

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

TEACHING SCHEME (w. e. f. 10<sup>th</sup> Jan,' 11)

### SEMESTER- VI

SR. NO	SUB.CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	361301	Biological Treatment of Waste Water.	3	2	0	5
2	361302	Environmental Monitoring	2	0	0	2
3	361303	Practice in Environmental monitoring.	0	0	4	4
4	361304	Air Pollution and Control.	3	0	2	5
5	361305	Environmental Legislation And Audit	3	2	0	5
6	361306	Cleaner Production Engineering	2	1	0	3
7	361307	Environmental Engineering project.	0	0	6	6
		<b>TOTAL</b>	<b>13</b>	<b>5</b>	<b>12</b>	<b>30</b>

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

### SEMESTER- VI

**Subject Code : 361301**

**Subject Name: BIOLOGICAL TREATMENT OF WASTEWATER**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<b>1.0 BIOLOGICAL METHODS OF ANALYSIS OF WASTEWATER.</b>  1.1 Methods of determination of BOD, COD, TOC and their relationships 1.2 Factors affecting parameters, of pollution	<b>5</b>
<b>2</b>	<b>2.0 BIOLOGICAL TREATMENT METHODS.</b>  2.1 Different methods of biological treatment on site 2.2 Chemistry of Aerobic and anaerobic treatment methods with, Advantages & Disadvantages.	<b>5</b>
<b>3</b>	<b>3.0 AEROBIC TREATMENT OF WASTEWATER.</b>  Principle, Construction & working, Advantages & Disadvantages & Application. of following:  3.1 Suspended growth processes 3.2 Activated sludge process (ASP) and its modifications 3.3 Aerated lagoons 3.4 Waste stabilization ponds. 3.5 Attached growth processes 3.6 Trickling filters (TF) 3.7 Rotating biological contractors (RBC)	<b>13</b>
<b>4</b>	<b>4.0 ANEAROBIC TREATMENT OF WASTEWATER.</b>  4.1 Suspended growth processes Principle, Construction & working, Advantages & Disadvantages & Application. 4.1.1 Sludge digesters. 4.2 Attached growth Processes Principle, Construction & working, Advantages & Disadvantages & Application 4.2.1 Upflow anaerobic sludge blanket reactor (UASB)	<b>13</b>

<b>5</b>	<b>5.0 REMOVAL OF REFRACTORY ORGANICS.</b>  5.1 Nitrogen removal process. 5.2 Phosphorus removal process.	<b>6</b>
	<b>TOTAL</b>	<b>42</b>

**NOTE:-**

Following are the minimum experiences required, but the college can do more experiences if possible.

**Laboratory Experiences:**

1. To Determine Reaction rate kinetics constant
2. Tutorials on aerobic treatment of wastewater
3. Tutorials on Anaerobic treatment of wastewater
4. Tutorials on aerobic suspended growth processes
5. Tutorials on aerobic attach growth processes
6. Tutorials on aerobic suspended growth process
7. Tutorials on aerobic attached growth processes
8. Removal of nutrients like nitrogen phosphorous etc. from waste water

Visit to the Site / Plant Laboratory is compulsory

**TEXT BOOK**

1. Wastewater engineering its reuse and disposal      Metcalf and Eddy (4<sup>th</sup> Edition)

**Reference Books:**

1. Introduction to environmental Engg.      Mechenzy and corn well
2. Environmental Engineering      Peavy and Rowe

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN ENVIRONMENTAL ENGINEERING**  
**SEMESTER- VI**

**Subject Code : 361302**

**Subject Name: ENVIRONMENTAL MONITORING**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<b>1.0 ENVIRONMENTAL MONITORING.</b>  1.1 Definition, Objectives and Functions of monitoring. 1.2 Selection of monitoring sites. 1.3 Types of monitoring Programme	<b>3</b>
<b>2</b>	<b>2.0 PROBLEMS ASSOCIATED WITH MONITORING.</b>  2.1 Environmental Variability.. 2.3 Place and location of monitoring. 2.4 Time of monitoring.	<b>2</b>
<b>3</b>	<b>3.0 SAMPLES AND TESTS.</b>  3.1 Sampling.- Grab, Composite, Integrated Composite etc 3.2 Sampling frequency and preservation. 3.2.1. Sampling frequency. 3.2.2 Sample container. 3.2.3. Water samplers. 3.2.4. Sample collection. 3.2.5. Labeling of container & transportation of samples. 3.2.6. Time interval between collection & analysis. 3.2.7. Preservation of water samples. 3.3. Preparation of Standard Solutions. 3.3.1 Important terms for expressing the concentration of a solution like, primary standards, secondary standards, stock solution, standard solutions, normality, molarity, percent solution. 3.3.2. Standardization of solutions. 3.3.3. Expression of results: mg/l, ppm.	<b>6</b>

<b>4</b>	<b>4.0 ERRORS &amp; TREATMENT OF ANALYTICAL DATA.</b>  4.1 Error : Determinate Error , Indeterminate Error. 4.2 Accuracy & Precision. 4.3 Distribution of random errors. 4.3.1 Frequency distributions. 4.3.2 Statistical treatment of finite samples.	<b>3</b>
<b>5</b>	<b>5.0 WATER QUALITY MONITORING.</b>  5.1 Determination of physical water characteristics. 5.1.1. Colour True & apparent color, Temperature, Odor, Taste, Turbidity – Visual & Instrumental method, Solids - Total solids, Total Suspended Solids, Total Dissolved Solids. 5.2 Determination of inorganic & non-metallic constituents. 5.2.1. pH : Potentiometric method. 5.2.2. Alkalinity, Hardness, Acidity, Sulfate by titration method. 5.2.3. Nonmetallic constituents : Chloride, Fluoride, Sulfide, Sulfite. 5.3 Determination of metallic constituents. 5.3.1. Chromium, Fe, Copper by spectrophotometer. 5.4 Determination of organic constituents. 5.4.1. BOD, COD, TOC, Oil & Grease, Surfactants. 5.5 Structure of monitoring report for water quality monitoring.	<b>9</b>
<b>6</b>	<b>6.0 AIR QUALITY MONITORING.</b>  6.1 Ambient Air Quality monitoring. 6.2. Source Air Quality monitoring. 6.3. Frequency & mode of sampling , sampling time and sampling locations for Air Quality monitoring. 6.4. Environmental Procedure for determination of NO <sub>x</sub> , SO <sub>x</sub> , CO, SPM 6.5. Structure of monitoring report for Air Quality monitoring.	<b>5</b>
	<b>TOTAL</b>	<b>28</b>

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

### SEMESTER- VI

**Subject Code : 361303**

**Subject Name: PRACTICE IN ENVIRONMENTAL MONITORING**

**NOTE:-**

Following are the minimum experiences required, but the college can do more experiences if possible.

**Laboratory Experiences:**

- 1 Tutorials on Environmental Monitoring
- 2 Problems associated with monitoring - Tutorials based on Environmental variability & problems like what, where & when to monitor ?
- 3 Tutorials based on sampling techniques, sampling frequency, & preservation of samples.
  - \* Experiments based on preparation of primary standards.
  - \* Experiments based on preparation of normal and molar solution.
  - \* Experiments based on standardization of prepared solutions.
- 4 Examples based on errors & its treatment with different methods
- 5 Water Quality Monitoring -Experiments of determination of physical characteristics like Turbidity & Solids from water & wastewater.
  - Experiments of determination of pH Alkalinity, Hardness, Acidity, Alkalinity etc.
  - Experiments for determination of organic constituents like BOD, COD, TOC, Oil & Grease.
- 6 Tutorials based on ambient air quality & stack monitoring.
- 7 Tutorials based on frequency & Time of sampling.
- 8 Examples based on sampling locations.
- 9 Experiments for determination of NO<sub>x</sub>, SO<sub>x</sub>, CO, and SPM.

**Note :- Technical visit is to be arranged on water quality monitoring & Air quality monitoring.**

**TEXT BOOK :**

1. Hand book of methods in Environmental Studies
2. Relevant IS code

S.K.Maiti

## Reference Books:

1. Hand book of methods in Environmental studies (vol.I & II ) S.K. Maiti
2. Eco Informatics ( Part- Environmental Monitoring) S.K. Agrawal
3. Air Pollution M. N. Rao
4. IS : 5182, Methods for measurement of air pollution (part-I,II,IV,V,X )
5. Environmental Chemistry Sawyer and McArthy

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

### SEMESTER- VI

**Subject Code : 361304**

**Subject Name: AIR POLLUTION AND CONTROL**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<b>1.0 INTRODUCTION AND CLASSIFICATION OF AIR POLLUTANTS.</b>  1.1 Air pollution an Environmental problem. 1.2 Classification of air pollutants. 1.2.1 Natural contaminants. 1.2.2 Particulate. 1.2.3 Gases & vapors. 1.2.4 Primary and secondary air pollutants.	<b>3</b>
<b>2</b>	<b>2.0 SOURCES OF AIR POLLUTION AND ITS EFFECT :-</b>  2.1 Sources of Air pollution -Stationary sources, Mobile sources. 2.2 Effects of air pollution on human health. 2.3 Effects of air pollution on animals. 2.4 Effects of air pollution on plants. 2.5 Effects of air pollution on Properties. 2.6 Effects of air pollution on society.	<b>3</b>
<b>3</b>	<b>3.0 METEOROLOGY :-</b>  3.1 Meteorological factors influencing air pollution. 3.2 Dispersion. 3.3 Temperature Lapse Rates and Stability. 3.4 Measurement of Wind Velocity, direction & Temperature. 3.5 Effect of meteorological parameters on Plume Behavior. 3.6 Dispersion of air pollutants. 3.7 Determination of Stack height based on these parameters 3.8 Stability classes.	<b>9</b>
<b>4</b>	<b>4.0 AIR POLLUTION SAMPLING AND MEASUREMENTS-</b>  4.1 Classification of sampling methods. 4.2 Duration of Sampling.	<b>9</b>



	4.3 Ambient Sampling & its location. 4.3.1 Collection of Gaseous Air Pollution. 4.3.2 Collection of Particulate Matter. 4.4 Stack Sampling & selection of sampling location.	
<b>5</b>	<b>5.0 AIR POLLUTION CONTROL METHODS AND EQUIPMENTS.</b>  5.1 Types of collection methods. 5.2 Particulate Emissions Control equipments. 5.2.1 Gravity. 5.2.2 Cyclones. 5.2.3 Fabric Filters. 5.2.4 Electrostatic Precipitators. 5.2.5 Wet Scrubbers. 5.3 Selection of Collectors. 5.4 Control of Gaseous Emissions. 5.4.1 Absorption by Liquids. 5.4.2 Adsorption by Solids.	<b>9</b>
<b>6</b>	<b>6.0 CONTROL OF SPECIFIC GASEOUS EMISSIONS.</b>  6.1 Control of SO <sub>x</sub> . 6.1.1 Chemistry of SO <sub>2</sub> . 6.1.2 Lime & Limestone scrubbing. 6.1.3 Wet lime scrubbing. 6.1.4 Single Alkali scrubbing & Double Alkali scrubbing. 6.1.5 Dry process. 6.2 Control of NO <sub>x</sub> . 6.2.1 Combustion control methods.	<b>9</b>
	<b>TOTAL</b>	<b>42</b>

**NOTE:-**

Following are the minimum experiences required, but the college can do more experiences if possible.

**Laboratory Experiences:**

1. Tutorial based on classification of air pollution.
2. Tutorial based on sources of pollution & its effect.
3. Tutorial based on meteorology.
4. Tutorial based on air pollution sampling & measurements.
5. Tutorial based on air pollution control methods & equipment.
6. Tutorial based on control of specific gaseous pollutants.
7. Seminar May be arranged in group of three students. Students should report their

seminar.

**Note :-** Technical visit must be arranged on Air pollution control system

**TEXT BOOK:**

1. Text Book Air Pollution and Control by , M. N. RAO

**Reference Books:**

- 1 Air Pollution ; Causes and Effective control by, R.K. ARRORA
2. Air Pollution Control by, S.P. MAHAJAN
3. Air Pollution Control In Industries by, T.K.RAY
4. Air Pollution by, S. K. AGARWAL
5. Air Pollution and Its Control by, Summit Malhotra
6. Air pollution by Wark & Worner.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

### SEMESTER- VI

**Subject Code : 361305**

**Subject Name: ENVIRONMENTAL LEGISLATION AND AUDIT.**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<b>1.0 HISTORICAL AND CONSTITUTIONAL PERSPECTIVES.</b>  1.1 Discuss Historical Perspective of Environmental protection. 1.2 State Constitutional guarantees to environmental protection. 1.3 Discuss National and International environmental policies.	<b>3</b>
<b>2</b>	<b>2.0 STUDY OF VARIOUS SECTIONS AND CLAUSES OF WATER ACT, 1974.</b>	<b>4</b>
<b>3</b>	<b>3.0 AIR ACT, 1981.</b>  3.1 Study of various sections and clauses of Air ( prevention and control ) act, 1981	<b>4</b>
<b>4</b>	<b>4.0 ENVIRONMENTAL( PROTECTION) ACT, 1986.</b>  4.1 Study of various sections and clauses of Environment ( Protection) Act, 1986.	<b>4</b>
<b>5</b>	<b>5.0 HAZARDOUS WASTE RULES.</b>  5.1 Study of various provisions of Hazardous waste rule, 1989 for management and handling of hazardous waste.	<b>3</b>
<b>6</b>	<b>6.0 WATER CESS ACT.</b>  6.1 Study of various sections 6.2 Clauses of water cess act with their lacuna.	<b>2</b>
<b>7</b>	<b>7.0 COASTAL REGULATION ACT.</b> 7.1 Study of various provisions.	<b>3</b>
<b>8</b>	<b>8.0 Various Other regulations and acts like Biomedical Wastes (Management and Handling), Municipal Solid Waste Rules, Plastic Manufacturing Sale and Usage Rules etc.</b>	<b>3</b>

<b>9</b>	<b>9.0 ENVIRONMENTAL AUDIT.</b>  8.1 Define the term, Explain Methodology –pre audit activities on site activities, post audit activities. 8.1 .1 Concept & need of Environmental Audit. 8.1.2 Audit procedures. 8.1.3 Pre audit activities. 8.1.4 Onsite activities. 8.1.5 Post audit activities. 8.2 Case studies (Minimum FIVE) related with environmental audit for different types of industries.	<b>16</b>
	<b>TOTAL</b>	<b>42</b>

**NOTE:-**

Following are the minimum experiences required, but the college can do more experiences if possible.

**Laboratory Experiences:**

1. 1 Historical and Constitutional Perspectives
2. Study National and International policies
- 3 Study of various sections and clauses of Water Act,1974 At least two or three Case studies
- 4 Study of various sections and clauses of Air Act -At least two or three Case studies
- 5 Study of various sections and clauses of Environmental Protection Act At least two or three Case studies
- 6 Study of Hazardous waste rule At least two or three Case studies
- 7 Study of various provisions of Water Cess Act
- 8 Study of various provisions of Coastal Regulation Act
- 9 Case studies related with methodology of Environmental Audit

**TEXT BOOK**

- 1. Environmental Law                      C.K.Pithawala**

**Reference Books:**

1. Constitution of India.
2. Water act, 1974,78,88
3. Air act, 1981,87
4. Water cess act,1977,92
5. Environmental Protection Act, 1986
6. Environmental law and policy in India, Armin Rozencaranz, Shyam Divan, and Martha L. Noble, Tripathi Publication.
7. Environmental Auditing, CPCB Publication.
8. Related I.S.
9. GPCB literature

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN ENVIRONMENTAL ENGINEERING**  
**SEMESTER- VI**

**Subject Code : 361306**

**Subject Name: CLEANER PRODUCTION**

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<b>1.0 CLEANER PRODUCTION CONCEPT :</b>  1.1 Theory of cleaner production 1.2 Effect of Cleaner Production on industrial economy 1.3 Need for Cleaner Production 1.4 Barriers to Cleaner Production.	<b>8</b>
<b>2</b>	<b>2.0 CLEANER PRODUCTION METHODOLOGY :</b>  2.1 Six step methodology for Cleaner Production 2.2 Designation of Cleaner Production 2.3 Analyze process 2.4 Steps 2.5 Selection of Cleaner Production 2.6 Implementation 2.7 Maintaining 2.8 Total quality management 2.9 Concepts 2.10 Define Cleaner Production options 2.11 Measure Cleaner Production Programme.	<b>8</b>
<b>3</b>	<b>3.0 GOOD HOUSE KEEPING :</b>  3.1 Need to implementation of Good housekeeping. 3.2 Check lists for Good house keeping.	<b>4</b>
<b>4</b>	<b>4.0 CASE STUDIES ON CLEANER PRODUCTION.</b>	<b>8</b>
	<b>TOTAL</b>	<b>28</b>

**NOTE:-**

Following are the minimum experiences required, but the college can do more experiences if possible.

### **Laboratory Experiences:**

- 1 Study about different Cleaner Production Concepts
- 2 Study of various methodologies used in Cleaner Production.
- 3 Tutorial based on need & different techniques of Good House Keeping
- 4 Case Studies of Cleaner Production .

**Note:- Students will prepare technical report based on Technical visit (Minimum Two)**

### **TEXT BOOK/Reference Books:**

- 1.Cleaner Production : Environmental & Economic Perspectives by Krishna B.Misra, Published by springer.
2. Refer Website of GCPC and NCPC

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN ENVIRONMENTAL ENGINEERING

### SEMESTER- VI

**Subject Code : 361307**

**Subject Name: ENVIRONMENTAL ENGINEERING PROJECT.**

#### **CONTENTS**

Each student is required to carry out the Environmental Engineering Project, which may be related to Environmental Engineering. Field or current needs/issues as may be decided by staff in –charge. The student will have to submit a report of the work done which will essentially include the following.;

- I. Introduction.
- II. Aim & Objective of project
- III. The Problem.
- IV. Methodology to solve problem.
- V. Results & conclusion.
- VI. The student will have to present the seminar on the topics from the current /previous semester courses or on current / advanced topics related with Environmental Engineering

#### **(PROJECT AREAS SUGGESTED (MINI PROJ. & MAJOR PROJECT))**

1. Survey related to water quality of surface water sources(River, Stream, Lake, Pond) and Ground water sources. – Specific importance of each parameter be considered.
2. Determination of characteristic of industrial wastewater (pharmaceutical industry, dairy industry. Textile industry, etc.)
3. Treatability study of industrial wastewater (dye & dye intermediate industry, Bulk drug industry, Textile industry, paper industry etc.)
4. Preparation of working models of treatment units.
5. Environmental Audit of industry.
6. Survey of sewage treatment plant of city.- Study on operational parameters of STP/WTP/ETP.
7. Determination of water utilization and wastewater generation per unit per product.
8. Environmental Monitoring.
9. Survey about estimation of solid waste generation of city.

10. Study about new technologies related to effluent treatment.
11. Study about efficiency of treatment units of effluent treatment plant.
12. Application of cleaner production concept in particular industry.
13. Survey about industrial land fill site.- Impact on soil, Ground water and Social aspect
14. Survey about Ambient Air Quality of particular city and their latest notification
15. Any live area can be selected as per the availability of resources and data
16. Study and applicability of Environmental Legislation in field.

**The students should present their work in presence of Staff.**

#### Reference Books:

1. Hand Book of methods in Environmental studies VOL I & II S K. Maiti.
2. Air Pollution M. N. Rao & H.V.N. Rao.
3. Chemistry for Environmental Engg. Clair Sawyer & McCarty.
4. Wastewater Engineering Metcalf & Eddy
5. Integrated solid Waste Management Tchobanoglous.
6. Water Chemistry Benjamin.
7. Standard methods Published by American Water works Association, 20<sup>th</sup> Edition.
8. Web sites of GPCB and CPCB