discuss the two types packing techniques of column chromatography. Mention any two disadvantages of the same over TLC.

[2+4+4]

2A. A chromatographic column with L=10.3 cm and the linear flow rate= 17.4 cm min^{-1}. (a) How long does it take for solvent to pass through the column? (b) Find the retention time for a solute with a capacity factor of 10.

2B. Discuss rate theory of chromatography. Explain the different factors that affecting column efficiency.

2C. Describe with one example each the working of detectors used in GLC and HPLC.

[2+4+4]

3A. Give reasons for the following;

i) N_2 molecule is microwave inactive but Raman active.

ii) UV spectrum is generally observed as a broad band.

3B. Explain briefly about the principle involved in various detectors used in IR spectrophotometer

3C. i) Derive the Larmor equation used in NMR spectroscopy. Write its significance.

ii) How many peaks would you get for the hydrogens in the molecule, CH_2ClCH_2Cl and how would they be split?

[2+4+4]

4A. The rotational constant of ICl is 0.1142 cm-1. Calculate the ICl bond length. (At. Wt. of Cl= 34.9688 *mu*, I = 126.905 *mu*)

4B. Explain with suitable example how the geometrical isomerism and conjugation influence the UV absorptions?

4C. Distinguish between the following;

i) Stokes and Antistokes lines

ii) IR and Raman spectroscopy

[2+4+4]

5A. The fundamental vibrational transition ($v = 0 \rightarrow v = 1$) for CO is observed at 2170.2 cm–1. Treat CO as a harmonic oscillator, and determine the harmonic force constant *k* in g/s^2.

5B. i) Explain any two factors that cause bathochromic shift of absorptions in UV-Visible spectroscopy.

ii) Explain the shielding and deshielding phenomenon of protons with illustrative examples.

5C. Discuss the applications of IR spectroscopy in the analysis of organic compounds.

[2+4+4]

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