GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ENVIRONMENTAL MONITORING
(COURSE CODE:3361302)

Diploma Programme in which this course is offered	Semester in which offered
Environment Engineering	Sixth

1. RATIONALE

Environmental Monitoring provides valuable data that identifies the concentration of pollutants in environment (air, water, soil etc.) as compared to permissible levels to provide early warning of environmental threats. In this course of 'environmental monitoring' various aspects of water quality monitoring and air quality monitoring are included for students to learn.

2. COMPETENCY

The course content should be taught with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Perform various tests to measure the concentration of pollutants in environment (air, water, soil etc.) and analyse the gathered data with reference to permissible levels and if required suggest corrective actions.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

i. Describe the need and importance of environmental monitoring in environmental engineering field and problems associated with it.
ii. Identify the pros and cons of various approaches to monitoring the environmental data
iii. Use sampling techniques.
iv. Prepare different solutions during analytical procedures for determination of water and air pollutants content.
v. Prepare and interpret monitoring report/s.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+P+T)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**ESE**	**PA**	**ESE**	**PA**	**200**
2	0	4	6	70	30	40	60	

Legends : L-Lecture ; **T**-Tutorial /Teacher Guided Student Activity ; **P**-Practical ; **C**-Credit ; **ESE**-End Semester Examination ; **PA** –Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
Unit-I Environmental monitoring and Associated Problems	1a. Explain the objective and functions of monitoring. 1b. Describe the selection of monitoring sites and types of monitoring programme. 1c. Explain the meaning of 'Environmental Variability'. 1d. Describe the site selection for monitoring	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.
Unit-II Quality control and Quality Assurance	2.1 Explain different types of sampling 2.2 Describe the preservation of different types of water and waste water sample 2.3 Collect sample of water using appropriate sampling techniques. 2.4 Prepare different types of chemical solution for analysis	2.1 Sampling: Grab Sampling, Composite Samplin, Integrated Composite Sampling 2.2 Sampling Frequency and Preservation: sampling frequency, sample container, water samplers, sample collection, labelling of container and transportation of samples, time interval between collection and analysis, preservations of water samples. 2.3 Preparation of standard solutions: terms like primary standards, secondary standards , stock solution, standard solution , normality, molarity, percent solution, standardization of solutions, Expression of results; mg/l, ppm.
Unit- III Errors and Treatment of Analytical Data	3.1 Describe different terms related to errors and treatment of analytical data. 3.2 Solve a given problem using statistical treatment of finite samples.	3.1 Errors: Determinate Error, Intermediate Error. 3.2 Accuracy and Precision. 3.3 Distribution of random errors: Frequency Distribution, Statistical Treatment of finite samples.
Unit-IV Water Quality Monitoring	4a. Describe the different methods for determination of physical water characteristics 4b. Describe the different methods for determination of inorganic and non metallic constituents 4c. Describe the different	4.1 Physical water characteristics: Colour True and apparent colour, Temperature, Odor – Threshold method, Taste – Taste Threshold method, Turbidity – Visual and Instrumental method, Solids – Total solids , Total suspended solids, total dissolved solids . 4.2 Inorganic and non-metallic constituents: pH, Potentiometric method, Alkalinity,

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
	methods for determination of metallic constituents. 4d. Describe the different methods for determination of organic constituents	Hardness, Acidity, Sulphate by titration method, Non-metallic constituents; Chlorides, Florides, sulfides and sulfite. 4.3 Metallic constituents:Chromium , Fe, Copper by spectrophotometer. 4.4 Organic constituents: BOD , COD , TOC , Oil and Grease , Surfactants. 4.5 Structure of monitoring report for water quality monitoring.
Unit-V Air Quality Monitoring	5a. Describe the ambient air pollution monitoring: techniques and instrumentation. 5b. Collect sample/s of air using appropriate sampling techniques. 5c. Describe the selection of sampling location for air quality monitoring	5.1 Ambient air quality monitoring. 5.2 Source of air quality monitoring . 5.3 Frequency and mode of sampling , Sampling time and sampling locations for air quality monitoring. 5.4 Environmental procedures for determination of: NOx, Sox, CO, SPM (Suspended Particulate Matter) 5.5 Structure of monitoring report for air quality monitoring.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environmental Monitoring and Associated Problems	06	06	06	04	16
II	Quality Control and Quality Assurance	05	03	04	04	11
III	Errors and Treatment of Analytical Data	03	02	02	03	07
IV	Water Quality Monitoring	07	06	06	06	18
V	Air Quality Monitoring	07	06	06	06	18
Total		**28**	**23**	**24**	**23**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (Bloom's revised 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.

7. SUGGESTED EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours Required
1	I	Solve given problems based on objectives and functions of monitoring, selection of monitoring sites, types of monitoring programme.	6
2	II	Solve given problems based on environmental variability and problems like what, where and when to monitor?	4
3	III	• Solve given problems based on sampling techniques, sampling frequency and preservations of samples • Prepare primary standards. • Prepare normal and molar solution. • Standardize prepared solutions.	6
4	IV	Solve given problems based on errors and it's treatment with different method.	4
5	V	• Determine physical characteristics like turbidity and solids from water and wastewater using appropriate test methods. • Determine pH, Alkalinity , Hardness , Acidity etc using appropriate test methods. • Determine organic constituents like BOD, COD, TOC, oil and grease using appropriate test methods. • Determine metallic constituents , Chromium , Fe, Copper by spectrophotometer.	20
6	VI	• 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 NOx , SOx, CO and SPM.using appropriate test methods	08
7	VII	Visit site , take samples and prepare a report related to Air and Water quality sampling	08
Total			**56**

8. SUGGESTED STUDENT ACTIVITIES (Home/Field Assignment)

i. 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.
ii. Collect sample of water and air from the specific field location.
iii. Prepare sketches for different types of Plume behavior.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Arrange Expert Lectures,
ii. Arrange field visits to measure Air and Water Pollution.
iii. Ask students to prepare reports/mini projects on different causes of air/water/soil pollution in a given location and suggested remedial measures

10. SUGGESTED LEARNING RESOURCES

(A) Books

S. No.	Title of Books	Author	Publication
1	Handbook of methods in Environmental Studies(Vol.I and II)	Maiti, S.K.	Oxford Book Company, 2004
2	Eco Informatics (Part-Environmental Monitoring)	S.K. Agrawal	A.P.H Publishing corporation
3	Air Pollution	M.N.Rao	Tata McGraw-Hill Publishing Company Limited
4	IS:5182 , Methods for measurements of air pollution(Part- I,II,IV,V,X)		

(B) Software/Learning Websites

http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE :

Faculty Members from Polytechnics

- **Prof .M.C. Sanandiya**, Lecturer in Environmental Engineering, Shri K. J.Polytechnic, Bharuch
- **Prof. Jini Sunil**, Lecturer in Environmental Engineering, Shri K. J.Polytechnic, Bharuch

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. M.C. Paliwal** , Associated Professor, Department of Civil and Environment Engineering
- **Dr V. H. Radhakrishnan**, Professor, Department of Civil and Environment Engineering,