

Name of Faculty	:	Faculty of Science
Name of Program	:	Master of Science
Course Code	:	2MSO04
Course Title	:	Analytical Chemistry
Type of Course	:	Basic Science
Year of Introduction	:	2023-24

Prerequisite	:	Knowledge
Course Objective	:	Analytical chemistry spans nearly all areas of chemistry but involves the development of tools and methods to measure physical properties of substances and apply those techniques to the identification of their presence (qualitative analysis) and quantify the amount present (quantitative analysis) of species in a wide variety of settings.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand extraction techniques.
	CO2	Remember principle, instrumentation and advantages of Gas and Liquid Chromatography.
	CO3	Analyze basics of spectrophotometry.
	CO4	Use of spectrophotometer.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
SEE	CIA	SEE	CIA					
4	0	0	4	70	30	-	-	100

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P- Practical, C - Credit, SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping With COs
1	Sample Preparation Techniques: Liquid-liquid extraction/solvent extraction-partition coefficient, distribution ratio and percent extraction. Solvent extraction of metal ions-ion association complexes and metal chelates, multiple batch extraction, Craig's counter-current	15	25%	CO1

	distribution. Accelerated and Microwave assisted extraction, protein precipitation and solid phase extraction (SPE). Hybrid SPE and solid phase micro extraction (SPME).			
2	<p>Modern separation techniques:</p> <p>A) Gas Chromatography: Principle including concept of theoretical plates and van-Deemter equation. Instrumental set up- carrier gas, sampling system, column and detector. Types of columns, their advantages and limitations. Detectors in GC analysis. Temperature programmed GC. Factors affecting retention, peak resolution and peak broadening.</p> <p>B) Liquid chromatography: Principle, Instrumentation, Advantages and applications of HPLC. Types of columns and detectors. Principle and applications of size exclusion, gel permeation, ion retardation, normal phase and reverse phase chromatography.</p>	15	25%	CO2
3	<p>Fundamentals of Spectrophotometry: Properties of light, absorption of light, interaction of light with matter and origin of spectra. The spectrophotometer- calibration, sources of light, monochromators and detectors. Beer's law in chemical analysis, photometric accuracy- Ringbom Plot, derivative spectrophotometry, optical rotatory dispersion and circular dichroism.</p>	15	25%	CO3 CO4
4	<p>Applications of Spectrophotometry: Analysis of mixture-resolved and unresolved spectra, measurement of equilibrium constant: Scatchard Plot; Stoichiometry-method of continuous variation- the Jobs plot. Photometric titrations. Application for quantitative measurement of spectrophotometry.</p>	15	25%	CO3 CO4

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	25	25	25	25	-	-

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Learning Websites

Sr. No.	Name of Website
1	https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Physical_Methods_in_Chemistry_and_Nano_Science_(Barron)/03%3A_Principles_of_Gas_Chromatography/3.01%3A_A_Principles_of_Gas_Chromatography
2	https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Instrumentation_and_Analysis/Chromatography/Liquid_Chromatography

Reference Books

Sr. No.	Name of Reference Books
1	Quantitative Chemical Analysis, by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
2	Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
3	An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
4	Analytical Chemistry, by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
5	Principles of Instrumental Analysis, by Douglas A. Skoog, 3rd Edition, HoltSaunders International Edition.
6	Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, 2002.
7	Instrumental Methods of Chemical Analysis, by Galen W. Ewing, 4th Edition, International Student Edition.