

GUJARAT TECHNOLOGICAL UNIVERSITY

Analytical Techniques

SUBJECT CODE: 2133502

B.E.Semester: III (Environmental Science and Technology)

Type of course: Environmental Science and Technology

Prerequisite: Needs basic knowledge of Chemistry

Rationale: The main objective of this subject is to provide a strong basis of Analytical chemistry that will be applicable to other areas of the degree course such as chemical reaction engineering. It also helps for assurance of quality, safety and efficacy of drugs, pharmaceuticals and of any compound.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks	
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
PA	ALA	ESE		OEP						
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
1.	Fundamentals of Analytical Chemistry: Concept of quality: Definition of quality, Quality control & assurance, TQM. Correlation between quality & analysis, steps & types of chemical analysis, Stoichiometry & expression of concentration.	04	10
2.	Theory of errors: Sources & classification of errors. Statistical treatment of analytical data & presentation of result. Sampling of solids, liquids & gases. Evaluation & validation of analytical methods. Good laboratory practices.	04	10
3.	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	15	30
4.	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. Nuclear magnetic resonance spectroscopy: Introduction,	15	25

	Theory & Instrumentation, chemical shift concept, spin spin coupling ,isotopic nuclei, reference standards & solvents, applications. Mass spectrometry: Basic principles & brief outline of instrumentation. Ion formation, molecular ion, meta stable ion, fragmentation process in relation to molecular structure & functional groups.		
5.	Volumetric analysis: Acid base titrations: Indicators; Oxidation-reduction titrations; Complexation using ligands, complexometric titration with EDTA, metal ion indicators; simple calculations; analysis of Na ₂ CO ₃ , Fe ₂ O ₃ , Brass, Solder etc.	08	10
6.	Quantitative analysis. Precipitation, types of precipitates, impurities, co precipitation, post-precipitation, conditions for precipitation, precipitation from homogeneous solution. Gravimetric determination of Fe, Ni & Cu, calculations. TGA	05	15

Reference Books:

1. Instrumental Methods of Chemical Analysis, E. W. Ewing, McGraw Hill, New York. 4th Ed, 1975
2. Instrumental Methods of Analysis, B. K. Sharma, Goel Publishing house.
3. Elementary Organic Spectroscopy, Y.R. Sharma, S.Chand & company Ltd. New Delhi 2008

Course Outcome: After learning the course the students should be able:

1. To express fundamentals of Analytical Techniques.
2. To understand the working of instruments as well as for the development of new technologies.
3. It provides assurance of quality, safety and efficacy of drugs , pharmaceuticals and of any Compound.

List of Experiments and Open Ended Projects:

PRACTICALS (ANYFIVE):

1.	Separation using Paper Chromatography
2.	Separation using Thin Layer Chromatography
3	Volumetric Estimation of alloys
4.	To find out concentration of unknown solution using Colourimeter
5.	Separation using Column Chromatography
6.	Working and principle of UV Spectrophotometer
7.	Complexometric Titration by EDTA
8.	Gravimetric Estimation
9.	Potentiometric Titration of between BaCl ₂ and K ₂ CrO ₄
10.	Turbidity meter

Major Equipment:

1. UV Spectrophotometer
2. TDS meter
3. Colorimeter
4. Turbidity meter
5. Polari meter

Open Ended Project fields:-

Some suggested projects are listed below:

1. To prepare calibration curve for unknown sample at different wavelength using UV Spectrophotometer
2. To prepare calibration curve for unknown sample at different wavelength colourimeter
3. Check the purity of unknown sample using Thin Layer Chromatography
4. Develop different solvent systems for Column Chromatography
5. Different parameters affecting R_f value in PC and TLC

***PA(M):** 10 marks for Active Learning Assignments (ALA), 20 marks for other methods of PA

ACTIVE LEARNING ASSIGNMENTS:

Preparation of power-point slides, which include videos, animations, Pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus is covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three Works should be sent to achievements@gtu.edu.in.