Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2022-2023

Course Handout (Part - II)

Date:09.01.2024

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: CHEM F329**
Course Title **Analytical Chemistry**
Instructor-in-charge **: N. RAJESH**

1. **Course Description:** Data handling, sample preparation, unit operations, volumetric analysis, potentiometry, chromatography, solvent extraction, trace metal separation and estimation in biological and environmental samples with emphasis on green chemistry.

2. **Scope & Objective of the Course:** The objective of this course is to provide a comprehensive survey of the basic concepts in analytical chemistry. The topics to be covered include a brief review of classical methods of analysis, data handling, instrumental methods of analysis and their applications. Separation methods in environmental analytical chemistry such as solvent extraction and chromatography will also be dealt with in detail. The course involves considerable classroom participation in the form of analyzing case studies, group discussions etc. Considerable emphasis would be given to **greener methodologies for the detoxification of toxic metal ions, dyes, PCB's etc from industrial effluents. Lab component involving the above methods would form a part of the evaluation scheme.**

Text Book: T1. Analytical Chemistry, GARY. D. CHRISTIAN, 6th ed. Wiley, 2003.

Reference Book: R1. Fundamentals of analytical chemistry, Skoog, West Holler, 7th Ed, Harcourt Pub, 2001.

3. Course Plan:

Lec. No.	Topics to be Covered	Learning outcome	Learning Objectives	Chapter in the Text Book
3	Data handling, sampling in analysis	Relevance of statistics in handling data	Reliability of data, statistical test, sampling of solids, liquids and gases.	Chap. 1,2 (T1)
2	Complexometric titration's and redox titrations	Importance of classical methods in environmental appln	EDTA method to estimate total hardness in water , Redox titrations	Chap. 8 (T1)
3	Chromatography basic concepts	Separation principles	Principal of all types of chromatography and their utility in analysis	Chap. 17 (T1)
4	Ion exchange and adsorption	Relevance in separation science and technology	Cation exchange and anion exchange separations emphasizing green chemistry	Chap. 17 (T1)
3	GC and HPLC	Sophisticated instrumental	Principles and application of GC and	Chap. 17 (T1)

		separation in industry	HPLC.	
3	Solvent Extraction	Importance in hydrometallurgy and nuclear industry	Extraction of metal chelates, ion-association complexes, applications emphasizing green chemistry	Chap. 16 (T1)
3	UV-visible and IR spectroscopy	Understand spectrophotometric principles in trace analysis	Beer's Law, Photometric estimation, selection rules in IR, interpretation of IR spectra	Chap. 14 (T1)
2	Atomic absorption spectroscopy	Importance in ppm and ppb analysis in diverse applications	Flame AAS, graphite furnace AAS, applications	Chap. 15 (T1)
2	Automation in analysis	Sophisticated automations in industry and its relevance today	Process control automation on line analyzers, computers in analytical chemistry	Chap. 19 (T1)
4	Potentiometry	Importance of electroanalytical techniques in trace analysis	Redox titrations, pHmetry, ion-selective electrodes and applications	Chap.11,12 (T1)
2	Polarography	Importance of electroanalytical techniques in trace analysis	DC polarography and its utility in chemical analysis	Chap. 21 (T1) (R1)
4	Trace metal estimations	Utility of distinct methods for trace metal analysis	Selected methods for analysis of toxic metal ions	P. 681-753 (T1)
4	Environmental analysis	Speciation and sub ppb level analysis of toxic contaminants	Analysis of air, water, pesticides and other trace metals in environment	Lecture notes
1	Radioanalytical methods	Relevance of analytical techniques in nuclear chemistry	Radiochemistry, gamma spectrometry beta counters isotope dilution analysis	Lecture notes

List of proposed Experiments (some of them may extend to two lab classes)

I cycle

1. **Calibration of burette, pipette and volumetric flask (varying capacities) with statistical interpretation and calculating density of a unknown compound (liquid)**
2. **TDS, pH, conductivity hardness, COD and Hardness determination of varying water samples**
3. **Determination of calcium content in Egg shell (volumetric/gravimetric)**
4. **Analysis of copper in a wire or alloy sample**
5. **Separation of mixture of metal ions by column chromatography**

II Cycle

1. **Analysis of Iron in tap water / paracetamol in tablet**
2. **Potentiometric titration for phosphate in coke sample**
3. **Analysis of fluoride in tooth paste sample (Ion selective electrode)**
4. **Separation of anion/cations using ion chromatography (instrumentation)**
5. **Separation of benzene and toluene by GLC**
6. **Analysis of lead by solvent extraction**

4. Evaluation scheme

S No.	Component	Duration	Weightage (%)	Date and Time	Nature of component
1	Mid semester test	90 min.	35	11/03 - 9.30 - 11.00AM	Closed book
2	Lab experiments		15	Continuous	Open
*3	Assignments/Quiz		10	Take home	Open
4.	Comprehensive. Exam.	3 hr	40	06/05 FN	Closed book

***Home assignment topics would be given and each student is expected to submit a report on the assigned topic which will be evaluated.**

5. **Make-up Policy:** Make-up will be granted for only very genuine and deserving cases.
6. **Chamber Consultation hours:** To be announced in the class.
7. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.
8. **Notices:** Relevant notices regarding the course will be displayed on Chemistry Notice Board/CMS.

Instructor-In charge
N. RAJESH