

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: I Environmental Management

Subject Name Air Pollution Control and Management

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Sr.No	Course content
1.	<p>Introduction:</p> <p>Air pollution systems, air pollutants, atmospheric particulate matters, atmospheric pollution concentration levels, Meteorology: temperature in lower atmosphere, winds and wind roses. Brief introduction to the Gaussian Plume Equation: Gaussian concentration equation, Point source dispersion formula, dispersion parameters in Gaussian models, plume rise.</p>
2.	<p>Air pollution sampling and measurement:</p> <p>Ambient air sampling, stack monitoring, analysis of air pollutants, viz., SO<sub>2</sub>, NO<sub>x</sub>, CO, oxidants, ozone, hydrocarbons and particulate matters, sampling and estimation of gaseous pollutants of transport vehicles and inside of industrial units and laboratories.</p>
3.	<p>Control of Particulate matter:</p> <p>Introduction, distribution and sources of particulate matter, size distribution and collection mechanism, control devices; viz., Gravitational Settling Chambers, Centrifugal collectors, wet collectors, fabric filters, electrostatic precipitators.</p>
4.	<p>Control of gases and vapours:</p> <p>Adsorption, absorption, design of adsorption tower, design of absorption tower, condensation and combustion, use of catalysts.</p>
5.	<p>Control of specific gaseous pollutants:</p> <p>Control of sulphur dioxide emission, desulphurization of flue gases, dry methods, wet scrubbing methods, control of nitrogen oxides, carbon monoxide and dioxide and hydrocarbons, air pollution surveys.</p>
6.	<p>Air quality and emission standards, air pollution indices, and miscellaneous current topics.</p>
7.	<p>Disaster management in case of failure of control equipment</p>

### List of Practical's and Term work:

1. Practical's based on working following instruments.
  - High Volume Air Sampler.
  - Stack Monitoring Kit.
  - VOC monitor
  - Flue Gas Analyzer.
  - Weather Monitoring Station.
  - CO monitor.
2. Term work will comprise of assignments and exercises based on Meteorology, Gaussian Dispersion Model, Estimation of Ground Level Concentration, Air Quality Standards, Emission Standards, Gravitational Settling Chambers, Centrifugal Collectors, Wet Collectors, Fabric Filters and Electro Static Precipitator.
3. Field Visit: To demonstrate the working of Stack Monitoring Kit

### Reference Books:

1. Air pollution: By K Wark and C Warner
2. Air Pollution control: By De Nevers
3. Environmental Pollution control engineering: By C S Rao
4. Air pollution control: By Howard and Hesketh
5. Air Pollution Volume I to VII: By Stern
6. Air Pollution: By Seinfeld

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: I Environmental Management

Subject Name Industrial Wastewater Management

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Sr.No	Course content
1.	General: Industrial waters and wastewaters, cost of water pollution abatement as integral component of project, key reference to relevant Indian Standards;
2.	Disposal Standards: Various disposal sinks, effluent and stream standards; theories of water pollution and control: reduction of strength and volume, neutralization and proportioning, equalization suitability of control processes compatible with concentrations, environmental consideration for industrial location;
3.	CETP: Concept of Common Effluent Treatment Plant (CETP), pros and cons of CETP, case studies; Liquid toxic wastes: identification and quantification of toxic wastes, physico-chemical, bio-physical treatment processes for toxic wastes;
4.	Major industrial wastes: Origin, characterization, treatment; Recycling and reuse of wastewater: advanced wastewater treatments such as removal of refractory organics, nitrogen, phosphorus, fluoride and TDS, cost benefit ratios, removal and recovery of metals from industrial wastewater.
5.	Waste minimization, waste exchange and cleaner production: definition of CP and terminology, the need of CP and its benefits, barriers to CP, planning and implementation, role of life cycle analysis in achieving CP goals.

### List of Practical's and Term work:

1. List of Practicals
  - I. Characterization of waste water.
  - II. Determination of optimum lime dose for neutralization of acidic wastes.
  - III. Treatability studies for specific industrial wastes – Physico – Chemical treatment
2. Term work will comprise of assignments on the questions related to disposal standards for various sinks, CETP , Advanced Waste water treatment
3. Term paper on industrial waste water treatment and reuse for selected industries.

### Reference Books:

1. Industrial Water Pollution: Origins, Characteristics and Treatment By Nelson Nemerow
2. Environmental Engineering: By Peavy, Rowe and Tchobanoglous
3. Surveys in Industrial wastewater treatment – volume 1, 2 & 3 – edited by Barnes, Forster, Hruday.
4. Industrial Wastewater Treatment: By Eckenfelder
5. Wastewater: Treatment, Disposal and Reuse: By Metcalf and Eddy, Tschobanoglous
6. Advanced Wastewater Treatment: By Culp and Culp
7. Introduction to Environmental Engineering: By Davis Mackenzie and Cornwell.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: I Environmental Management

Subject Name    Municipal and Hazardous Solid Waste Management

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Sr.No	Course content
<b>[A]</b>	<b>Municipal Solid Waste Management:</b>
1.	Integrated Solid Waste Management: History, economics, need, material flows, types of wastes;
2.	Municipal Solid Waste characteristics and quantities, composition and generation; collection systems and design; Linear programming application in collection, transportation and transfer of wastes.
3.	Landfills: Planning, siting, permitting, landfill processes, landfill design, landfill operations, post-closure care and use of old landfills, landfill mining;
4.	Processing of Municipal Solid Waste: storage, conveying, compacting, shredding, pulping, roll crushing, granulating, the pi breakage theorem;
5.	Material Separation: General expressions, picking, screens, float/sink separators, magnets and electromechanical separators, other devices, material separation systems
6.	Combustion and Energy recovery: Heat value of refuse, materials and thermal balances, combustion hardware used in MSW, undesirable effects of combustion.
7.	Biochemical Processes: Methane generation by anaerobic digestion, composting, other biochemical processes.
8.	Application of GIS in locating landfill site.
<b>[B]</b>	<b>Hazardous Solid Waste Management:</b>
1.	Definition, Identification and Classification of Hazardous Solid Waste: Hazardous waste, toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness;
2.	Hazardous Waste Management: Waste Minimization, Waste Exchange, Recycling;
3.	Treatment technologies: Biological, chemical, Physico-chemical treatment, incineration, stabilization, solidification
4.	Land disposal
5.	Biomedical waste management: sources, generation, storage, transportation, disposal, waste treatment: disinfection, irradiation, incineration.

### Reference Books:

1. Solid Waste Management – Tchobanoglous, Tata McGraw Hill publications
2. Solid waste Management – A Vesilind
3. Hazardous Waste minimization: By Harry M Freeman, McGraw Hill publications
4. Hazardous Waste Management: By LaGrega
5. Manual on Solid Waste Management
6. Hazardous Waste Incineration: By Brunners, Calvin R.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: I Environmental Management

Subject Name : Groundwater Hydrology and Contamination

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Sr.No	Course content
1.	Introduction: Definition of ground water, aquifers, vertical distribution of subsurface water, hydrological properties of water bearing strata, ground water in hydrologic cycle.
2.	Ground water hydraulics: Darcy's law, its range of validity, Dupuit Forchheimer assumptions, Applications of Darcy's law for simple flow systems, Governing differential equations for confined and unconfined aquifers, Steady and unsteady flow solutions for fully penetrating wells, partially penetrating wells, interference of wells, test pumping analysis with steady and unsteady flows, delayed yield, method of images,
3.	Ground water quality: Indian and international standards
4.	Ground water pollution: Sources, remedial and preventive measures
5.	Ground water conservation: Ground water budget, seepage from surface water, artificial recharge
6.	Models for Groundwater Flow, Sampling and Monitoring Methods, Transport Mechanisms, Modeling Advective-Dispersive Transport, Adsorption and Chemical Reaction, Biodegradation Kinetics, Numerical Flow and Transport Modeling, Waste Site Characterization/Investigation, Ground Water Remediation, Legal Issues in Groundwater Contamination Appendices.

### Term work:

Term work will comprise of assignments on the questions related to definition of terms used in ground water hydrology, ground water contamination, methods of treatment of contaminated ground water and numericals on Darcy's law, Dupuit law for yield.

### Reference Books:

1. Ground Water : by Raghunath
2. Ground Water Hydrology: By D K Todd
3. Groundwater Resources Education by W C Walton
4. Numerical Ground Water Hydrology by Roger Diewest.
5. Ground water hydrology and contamination by Nicholas Cheremenisoff



# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: I

## Environmental Management

Subject Name : Water and Wastewater Treatment Technologies

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Sr.No	Course content
1.	Introduction: Characteristics of water & Wastewater basis of permissible limits, interpretation of analysis report of water, wastewater, sludge and soil.
2.	Quantities of water and waste water flows, water requirements for domestic and industrial purposes, wastewater formation, spectrum of particle size distribution, variation in flows and particle sizes.
3.	Theory of discrete particle settling stock's law applied to fluids , design settling tanks, efficiency of sedimentation units, types of sedimentation tanks.
4.	Coagulation – flocculation, colloids and their stability, mechanisms of destabilization, limitations, mechanical & hydraulic flocculation, coagulation agents and their recycling.
5.	Flow through process media, mechanisms of filtration dominant mechanisms for a particular size, hydraulics of filtration, filter clogging , filter washing , types of filter and their flow directions break through.
6.	Physico – chemical removal of dissolved, organics, sorption mechanisms and isotherms, estimation of sorbent requirements.
7.	Biological parameters : Biological method of analysis, parameters affecting BOD, BOD equations , methods of estimating BOD,COD procedures
8.	Treatment kinetics: Zero, first, second fractional and executive order reactions in biologic treatment, time and temperature effects.
9.	Reactor Design: Kinetics of oxic treatment CSTR and plug flow reactors , mathematical models for fixed film and suspended growth reactors, evaluation of treatment systems.
10.	Microbiology of anoxic process: Optimal anoxic environment, kinetic constants, stuck reactors, problems, high rate and multistage anoxic digesters, Concept and use of UASB , UAF and hybrid filters.

### Term work:

1. Term work will comprise of assignments on the questions related to sketches and description on water and wastewater treatment, numericals on coagulation and flocculation, numericals on rapid sand filters, numericals on sedimentation, aerobic treatments of water and wastewater and its numerical, anaerobic treatment of water and waste water, numericals on quantity of sludge generation.

### Reference Books:

1. Wastewater treatment, disposal and reuse: By Metcalf & Eddy
2. Introduction to Environmental Engineering: By Mackenzie
3. Environmental Engineering: By Sincero and Sincero
4. Environmental Engineering: By Peavy, Rowe and Tchobanoglous
5. Water Quality and Treatment (A handbook of community water supplies 5<sup>th</sup> edition): Published by American Water Works Association.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: I Environmental Management

Subject Name Inter disciplinary 1 Environmental Impact Assessment

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Sr.No	Course content
1.	Environmental Management: Introduction, Environment and Development, Sustainable development; managing the environment, essentials of an environment policy and environment act, Environmental issues, priority trade offs, scanning approach priority settings.
2.	Concept of Environmental Impact Assessment: Concept of Environment; Concept of Environmental impact Analysis and assessment; development of Environmental Impact Assessment, legislative basis, detailed contents of EIA/EIS; Environmental attributes.
3.	Institutional aspects of Environmental Assessment: Interagency coordinates, enrollment of affected groups, and local NGOs, Strengthening capabilities financial intermediately lancing.
4.	Management of Environmental Assessment, cost and time to prepare EIA, sources of financing, and procurement of consultants.
5.	Environmental costs and benefits: Estimation of market value of environmental components, analysis of projects and policies with consideration of environmental cost and benefits, priority values and value function graphs, valuing the impacts in monetary terms, monetary objective decision making, issues of risk and uncertainty.
6.	Impact assessment methodologies: Choosing a methodology, categorizing methodologies, review criteria, different assessment methods with relevant examples.
7.	Case histories: Case histories related to power generation and transmissions, transportation, water resources development, mining, oil exploration, water and wastewater treatment plants, airports, ports and harbours etc.
8.	Public hearing and the law, role of NGO in public hearing.
9.	Strategic Environmental Impact Assessment: Concept of SEA, application of SEA in the field, developing the SEA document, case studies of SEA in different countries

Term work:

Term Work will comprise of assignments and exercises based on basic concepts, interaction matrices, EIA methods and case studies.

Reference Books:

- 1) Handbook of EIA : By Rau Whooten
- 2) Environmental Impact Assessment: By Larry Canter
- 3) Environmental Impact Analysis - a Decision Making Tool: By R K Jain
- 4) Handbook of Environment Impact Assessment: By Judith Prett
- 5) Theory and Practice of Environmental Impact assessment: By Abbasi and Ramesh
- 6) Environmental Impact Assessment: By Shrivastava

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: II

## Environmental Management

Subject Name Environmental Impact Assessment

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Sr.No	Course content
1.	Environmental Management: Introduction, Environment and Development, Sustainable development; managing the environment, essentials of an environment policy and environment act, Environmental issues, priority tradeoffs, scanning approach priority settings.
2.	Concept of Environmental Impact Assessment: Concept of Environment; Concept of Environmental impact Analysis and assessment; development of Environmental Impact Assessment, legislative basis, detailed contents of EIA/EIS; Environmental attributes.
3.	Institutional aspects of Environmental Assessment: Interagency coordinates, enrolment of affected groups, and local NGOs, Strengthening capabilities financial intermediately lancing.
4.	Management of Environmental Assessment, cost and time to prepare EIA, sources of financing, and procurement of consultants.
5.	Environmental costs and benefits: Estimation of market value of environmental components, analysis of projects and policies with consideration of environmental cost and benefits, priority values and value function graphs, valuing the impacts in monetary terms, monetary objective decision making, issues of risk and uncertainty.
6.	Impact assessment methodologies: Choosing a methodology, categorizing methodologies, review criteria, different assessment methods with relevant examples.
7.	Case histories: Case histories related to power generation and transmissions, transportation, water resources development, mining, oil exploration, water and wastewater treatment plants, airports, ports and harbours etc.
8.	Public hearing and the law, role of NGO in public hearing.
9.	Strategic Environmental Impact Assessment: Concept of SEA, application of SEA in the field, developing the SEA document, case studies of SEA in different countries.
10.	Application of GIS in carrying out EIA.

Term work:

Term Work will comprise of assignments, exercises and quiz based on basic concepts, interaction matrices, EIA methods and case studies.

Reference Books:

- 7) Handbook of EIA : By Rau Whooten
- 8) Environmental Impact Assessment: By Larry Canter
- 9) Environmental Impact Analysis - a Decision Making Tool: By R K Jain
- 10) Handbook of Environment Impact Assessment: By Judith Petts.
- 11) Theory and Practice of Environmental Impact assessment: By Abbasi and Ramesh
- 12) Environmental Impact Assessment: By Shrivastava

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: II Environmental Management

Subject Name Treatment Process Design and Drawing

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Sr.No	Course content
[A]	Process Design: Engineering design of pollution control processes and devices including hydraulics and dimensions of any ten or following units:
1.	Multicyclone,
2.	Bag filter,
3.	Venturiscrubber,
4.	Electrostatic precipitator,
5.	Parshall flume,
6.	Clariflocculator,
7.	Tube Settlers,
8.	Rapid sand filters – Verities,
9.	Activated Sludge Process system and its modifications
10.	Trickling filter , Rotating Biological Contractor
11.	Desalination systems :Reverse Osmosis, Ultra Filtration, Nano Filtration
12.	Hydraulic design of plumbing in multi-storeyed buildings;
13.	Hydraulic design of distribution networks including modifications to dead end systems;
14.	Hydraulic design of sewerage systems; sizing of air blowers and air compressors for various practices in vogue.

15.	High Rate Anaerobic systems: Up flow Anaerobic Sludge Blanket (UASB), Upflow Anaerobic Filter
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### Term work

1. Term work will comprise of assignments on the questions related to Volume reduction, strength reduction, equalization and sketches and description of
  - i. Conventional & modification of Activated Sludge Process,
  - ii. Types of aeration devices
  - iii. Types of mixing devices
  - iv. Flow measuring devices
  - v. Filtration systems
2. Detailed design and drawing of treatment units like clarifloculator, ASP, Trickling filter, Screen, UASB, RSF, Plant hydraulics

### Reference Books:

1. Waste Water Treatment, disposal & reuse - Metcalf & Eddy
2. Wastewater treatment plant: By Qasim
3. Waterworks Engineering: By Qasim
4. Biological Process Design for Wastewater Treatment: By Benefield and Randall
5. Manual on Sewage Collection and Treatment
6. Manual on Water Supply and Treatment



# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: II

## Environmental Management

Subject Name Environmental Legislation

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Sr.No	Course content
1.	INTRODUCTION : Overview of constitution of India; Fundamentals duties and rights; State centre and concurrent lists of subjects.
2.	Historical legislative background of environmental concerns in different Acts, including IPC, Administrative mechanisms for environmental protection at state and central level.
3.	Water Act, 1974 : Familiarization with important sections and clauses of the Act; Comments on certain provisions, lacunae; Amendments to the Water Act 74; Water rules.
4.	Cess Act, 1977 : Familiarization with important sections and clauses of the Act; Amendments to Cess Act 1977.
5.	Air Act, 1981 : Familiarization with important sections and clauses of the Act; Amendments to Air Act 1981; Air rules.
6.	Environmental Protection Act, 1986: Familiarization with important sections and clauses of the Act; Amendments if any; Environmental rules; Hazardous waste rules; Hazardous microorganism rules.
7.	Different Notifications under EPA 1986.
8.	The Forest Conservation Acts, National Policy of Environmental protection and forest.
9.	Case Studies: Study of important features of about 5 – 10 recent Environmental court cases.
10.	General: Supreme Court's directives to media and educational institutions; Role of public awareness and NCD's campaign of safe and sustainable development. Need for special environmental courts.

### Term work:

Term work will comprise of assignments on the questions related to important sections and clauses of Water Act, 1974, Air act, 1981, Environmental Protection Act, 1986, Water Cess Act, 1977, Notification under EPA 1986, case studies related to environment

### Reference Books:

1. Constitution of India
2. The Water (Prevention and Control of Pollution) Act, 1974
3. The Air (Prevention and Control of Pollution) Act, 1981
4. The Motor Vehicle Act, (Amended), 1989
5. The Water Cess Act, 1977
6. The Environmental Protection Act, 1986
7. Amendments and notifications published under above Acts
8. Environmental Law and policy in India, Armin Rozencaranz, Shyam Divan  
Marhta L. Noble, Tripathi publication
9. Commentary on Environmental Legislation: By Lal
10. Environmental Legislation: V Krishnamurti

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: II Environmental Management

Subject Name Environmental Risk Assessment and Management

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Sr.No	Course content
1.	Introduction: Environment Risk assessment and Management: The what's, whys and how's.
2.	Risk Assessment: Assessing risk to human health and ecological systems from chemicals
3.	Risk assessment and management for waste treatment and disposal.
4.	Risk Communication
5.	Economics of risk and valuing risk
6.	Risk Assessment Process: Conceptual frame work, Hazard identification, Hazard assessment, Risk estimation, Risk evaluation, Risk mitigation, Risk assessment in option evaluation, Risk assessment during operation of risk assessment.
7.	Maximum Credible accidents (MCA) analysis: Hazard indices viz. Dow's fire and explosion. Indexc (FEI) and MOND index – degree of hazard – toxicity index
8.	Consequence analysis: Development and assessment of various scenarios, determination of extent of damage
9.	Disaster Management Plan (DMP) and Emergency preparedness plan (EDP)

### Term work:

Term Work will comprise of assignments and exercises based on MCA analysis, Hazard indices, Dow's fire and explosion index, toxicity index, fault tree analysis, HAZAN and HAZOP, DMP and Emergency preparedness Plan.

### Reference Books:

1. Hand book of Environmental Impact Assessment vol –1: By Judith petts,
2. The Risk Assessment of Environmental and Human Health Hazards (Text book of case studies): By Paustenbach, D.ceds
3. Hand book of Env Risk Assessment and Management Edited: By Peter Callow
4. Environmental Risks and Hazards: By Cutter and Susan

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: II

## Environmental Management

Subject Name Environmental Modelling

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Sr.No	Course content
1.	Introduction: Scope of Environmental Modelling, Mass balances, Basic concepts of transport phenomena, Chemical reaction kinetics, equilibrium, chemical modelling.
2.	Environmental Modelling: Eutrophication of lakes, stoichiometry, phosphorus as a limiting nutrient, mass balance on total phosphorus in lakes ,dynamic ecosystem, Models for Eutrophication Assessments
3.	Conventional pollutants in rivers: Introduction, mass balance equation, plugs flow systems, Streeter-Phelps equation, modifications to Streeter Phelps equation, Dissolved oxygen in rivers & estuaries.
4.	Ground water contamination: Introduction, Darcy's law, flow equations, Contaminant solute transport equation, Bio transformations.
5.	Climate and climate system modelling: Climate change and general circulation models, models of the atmosphere and oceans, models of the atmospheric chemistry and aerosols, global carbon box.

### Term work:

Term work will comprise of assignment and exercises based on mass balances, Basic concepts of transport phenomena, chemical modeling, Eutrophication of lakes, Conventional pollutants in rivers, ground water contamination, climate and climate system modeling.

### Reference Books:

1. Environmental modelling: Fate & transport of pollutants in Water, Air and Soil by Jerald L Schnoor.
2. Environmental Modelling by John Wainwright & Mark Mulligan
3. Modelling the Eutrophication Process by M W Lorenzen

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E Semester: II Environmental Management

Subject Name Environmental Monitoring & Statistics

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Sr.No	Course content
1.	<b>Environmental Monitoring:</b> Purpose of monitoring, Scales of observation, Environmental characteristics, Representative units, Sampling Location, Types of environmental monitoring, Sampling plan, Analytical data quality requirements: Precision and Accuracy, Detection limits, Reporting data
2.	<b>Statistics in Environmental Monitoring</b> Samples & Population : Random Sampling, Sample support, Frequency Distribution & Probability Density Function : Mean , Variance , Standard Deviation , Gaussian Variable, Sample size & Confidence interval, Co variance & Correlation, Liner Regression, Interpolation & Spatial Distribution
3.	<b>Water Quality Monitoring</b> Sampling techniques, Preservation of water sample, Physical Properties of water & its monitoring: Temperature, Conductivity, Turbidity etc., Chemical Properties of water & its monitoring 1. Electrometric method: pH 2. Colorimetric method 3. Spectroscopy method, Standardization & calibration of monitoring instruments.
4.	<b>Air Quality Monitoring</b> Type of Air Quality monitoring - Ambient Air Quality monitoring , Source Air Quality monitoring, Ambient Air Quality Monitoring- Selection of monitoring sites , Sampling time, Frequency & mode of sampling, Source Air Quality Monitoring – Type of Monitoring procedure.
5.	<b>Environmental Microbial Properties &amp; Processes</b> Benefits of environmental microbes, Microorganism in soil, Sampling procedure for microbial characterization, Methods for characterizing microorganisms & microbial properties in water & soil.
6.	<b>Map, GIS &amp; Remote Sensing in Environmental Monitoring</b> Maps:- Principals of mapping, Location and Land – Partitioning systems, topographic maps, Global positioning systems, Geographic Information System( GIS):- GIS and Geographic Information Systems Data, Remote Sensing: Physical Principles of Remote Sensing, optical properties of earth surface materials, remote sensing at landscape scale, applications of remote sensing in environmental health & toxicology
7.	<b>Physical, Chemical and Microbial contaminants</b>

	Physical contaminants – Naturally occurring particulates, Human made particulates, Mechanisms and control of particulate, Chemical contaminant:- Type of contaminants, Sources of Contaminants, contaminant transport and fate, Microbial contaminants:- Environmentally transmitted pathogens, concept of indicator organisms, sample processing and storage.
8.	<p><b>Surface Water and Ground Water Monitoring</b></p> <p>Surface Water Monitoring:-Water Quality parameters, sampling the waters, Water sampling equipments, Ground Water Monitoring: - Objectives, Location of monitor wells, well construction, Design and Execution of ground water sampling programs.</p>

Term work:

Term work will comprise of assignments on the questions related to environmental characteristics, sampling locations, types of environmental monitoring, detection limits, numericals on statistics in environmental monitoring, water quality monitoring, Air quality monitoring, map, GIS, and Remote Sensing in Environmental Monitoring, physical, chemical and microbial contaminants, surface water monitoring and ground water monitoring.

Reference Books:

- 1) .Environmental monitoring and characterization by Janick F Artiola, Ian L Pepper, Mark Brusseau
- 2) .Environmental Chemistry by Sawyer & McCarty.

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: II

## Environmental Management

Subject Name **Inter disciplinary : Environmental Audit and Legislation**

### Environmental Audit

1. Philosophy of Environmental Audit, Definitions, Benefits, Objectives
2. Audit Procedures : Pre-Audit Activities, Activities at site and Post audit activities,
3. Material Mass Balance and Water balance
4. Solid waste estimation,
5. Cost of Environmental audit & effectiveness of Environmental audit.

### Legislation

1. Introduction :  
Overview of constitution of India; Fundamentals duties and rights; State center and concurrent lists of subjects. Historical legislative background of environmental concerns in different Acts, including IPC, Administrative mechanisms for environmental protection at state and central level.
2. Water Act, 1974 : Familiarization with important sections and clauses of the Act; Comments on certain provisions, lacunae; Amendments to the Water Act 74; Water rules.
3. Water Cess Act, 1977 : Familiarization with important sections and clauses of the Act; Amendments to Cess Act 1977.
4. Air Act, 1981 : Familiarization with important sections and clauses of the Act; Amendments to Air Act 1981; Air rules.
5. Environmental Protection Act, 1986: Familiarization with important sections and clauses of the Act; Amendments if any; Environmental rules; Hazardous waste rules;
6. Different Notifications under EPA 1986 namely PLI Act 1991, Biomedical Waste Rules 1998 and others..

### Term work:

Term work will comprise of assignments on the questions related to important sections and clauses of Water Act, 1974, Air act, 1981, Environmental Protection Act , 1986, Water Cess Act, 1977, Notification under EPA 1986, Environmental Audit, case studies related to environment,

### Reference Books:

1. Constitution of India
2. The Water (Prevention and Control of Pollution) Act, 1974
3. The Air (Prevention and Control of Pollution) Act, 1981
4. The Motor Vehicle Act, (Amended), 1989
5. The Water Cess Act, 1977



6. The Environmental Protection Act, 1986
7. Amendments and notifications published under above Acts
8. Environmental Law and policy in India, Armin Rozencaranz, Shyam Divan Marhta L. Noble, Tripathi publication
9. Commentary on Environmental Legislation: By Lal
10. Environmental Legislation: V Krishnamurti