



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Environmental Engineering

Subject Code : DI04013061

Subject Name : Environmental Monitoring

<b>w. e. f. Academic Year:</b>	2025-26
<b>Semester:</b>	4 <sup>th</sup>
<b>Category of the Course:</b>	Professional Elective - II

<b>Prerequisite:</b>	Environmental Chemistry
<b>Rationale:</b>	Environmental monitoring forms the backbone of environmental management, policy-making, and sustainable development. This course equips diploma students of environmental engineering with the theoretical knowledge and practical skills to assess air, water, and soil quality, as well as to operate monitoring instruments, collect reliable data, and interpret results in accordance with environmental standards.

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain the objectives, functions, and types of environmental monitoring and the selection of monitoring sites.	R,U,A
02	Evaluate water quality by performing sampling and laboratory analysis of key parameters.	R,U,A
03	Interpret air quality data obtained from monitoring gases and particulates in relation to standards and indices.	R,U,A
04	Assess soil quality through analysis of physical, chemical, and biological parameters.	R,U,A

*\*Revised Bloom's Taxonomy (RBT)*

## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA(M)	PA (I)	ESE(V)	
3	0	2	4	70	30	20	30	150



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1. Introduction to Environmental Monitoring and Fundamentals of Monitoring Techniques	1.1 Objectives and functions of monitoring. 1.2 Selection of monitoring sites. 1.3 Types of monitoring programme. 1.4 Environmental Variability. 1.5 Place and time and location of monitoring. 1.6 Different types of monitoring: continuous, intermittent, passive, and active 1.7 Sampling techniques and protocols 1.8 Measurement instruments and equipment, Calibration, maintenance, and operation of monitoring devices 1.9 Data collection and recording, qualitative and quantitative	8	15
2. Water Quality Monitoring	2.1 Parameters and pollutants affecting water quality 2.2 Sampling methods for various water sources 2.3 Laboratory analysis, 2.4 Common laboratory tests for water quality assessment: titration, colorimetry, spectrophotometry, Interpreting laboratory results and assessing compliance with water quality standards 2.5 Biological monitoring methods and their significance, Bioindicators and their use in determining water quality 2.6 Introduction to emerging contaminants (e.g., pharmaceuticals, microplastics) and their impact on water quality, advanced monitoring techniques (e.g., mass spectrometry, high-performance liquid chromatography) for detecting and analyzing emerging contaminants	14	30
3. Air Quality Monitoring	3.1 Parameters and pollutants related to air quality 3.2 Sampling methods for gases and particulate matter 3.3 Data analysis and interpretation for air quality assessment, Interpretation of air quality data in relation to air quality standards and guidelines, Use of air quality indices to communicate air pollution levels 3.4 Analyzing temporal and spatial variations in air quality data 3.5 Indoor Air Quality Monitoring, Parameters affecting	11	25



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	IAQ: volatile organic compounds (VOCs), radon, mold, and allergens 3.6 Monitoring techniques and strategies for assessing IAQ		
4. Soil Quality Monitoring	4.1 Understanding key parameters affecting soil quality: soil pH, organic matter, nutrients (nitrogen, phosphorus, potassium), heavy metals, salinity, and texture 4.2 Sample collection, handling, preservation, and preparation for analysis 4.3 Techniques for determining heavy metal concentrations in soil 4.4 Soil Erosion and Conservation Monitoring 4.5 Soil Microbial and Biological Assessment 4.6 Soil Remediation and Restoration Techniques 4.7 Soil Quality Monitoring for Sustainable Agriculture	12	30
	<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
35	45	20	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Environmental Monitoring Handbook	Frank R. Burden Ulrich Foerstner Ian D. McKelvie Alex Guenther	The McGraw-Hill Companies, Inc 2002; ISBN: 9780071351768
2	Environmental Monitoring	Shyam Kishor Agarwal	APH Publishing, 2005, ISBN:9788176488242



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S. No.	Title of Book	Author	Publication with place, year and ISBN
3	Environmental Monitoring: Approaches and Perspectives	Dr. Vimala Singh, Dr. Deepika Saini	Immortal Publications, ISBN-13 : 978-93-5493-662-3
4	Environmental Monitoring and Analysis (2 Vols.)	P.K. Behera and S.K. Sahu	Dominant Publishers And Distributors (1 January 1993), ISBN-13 : 978-8178885285
5	Indian standard methods for analysis of water, air and soil parameters	BIS	BIS

**(b) Open source software and website:**

- www.gpcb.gov.in
- <https://cpcb.nic.in/about-namp/www.neeri.res.in>
- www.Nptel.ac.in
- <https://www.indiacode.nic.in/>

**Suggested Course Practical List:**

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Solve given problems based on objectives and functions of monitoring, selection of monitoring sites, types of monitoring programme.	I	02
2	Collect water samples from a local river, lake, or pond. Perform on-site measurements for parameters such as pH, dissolved oxygen, turbidity, and temperature. Determine metallic constituents, Chromium, Fe, Copper by spectrophotometer.	II	04
3	Conduct laboratory analysis for nutrients (nitrate, phosphate) and heavy metals for ground water sample.	II	04
4	Use handheld air quality meters to measure concentrations of particulate matter (PM <sub>2.5</sub> , PM <sub>10</sub> ), nitrogen dioxide (NO <sub>2</sub> ), sulfur dioxide (SO <sub>2</sub> ), and carbon monoxide (CO) at different locations on campus or in the city. Analyze and interpret the collected data, comparing it with air quality standards.	III	04
5	Assess indoor air quality in different buildings on campus.	III	04



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S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Measure parameters such as CO <sub>2</sub> levels, VOCs, and humidity. Discuss the potential sources of indoor air pollution and suggest improvements.		
6	Solve given problems based on ambient air quality and stack monitoring. Solve given problems based on frequency and time of sampling. Solve given problems based on sampling locations. Determine NO <sub>x</sub> , SO <sub>x</sub> , CO and SPM using appropriate test methods	III	04
7	Collect soil samples from different locations on campus or nearby areas. Measure soil pH, organic matter content, and nutrient levels using basic field test kits. Discuss the significance of the results for soil quality.	IV	04
8	Field/Industry Visit (Water treatment plant / Air monitoring station / Soil testing lab/Landfill site)	All	04
			<b>Total:30</b>

## List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	<ul style="list-style-type: none"><li>Analytical Balance</li><li>High volume air sampler</li><li>Filter media</li><li>UV Spectrophotometer</li><li>Flame photometer</li><li>Distillation Assembly</li><li>Chemical testing glasswares</li><li>Hot air oven</li></ul>	1 to 14

## Suggested Project List:

- Design a small-scale air quality monitoring project in a local urban area. Measure and analyze pollutants such as PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, and SO<sub>2</sub> using portable air quality sensors.
- Conduct water quality assessments on a nearby river or lake. Collect water samples, analyze parameters like pH, dissolved oxygen, and assess the overall water quality.
- Assess soil health of college campus. Measure soil parameters such as pH, organic matter, and nutrient levels to provide recommendations for sustainable gardening practices.



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- d) Measure noise levels in and around your educational institution during different times of the day. Analyze the data to understand potential noise pollution and propose mitigation strategies.
- e) Assess indoor air quality in residential buildings by measuring parameters like CO<sub>2</sub> levels, VOCs, and humidity. Provide recommendations for improving indoor air quality.
- f) Measure and analyze greenhouse gas emissions in a local park. Use portable gas analyzers to assess CO<sub>2</sub>, methane, and other relevant gases.
- g) Assess groundwater quality of your college/city. Conduct sampling and analyze parameters like pH, nitrate, and heavy metals to understand the suitability for drinking water.
- h) Conduct a biodiversity assessment in local urban green spaces. Identify and document plant and animal species, and assess the impact of human activities on biodiversity.
- i) Measure light pollution levels in residential areas during different times of the night. Evaluate the impact on the environment and suggest strategies for reducing light pollution.
- j) Conduct a waste audit in a local community or college. Assess the types and amounts of waste generated, and raise awareness about proper recycling practices.

## **Suggested Activities for Students:**

- a) Prepare a report after gathering information the values of water and air pollution in your town or city and compare the values with that of other cities.
- b) Collect sample of water and air from the specific field location.
- c) Prepare sketches for different types of Plume behavior.
- d) Undertake micro-project.
- e) Give seminar on any relevant topic.

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