

Name of Faculty	:	Faculty of Science
Name of Program	:	Bachelor of Science
Course Code	:	2BSB05
Course Title	:	Instrumentation and Analytical Techniques
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	Having basic knowledge about chemistry, biology and laboratory skills.
Course Objective	:	It is designed to equip students with a strong foundation in instrumentation and analytical techniques, enabling them to conduct accurate chemical measurements, interpret data, and apply their skills in diverse scientific and industrial contexts.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand the fundamental principles of measurement, instrumentation, their role in chemistry.
	CO2	Evaluate measurement precision, accuracy and sources of errors in chemical analysis.
	CO3	Remember the working principles of UV- Visible, IR, NMR and Mass Spectroscopy techniques.
	CO4	Apply chromatography to separate and quantify components within complex mixtures.
	CO5	Analyze electrochemical data to extract meaningful information about analytes.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	SEE	CIA	SEE	CIA	
2	0	0	2	50	25	00	00	75

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 WithCOs
1	Introduction to Analytical Techniques Importance of analytical techniques in chemistry Qualitative vs. quantitative analysis Basic principles of measurement and instrumentation Precision, accuracy, and error analysis in chemical measurements	07	23.33%	CO1 CO2
2	Spectroscopic Techniques UV-Visible Spectroscopy: Principles and applications Infrared Spectroscopy (IR): Functional group identification Nuclear Magnetic Resonance (NMR): Proton and carbon NMR spectroscopy Mass Spectrometry: Molecular weight determination and fragmentation patterns	08	26.66%	CO3
3	Chromatographic Techniques Gas Chromatography (GC): Principle, instrumentation, and applications High-Performance Liquid Chromatography (HPLC): Types, columns, and applications Thin-Layer Chromatography (TLC): Procedure and sample separation Chromatography data analysis and interpretation	08	26.66%	CO4
4	Electrochemical and Thermal Techniques Potentiometry and Ion-Selective Electrodes (ISE) Polarography and Voltammetry techniques Thermogravimetric Analysis (TGA): Applications in material characterization Differential Scanning Calorimetry (DSC): Thermal behavior and phase transitions	07	23.33%	CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	20	20	20	20	20	-

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://nptel.ac.in/courses/104101135
2	https://nptel.ac.in/courses/104104066
3	https://nptel.ac.in/courses/104105084

Reference Books

Sr. No.	Name of Reference Books
1	Principles of Instrumental Analysis, by Douglas A. Skoog, F. James Holler, and Stanley R. Crouch
2	Analytical Chemistry, by Gary D. Christian
3	Quantitative Chemical Analysis, by Daniel C. Harris
4	Introduction to Spectroscopy, by Donald L. Pavia, Gary M. Lampman, and George S. Kriz
5	Spectrometric Identification of Organic Compounds" by Robert M. Silverstein, Francis X. Webster, and David J. Kiemle
6	Mass Spectrometry: Principles and Applications" by Edmond de Hoffmann and Vincent Stroobant
7	Chromatography: Concepts and Contrasts" by James M. Miller and Jane C. Miller
8	HPLC for Pharmaceutical Scientists, by Yuri V. Kazakevich and Rosario LoBrutto
9	Gas Chromatography, by Colin F. Poole and S.E. Hsu.
10	Electroanalytical Chemistry: A Series of Advances" edited by Allen J. Bard
11	Modern Electrochemistry 1: Ionics, by John O'M. Bockris, Amulya K.N. Reddy, and Maria E. Gamboa-Aldeco
12	Thermal Analysis: Fundamentals and Applications to Material Characterization" by Michael E. Brown and Alain Galerie