



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3723021

Semester – II

Subject Name: Advanced Analytical Techniques

Type of course: Elective

Prerequisite: Basic Concepts of physical, inorganic and organic chemistry.

Rationale: This course is intended to familiarize students with various traditional and modern physicochemical methods of analysis and the development of the students ability to the interpretation of the results obtained by various techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	2	0	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Theory of errors: Sources and classification of errors. Statistical treatment of analytical data & presentation of result. Sampling of solids, liquids and gases. Evaluation and validation of analytical methods. Good laboratory practices.	
2	Chromatographic methods: Introduction & classification of chromatography. Theory, instrumentation & applications of the following chromatographic techniques: (i) Column chromatography (ii) TLC (iii) Paper chromatography (iv) GC (v) HPLC	
3	UV-Visible Spectroscopy: Introduction, Theory of UV-Visible Spectroscopy & colourimetry, Beer Lambert law, Deviation from Beer Lambert law. Infrared Spectroscopy: Introduction, Infrared radiation & its interaction with organic molecules, vibrational mode of bonds, instrumentation & applications, interpretation of IR spectra. Mass spectrometry: Basic principles & brief outline of instrumentation. Ion formation, molecular ion, meta stable ion, fragmentation process in relation to molecular structure & functional groups.	
4	Potentiometry, ion selective electrodes. Voltammetric methods, Conductometry and conductometric titration, Coulometric methods applied to industrial analysis and air pollution observation.	
5	Thermogravimetric analysis, differential scanning calorimetry: principles and applications.	



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6	X-ray Diffraction studies Principles and applications, Various Microscopic analysis such as SEM, TEM and AFM. Working principles, applications and sample preparations.	
7	Errors and Treatment of statistical data True value, Precision, accuracy, error, mean and median, spread, deviation, standard deviation, coefficient of variation, variance, significant figures, types of errors, statistical treatment of random errors ,evaluation of experimental results, comparison of results	

Reference Books:

1. Chemical Analysis, Modern Instrumentation Methods and Techniques, F. Rouessac, A. Rouessac, Jon Wiley & Sons Ltd, 2007.
2. Analytical Chemistry, Theoretical and Metrological Fundamentals, K. Danser, Springer, 2007.
3. Instrumental Methods of Analysis, B. K. Sharma, Goel Publishing house.
4. Elementary Organic Spectroscopy, Y.R. Sharma, S.Chand & company Ltd. New Delhi 2008
5. Spectroscopic identification of organic compounds, R.M. Silverstein, F.X. Webster, D.J. Kiemle, John Wiley & Sons Ltd, 2005

Course Outcomes: At the end of the course, the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize fundamentals as well as recent developments in instrumental methods of analysis	20
CO-2	Understand the working of instruments as well as for the development of new technologies	35
CO-3	Select the best method of sample preparation required for a particular analytical technique.	20
CO-4	Spectroscopy and microscopy to identify molecular structures from their spectra and microgram	25

List of Open Source Software/learning website:

Preparation of power-point slides, which include videos, animations, Pictures, graphics for better understanding theory – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Advanced analytical techniques is covered.