GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151712
Semester – V
Subject Name: Environment Instrumentation

Type of course: Open Elective

Prerequisite: Fundamental knowledge of sensors & transducers

Rationale: Climate change is a big issue in today's scenario. Change in climate affecting not only the farmers but also affecting the living species on the earth. This subject will help to know the threats to environment, measurement of the parameters affecting the environment and control techniques by which such parameters are maintained at specified limit.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1.	**Introduction:** Necessity of Instrumentation & Control for environment, sensor requirement for environment.	4
2.	**Quality of water:** Standards of raw & treated water, sources of water & their natural quality, effects of water quality. Water quality parameters. Water treatment: Requirement of water treatment facilities, process design. **Waste water monitoring:** Automatic waste water sampling, optimum waste water sampling locations, and waste water measurement techniques. Instrumentation set up for waste water treatment plant. Latest methods of waste water treatment plants.	8
3.	**Sedimentation & flotation:** General equation for settling or rising of discrete particles, hindered settling, effect of temperature, viscosity, efficiency of an ideal settling basin , reduction in efficiency due to various causes, sludge, storage & removal, design criteria of settling tank, effect of temperature on coagulation.	4
4.	**Air pollution:** definitions, energy environment relationship, importance of air pollution, air pollution from thermal power plant, their characteristics & control. Air sampling methods & equipments, analytical methods for air pollution studies. Control of air pollution. Flue gas analysis for pollution control – Measurement of CO, carbon di-oxide, NOX and SOX, dust and smoke measurement.	4
5.	**Air monitoring:** measurement of ambient air quality. Flow monitoring: Air flow	4

	measurement, gas flow, non-open channel flow measurement, open channel waste water flow measurement. Rain water harvesting: necessity, methods, rate of NGOs municipal corporation, Govt., limitations. Quality assurance of storage water.	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	**14**	**21**	**21**	**7**	

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. Environmental Instrumentation & Analysis Handbook by Randy D. Down and Jay H. Lehr, John-Wiley & Sons, ISBN 0-471-46354-X
2. Principles of Instrumental Analysis by Skoog, Holler, Nieman, Thomson books-cole publications, Sixth ed., 2006.
3. Introduction to Instrumental Analysis by Braun, Robert D., Pharma Book Syndicate, Hyderabad. 2006
4. Analytical Instrumentation by Sherman, R.E. and Rhodes L.J., ISA Press, New York, 1996.
5. Process Measurement and Analysis by Liptak B.G, 3rd Edition, Chilton Book Company, Pennsylvania, 1995.
6. Process / Industrial Instruments and Controls Handbook by Considine D.M, 4th Edition, McGraw Hill, Singapore, 1993.
7. Air pollution engineering – M. N. Rao & H. V. N. Rao
8. Air pollution control technology – Wark & Warner

Text Book:

1. Instrumental Methods of Analysis by Willard, Merritt, Dean and Settle, 7th Edition, CBS Publishers and Distributors, India,1988.
2. Instrumental Methods of Analysis by Ewing G.W, 5th Edition, McGraw Hill, Singapore, 1992.
3. Mechanical and Industrial Measurements by Jain R. K, Khanna Publishers, Nai Sarak, Delhi, 1985.

Course Outcome: After learning the course the students will be able to

Sr. No.	CO statement	Marks % weightage

CO-1	able to understand the fundamental characteristics, terminologies, sensing and transduction principles of various types of sensors and transducers used for environment monitoring	20
CO-2	able to justify the use of an analytical instrument in monitoring and maintaining the quality of water and air for solving real world environmental problem.	20
CO-3	able to summarize and classify capabilities and limitations of analytical instruments	20
CO-4	able to prepare a report on various cases of environmental parameters monitoring and control	20
CO-5	able to work as an individual and as a team-member to design and implement analytical instrument using embedded systems.	20

List of Experiments:
1. To find out transmittance and absorbance of a given sample using colorimeter
2. Qualitative and quantitative analysis using UV-Visible spectrophotometer
3. To analyze a given water sample using turbidity meter
4. To detect hydrocarbon contents from a gas sample
5. Test and calibrate the pH electrode and pH meter.
6. To calibrate the conductivity meter and measure the conductivity of given sample.
7. Study of Gas Chromatograph
8. Study of HPLC system
9. Study of measurement for air polluting parameters like SO_2, NO_x, etc.
10. Prepare a report on weather stations
11. Prepare a visit report on water/waste water/ effluent treatment plant.
12. To design low cost analytical instrument.

At least one industrial visit is preferable to any water/ waste water/ effluent treatment plant.

Design based Problems (DP)/Open Ended Problem: **Nil**

Major Equipment:

Analytical instruments, Ambient condition monitoring system, etc.

List of Open Source Software/learning website:
http://www.nptel.ac.in/courses/105102089/9
http://nptel.ac.in/video.php