GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL ENGINEERING (13)
ADVANCED ENVIRONMENTAL INSTRUMENTATION
SUBJECT CODE: 2151302
B.E. 5th SEMESTER

Type of course: Basic Science

Prerequisite: Knowledge of subjects Environmental Sciences I and II

Rationale: To learn the advanced analytical techniques for analysis of water, wastewater and air samples

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	4	7	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction to instrumental method of analysis	**2**	**5**
2	Spectroscopic Methods of Analysis: Electromagnetic spectrum Applications of Beer- Lambert law Visual Colourimetry UV-Visible spectrophotometry Infrared Spectroscopy Raman Spectroscopy Atomic Absorption Spectroscopy Flame Emission Spectroscopy Mass Spectroscopy	**10**	**24**
3	Turbidimetry and nephalometry Visual method and instrumental method of turbidity measurement	**4**	**10**
4	Chromatography: Classification of chromatographic methods Column Chromatography Liquid Chromatography Adsorption Column Chromatography Ion exchange Chromatography Gas Chromatography High Performance Liquid Chromatography Ion Chromatograph	**10**	**24**

5	Miscellaneous Methods Conductometry Potentiometry Ion selective electrodes Dissolved oxygen sensors TOC analyser On line sensors	**10**	**24**
6	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	**6**	**12**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**15**	**15**	**10**	-

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

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

Reference Books:

1. Standard methods for the examination of water and wastewater; published by American public Health Association, American water works Association, Water pollution control federation (21st Edition & later).
2. Chemistry for Environmental Engineering by Sawyer and M C Carty (4th Edition- McGraw-Hill Publishing Company Ltd.)

Course Outcome:

After learning the course the students should be able to do:

1. Use the instrumental method of analysis.
2. Demonstrate the ability to operate sophisticated state of art analytical instrument to quantify micro level contaminants
3. Exhibit the capability to operate and calibrate analytical instruments like TOC analyzer and Ion selective meter.
4. Carry out statistical analysis of the data.

List of Experiments:

1. Determination of turbidity from water sample using Nephelo turbidity meter.
2. Determination of flouride concentration in drinking water using spectrophotometer.
3. Colorimetric analysis for copper using UV-Vis spectrophotometer.
4. Preparation of calibration curve of chromium using UV- Vis spectrophotometer.
5. Determination of metals (chromium/nickel/copper/arsenic) using Atomic Absorption Spectrophotometer.
6. Determination of cations and anions using Ion-Chromatograph
7. Determination of TOC from wastewater using TOC analyzer

Design based Problems (DP)/Open Ended Problem:

(based on working principle & application in Env. Engg.)

1. Flame photometer
2. Gas Chromatograph
3. High Performance Liquid Chromatograph

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.