GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)
ANALYTICAL TECHNIQUES
SUBJECT CODE: 2163610
B.E. 6th SEMESTER

Type of course: Chemical 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	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% 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**:	15	25

	Introduction, 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 Na2CO3,Fe2O3 , 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

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
60	**13**	**9**	**9**	**9**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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:

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

List of Experiments:

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 BaCl2 and K2CrO4
10. Turbidity meter

Design based Problems (DP)/Open Ended Problem:

Students are free to select any area of science and technology based on chemical technology applications to define Projects.

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 Rf value in PC and TLC

Major Equipment:

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

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 to be 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 submit to GTU.