

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name PRINCIPLES OF WATER TREATMENT

Sr.No	Course content
1.	Water Demand :Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, Taste and odour, Radio activity in water.
2.	Water Quality :Criteria for different impurities in water for potable and non-potable use.
3.	Physico – Chemical Processes for Water Quality Control :Process, dynamics and reactions, intake. Aeration :Concepts, limitations of aeration, types of aerators. Sedimentation : Types of settling: Type-I and II settling, Processes and tank design. Coagulation and Flocculation :Chemical handling and feeding including storage, Coagulation process, Stability of colloids, Destabilization in water and wastewater treatment. Transport of colloidal particles.
4.	Filtration :Processes, hydraulics of flow through media, pretreatment. Mathematical models for deep granular filters. Rate control. Slow and rapid sand filters. Dual media filters. Precoat filtration.
5.	Disinfection :Processes, Chemical and non-chemical methods, Chlorination, Methods, Uses, Limitations.
6.	Ion Exchange :Processes, Materials, Reactions. Methods of operation, Applications.
7.	Adsorption : Process, Equilibria and Isotherms. Kinetics, Factors affecting, Mode of operation..
8.	Specific Treatment :Control of odour, Colour and taste, Flouride, Fe & Mn.

List of Experiments:

1. Water quality criteria , Standards and sample collection and preservation
2. Physical Parameters of water quality like Solids , turbidity , colour and odour
3. Major Chemical Characteristics of Water using most modern instruments for parameters included in theory
4. Major Biological parameters of water using Presumptive, confirmative and completed test using appropriate culture media and microscope

5. Exposure to the Major Methods of testing of water characteristics which includes Volumetric Analysis, Colourimetric Analysis, Potentiometric analysis and Electrochemical and other methods .
6. Experimentation based on Optimum doses required for different field condition turbidity
7. Model of water treatment for surface water treatmentline

Reference Books:

1. Water Treatment Processes Hammer and Hammer McGraw Hill Inc
2. Water & Wastewater Engineering Vol. II by Fair, Geyer & Okun - John Wiley
3. Unit Processes by L.G. Rich - John Wiley
4. Environmental Engineering by Peavy, Rowe & Tehobanoglous - McGraw Hill
5. Waste water Treatment For Pollution Control and Reuse : By S.J. Arceiwala and S.R . Asolekar 3rd Edition Mc.Graw –Hill
6. Water Treatment: Principles and Design Published by American Water Works Association.
7. Standard Methods of Testing Water and Waste water Latest Edition Published jointly APHA, AWWWA,WPCF
8. Chemistry for Environmental Engineering -Clair Sawyer, Perry McCarty and Gene Parklin

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name ENVIRONMENTAL CHEMISTRY

Sr.No	Course content
1	Basic Concepts of General Chemistry :Fundamentals of atoms, molecules elements, Valancies, Nomenclatures; Chemical and oxidation reduction equations, Gas diagrams.Equilibrium constants and constants of Ionization, Activities and Solubility. pH, pX concepts and Logarithmic concentration diagrams.
2	Basic Concepts of Physical Chemistry :Thermodynamics and chemical equilibrium relationship. Vapour pressures of liquids, Osmosis, Dialysis. Solvent extraction electrochemistry, Chemical kinetics.
3	Basic Concepts of Organic Chemistry :Sources and properties of organic chemical compounds, Trade organics, Soap and detergents, Pesticides.
4	Soil Environmental Chemistry :Soil and agriculture, Nature and composition of soil, Acit-base and ion exchange reactions in soil macronutrients in soil, Fertilizers, Wastes and pollutants in soil, Soil loss and degradation, Genetic engineering and agriculture, Agriculture and health, Agricultural pollution and its control.
5	Methods of Chhemical Analysis Analysis applicable to water , waste water and Air quality principles of analysis of gravimetric , Volumetric , Colorimetric, photoelectric , Polarographic and Gas Ghromotographic methods: Applications of above analysiss methods for testing of Turbidity,colour , pH, acidity , alkalinity, Hardness , Dissolved Oxygen, Biochemical Oxygen Demand , Nitrogenous compounds, Sulphorous compounds, Volatile acids .

List of Experiments:

1. Water and Waste Water Sampling , Preservation and storage . Exposure Integrated , Composite and grab sampling techniques and instrumentation
2. Gravimetric Analysis : (a) Total solids (b) Sulphate determination
3. Volumetric Analysis of water and Waste water (a) Acidity , Alkalinity , Hardness : total and Calcium hardness (c) Chloride and the like
4. Colourimetric Analysis : (a) pH(b) Fluoride, (c) Chlorine etc.
5. Potentiometric Analysis
6. ElectroChemical analysis
7. Determination of parameters of major chemical parameters like Nitrogen compounds , Phosphorous compounds
8. Determination of Importance parameters of Sludge and soil
9. All Experiments needed and available for Soil Chemistry

Reference Books:

- (i) Chemistry for Environmental Engineering by C.N. Swayer and P.L. McCarty – McGraw Hill Book Co. – 3rd Edition
- (ii) Standard Methods of Testing of Water and Wastewater Use by APHA, AWWA, AND WPCF (USA) – Latest Edition
- (iii) Physico Chemical Examination of Water Sewage and Industrial Effluents, Pragati Prakashan, Meerut, India
- (iv) Fundamental of environmental Chemistry by Stanley E. Mahajan – Lewis Publishers

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name ENVIRONMENTAL MICROBIOLOGY

Sr.No	Course content
1	Introduction to Microbiology The scope of microbiology The history of microbiology. The characterization, classification and identification of microorganisms.
2	The Microscopic Examination of Micro Organisms :Types of microscopes and microscopy like Bright field, Dark field, Fluorescence, Phase contract, Transmission and scanning electron microscopy, preparations for Light microscope examination – wet mount and fixed stained smears.
3	The Microscopic Examination of Micro Organisms :Types of microscopes and microscopy like Bright field, Dark field, Fluorescence, Phase contract, Transmission and scanning electron microscopy, preparations for Light microscope examination – wet mount and fixed stained smears.
4	The Cultivation of Bacteria Nutritional types of bacteria, Bacteriological media, Physical conditions required for growth of bacteria, Cultivation of bacteria.
5	The Reproduction and Growth of Bacteria Binary fission, Growth, Normal growth cycle of bacteria, Synchronous growth, Continuous culture, quantitative measurement of bacterial growth.
6	Enzymes and their Regulation Types, Characteristics, Chemical and physical properties of enzymes, Nomenclature of enzymes. The nature and mechanism of enzyme action, Conditions affecting enzyme activity, Inhibition of enzyme activity, Conditions affecting enzyme formation, Determination of enzyme activity, Regulation of enzymes, Regulation of enzyme synthesis.
7	Microbial Metabolism Energy production, principles of bio energetics, Oxidation, Reduction reaction, Glycolysis, The pentose phosphate path way, Fermentation, Energy production by anaerobic and aerobic processes, TCA cycle, Energy production by photo synthesis, Cyclic, Non-cyclic photo phosphorylation. DNA, RNA, Transcription and Translation of genetic information. The process of protein synthesis.
8	The World of Bacteria Gram Negative and Gram positive bacteria, Bacteria with unusual properties, Gram positive filamentous bacteria etc.
9	The Other Types of Microorganisms: Fungi, Algae, Protozoa and viruses, Bacteriophages, Replication of phages
10	Control of Microorganisms: Control of microorganisms by physical, chemical agents.
11	Environmental Microbiology: Microbiology of soil, Aquatic microbiology, Microbiology of domestic water and wastewater, microbiology of air.

12	Microorganism and Communicable Diseases :Epidemiology of infectious diseases, Microbial agents, Transmission and control of diseases, Bacteria and viruses, Protozoa, Fungi etc..
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List of Experiments:

- 1.Exersice on type of Microbes
- 2 Practical demonstration of Microscope and Microbes
- 3 Experiment on Testing of culture media and microbial growth
- 4 Experiment on Use of Membrane filter for microorganism testing
- 6 Experiment on Growth rate of Microorganisms
- 7 Experiment on MPN test
- 8 Experiment on Confirmation test of Coliform organisms
- 9 Demonstration of Viruses and microorganisms using Elecrton microscope
- 10 Exercise on Monods kinetics
11. Exercise on Micribial metabolisms

Reference Books:

1. Microbiology:by Plezar, Chan, Krieg - McGraw Hill
2. Environmental Microbiology by E. Gaudy and Gaudy – McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name **Inter Disciplinary 1 (to be offered by the Environmental Section of the Department for other PG students of the institute/s)**

ENVIRONMENTAL IMPACT ASSESSEMENT of ENGINEERING PROEJCTS

Sr.No	Course content
1	Introduction to Environmental Impact Analysis :Terms-environment,Impact and assessment, concept of EIA, Environmental settings, Prediction and assessment of impact on physical, biological and socio-economic environment.
2	Methods of Analysis of Impacts on Environment :Adhoc , Checklist, Matrix, Network, environmental Media quality Index Method, Cost Benefit Analysis,
3	Public Participation :Concept, Public hearing procedure and guidelines
4	Practical Considerations :Economic development and environmental degradation. Practical consideration in impact assessment
5	Location of Industries :Environmental impacts of typical industries, power plants, large projects, present scenario of various government resolutions on selecting the location of industries, environmental point of view.
5	Case Histories of Engineering Projects like Energy Generation Projects both thermal and Hydal , Infra-structure projects , Power Transmission etc..

Exercise / Practice of the subject

1. Exercise on Delphi technique for assigning significance to Environmental Attributes
2. Exercise on IMPASS game using example of EIA of Engineering Project
3. Exercise on Adhoc Method of EIA
4. Exercise on, Matrices, Method of EIA
5. Exercise on, Network, Method of EIA
6. Exercise on, Overlays c Method of EIA
7. Visit to a Project site/ Office of EIA expert
8. Collection data of Environmental attributes of project ongoing nearby
9. A report of EIA is to be prepared by a student on the project of his specilization

Reference Books:

1. Environmental Impact Assessment, Canter Mc Graw Hill Pub.
2. Environmental Impact Analysis. R.K. Jain, L. V. Urban and G.S. Stacey Publishers : van Nostrand reinhold New York
3. Environmental Impact Analysis. Hand book by John Ray and David Wooten .
4. Environmental Impact Assessment and Statement. John E. Heer, Joseph Hoggerty,

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name **Major Elective 1.1 Environmental Sanitation**

Sr.No	Course content
1	Control of Communicable and certain Noninfectious diseases : Types , agents , Control of Water , Food and Insect borne diseases and zoonoses
2	Residential and Institutional Environment : Appraisal Quality of Living , Hygiene Indices , Health Principles of Housing and its Environment
3	Indoor Quality Standards :- Causes and Sources of Indoor Air Pollution : Biological Contaminants , Thermal and moisture Requirement ; Ventilation
4	Radiation Protection:- Radiation Fundamentals - Types of radiation Ionizing and Non-Ionizing radiation , their uses and biological effects . Radioactive waste disposal Radioactive substances soil, water and air and their fate . Treatment and disposal Liquid and solid Radioactive wastes

List of Experiments:

1. Exposure to Sanitation basics and its importance
2. Reports of sanitary systems of adjoining City and towns
3. Preparation tutorial material visuals of Etiological agents and their reservoir ,vector , and spread of communicable diseases
4. Report preparation for a community sanitation conditions of a economically weak section in a city/rural area
5. Study of an epidemic and its point of origine suggested measures
6. Individually a student will prepare a project on (1)Ventilation system ,(2) Housing Environment and (3) Radiation sources, their uses and effects and one independent topic relevant to the course

Reference Books:

1. Environmental Engineering and Sanitation by Joseph A.Salvato , P.E. Dee - Wiley International latest edition (old 1992 edition)
2. Environmental Protection by Chanlett McGraw Hill Publishing Co.
3. Environmental Engineering Hand Book Lee and Tchobanoglous Mc Graw Hill

In place of above elective following Elective may be offered in First semester depending up on the need and availability of faculty

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name **Major Elective 1.2 Advances in Environmental Laboratories**

Sr.No	Course content
1	Introduction to instrumental methods of environmental analysis.
2	Application of optical spectroscopy to environmental analysis.
3	Electrochemical methods of environmental analysis.
4	Chromatographic environmental analysis.
5	Mass spectroscopy in environmental analysis.
6	Advances in mass spectrometry environmental analysis.

List of Experiments:

This is basically laboratory based syllabus only so list is same

1. Introduction to instrumental methods of environmental analysis.
2. Application of optical spectroscopy to environmental analysis.
3. Electrochemical methods of environmental analysis.
4. Chromatographic environmental analysis.
- 5 Mass spectroscopy in environmental analysis.
6. Advances in mass spectrometry environmental analysis.

Reference Books:

- (1)Instrumental Methods of Environmental Analysis by /Karan Sareen. Vedams e Books Pvt Ltd. New Delhi
- (2)Instrumental Methods Of Analysis, 7e(Hardcover - 2006) by M H Willard Publisher: C B S Publishers & Distributors
- (3)Standard Methods of Testing Water and Waste water Latest Edition Published jointly APHA, AWWWA,WPCF
- (4) Use of Manual of a software included for study

Semester 1 General Subjects to be Offered Across all Branches of PG

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name **PRINCIPLES OF WASTE WATE TREATMENT -**

Sr.No	Course content
1	Wastewater Characteristics :Sampling, composition and variations and preservation of samples , Physical, Chemical and biological characteristics, and analysis of wastewater.
2	Pollution of Natural Waters: Emission and receiving body standards. Stream pollution. Ocean disposal.
3	Reactor Design :Types, Kinetics, Selection of different reactors used for waste water treatment.
4	Wastewater Treatment Fundamentals :Flow sheets, Physico-chemical and biological processes. Screens comminutors. Grit chambers, Sedimentation, Equalization, Neutralization , Flootation and chemical treatment of waste waters.
5	Biological Treatment Processes :Fundamentals of Monods Kinetics and application in bioreactor Design Aerobic and anaerobic, Suspended – growth and attached – growth treatments, Types, Modifications, Activated – sludge unit, Trickling filters, Aerated lagoons, Stabilisation ponds, Oxidation ditches, Aerators. Theory of sludge handling treatment and disposal.
6	Sludge Treatment :Treatment system Chemical ,Biological, Incineration and disposal of sludge solids
7	Advances in Wastewater Treatment : Nitrification, Denitrification, Phosphorous and other nutrient removal treatment processes , Total dissolved solid removal methods Introduction Use members and nano-technological -processes for waste water treatment
8	Reuses of waste water :- Industrial , Agricultral and domestic reuses . Concept of Gray water and uses . Green houses and buildings

List of Experiments:

1. Waste Water Sampling , Preservation and storage . Exposure Integrated , Composite and grab sampling techniques and instrumentation
2. Major Physical Parameter Testing of Sewage and Industrial waste waters
3. DO and BOD testing using conventional laboratory methods.
4. Determination rate constant of BOD utilization and oxygenation
5. Determination of COD with modification for different special waste water
6. Determination of parameters of major chemical parameters like Nitrogen compounds , Phosphorous compounds
7. Model of aeration waste treatment and its performance.
8. Report of Performance evolution of a waste water treatment plant
- 9 Demonstration of Viruses and microorganisms using Elecrtion microscope
- 10 Exercise on Monods kinetics
11. Exercise on Micribial metabolisms

Reference Books:

1. Wastewater Engineering Disposal & Reuse by George Tchobanoglous by Tata Metcalf & Eddy - McGraw Hill 2003 edition or later
2. Water and Wastewater Treatment by Schroeder - McGraw Hill
3. Water & Wastewater Engineering – II by Fiar, Geyer & Okun - John Wiley
4. Standard Methods of Testing Water and Waste water Latest Edition Published jointly APHA, AWWWA, WPCF

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name **INDUSTRIAL WATER AND WASTEWATER TREATMENT**

Sr.No	Course content
1	Introduction to Industrial Water Treatment : Sources and Quality of Water Required for Different uses and different Industries Treatment of water for cooling, Heating, Steam generation and other process water requirement.
2	Waste Reduction : Methods of volume reduction, Strength reduction, Neutralization, Equalisation and proportioning as related to Industrial waste treatment.
3	Industrial Waste Treatment :Origin, Characteristic and Treatment of major industrial wastes. Pre- and Primary treatment , Adsorption, Ion Exchange and Chemical treatment Processes used for Industrial waste waters
4	Wastewater Treatment Fundamentals :Flow sheets, Physico-chemical and biological processes. Screens comminutors. Grit chambers, Sedimentation, Equalization, Neutralization , Floation and chemical treatment of waste waters.
5	Saline Water Conversion :Ion exchange, Distillation, Electro dialysis, Freezing, Reverse, Osmosis.
6	Economic Aspects of Industrial Waste Treatment Concept of joint treatment of industrial and domestic waste, CETP, Design considerations.

List of Experiments:

1. Colletion of data on Industries located in around the location of institute
 2. Preparation of charts of major Industrial water needs and waste water generation streams
 3. Collection field data of one industry in detail related to its water requirement and waste water generation and treatment facility with the industry.
 4. Treatability study of an industrial effluent
 5. Performance evolution of the existing facilities of typical well established waste treatment industrial plant
 6. Project Preparation of Industrial area or on Specific most polluting Industry
 7. field visit of common effluent treatment plant and its positive points and limitations
- (Sponsored candidate of industry may be given a specific task needed for their need in the area of lacuna prevailing n their units)

Reference Books:

1. Industrial Water Pollution by Nelson L. Nemerow - Addison Wesley Pub. Co.
2. Treatment of Industrial Waste by E.B. Besselièvre and M. Schwartz - McGraw Hill, Kega Kusha Ltd. Publication (latest), International Student Edition
3. Wastewater Treatment Plants Planning Designing & Operation by S.R. Quasim - H.R.W. (Holf Rine Heart & Winstone)
4. Industrial water Quality W. W. Eckenfelder, Jr. Davis L. Fford, Andrew Englande McGraw Hill Publishing Co.(2009 ed)
5. Water Quality and Treatment Hand Book of Public Water Supplies by AWWA - McGraw Hill
6. Industrial Waste Treatment by Gurnham
7. Wastewater Engineering: Treatment and Reuse by George Tchobanoglous Publisher Tata McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Master of Environmental Engineering

Subject Name **Major Elective2.1**
HAZARDOUS WASTE MANAGEMENT

Sr.No	Course content
1	Hazardous Waste Classification :Explosive, Flammable, Volatile, Radio active, Toxic and pathological wastes.Categories of hazardous waste as per schedule of hazardous wastes (Management and Handling) Rules 1989
2	Sources of hazardous Wastes :Refinery, Nuclear power plant, Metal plating industry, Chemical industries, Pesticide manufacturing industries etc.
3	Identification and Characteristics :Spent non-halogenated solvents, waste treatment sludges from various chromium and mercury compounds, scrubber sludge from blast furnaces and coke ovens, fission products from nuclear plant, spent fuels, mine and mill tailing, pathological and surgical wastes, AP.PI. separator sludges for oil refineries.
4	Handling of Hazardous Wastes :Collection of hazardous wastes and care in handling quantities of hazardous wastes generated. Storage of hazardous wastes, transportation and shipment of hazardous wastes.
5	Hazardous Waste Impact Analysis :Impact analysis, Impact on land, ground and surface and ground water
6	Final Disposal of Hazardous Wastes :Site selection, incineration, land filling. Leachates :Treatment and disposal.
7	Standards Applicable to Generators of Hazardous Wastes :Standards of collection, Reception, Treatment, Transport, Storage and Disposal as per Environmental Protection Act, 1986.
8	Hazardous Waste Management :Guidelines. Relevant legislation on hazardous waste management.

List of Experiments: Exercises

1. study of hazardous waste generation and sources
2. study on classification all types of hazardous wastes
3. study of identification and characterization of hazardous wastes
4. study of hazardous waste producing industry with details of points of generation in various forms.
5. exercise on material balance in hazardous waste generating industry.
6. Study of manifestation system of particular hazardous waste with processes including handling, storage, transportation and disposal
7. study on treatment technology of hazardous waste TWO TO THREE minimum.

8. study of relevant standards on hazardous waste generation, storage ,
9. visit report preparation of a hazardous waste case

Reference Books:

- 1.Wastewater Engineering Disposal & Reuse by George Tchobanoglous by Tata Metcalf & Eddy - McGraw Hill 2003edition or later
- 2.Water and Wastewater Treatment by Schroeder - McGraw Hill
- 3.Water & Wastewater Engineering – II by Fiar, Geyer & Okun - John Wiley
- 4.Standard Methods of Testing Water and Waste water Latest Edition Published jointly APHA, AWWWA,WPCF

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name MAJOR ELECTIVE2.2 SOLID WASTE MANAGEMENT

Sr.No	Course content
1	Types and sources of solid wastes: Characteristics : Physical and chemical
2	Solid waste Services and collection System : Street sweeping Types of solid waste services:- door to door, alley or street collection backyard collection etc. , Solid waste Collection Services Stationary and hauled collection system ,Route analysis and economics
3	Solid waste Storage and Volume reduction : Storage at point of generation , shredding and cutting, compressing and bailing, Incineration.
4	Transfer and transport :Solid waste transfer stations – location ,types and layouts Transfer and transportation vehicles and routes.
5	Solid waste Treatment system: Physical ,Chemical and Biological – rasing , Air and magnetic separation Incineration : Types, Features and different types of incinerator. Selection, economics and application.
6	Reuse and recycling of solid waste. Heat recovery. Composting and composting plants.
7	Ultimate disposal of solid waste. Sanitary land fills planning, Methods and cost comparison. Ocean dumping, Fusion torch.
8	Relevant legislations : international and national levels acts and legislations on solid waste management their implementation of them.

List of Experiments: Practical Exercise

1. **Collection of Municipal solid waste sample using quartering process**
2. experiment on moisture content, volatile matter and fixed matter.
3. experiment on physical size classification
4. testing of calorific values and other properties of solid wastes
5. collection of data with detail investigation on system of solid waste management and analysis of the system
6. Visit on sites of transfer station and disposal of solid waste
7. Experimentation on proximate and ultimate analysis of solid waste
8. exercise of collection route analysis
9. preparation of report of a city solid waste management system including positive points and lacuna in the present system
10. presentation of report

Reference Books:

- (i) Solid Wastes by Tchobanoglous, Theisen, Eliassen - McGraw Hill
- (ii) Management of Solid Wastes in Developing Countries by Flintoff - WHO
- (iii) Environmental Sanitation by Salvato - Wiley International
- (iv) Environmental Law and Policy in India –Rosencranz & Divan & Noble

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: II

Master of Environmental Engineering

Subject Name **Major Elective III**
Noise Pollution and Thermal Pollution and Their control

Sr.No	Course content of 1 Noise Pollution & Control
1	Physics and effects of noise :- Frequency and Sound Levels, Units of Noise based power ratio , Contours of Loudness . Effects on Human, Environment and properties
2	Sources and Monitoring of Noise Pollution :- Natural and Anthropogenic Noise Sources , Measuring Instruments for Frequency and Noise levels , Masking of sound
3	Reactor Design :Types, Kinetics, Selection of different reactors used for waste water treatment.
4	Control Of Noise Pollution :- Treatment of noise at source, Path and receptors..
2Thermal Pollution & Control	
5	Basics of Thermal Pollution: waste heats into Water and other environments
6	Sources and , Effects and control, :- Effects on Environment , Macro and Micro aquatic organisms . Effects case studies ,Methods of Control: Cooling towers and nuclear reactor cooling systems

List of Experiments: Exercise of the course

- 1.Exercise on sound classification based on Pressure levels and Frequency
2. Experiment on the sound source using SPL and Frequency
- 3 Experiment on effects of sound barriers from a source
- 4 Exercise on effects of combination of different sound
- 5 report of a noisy area of a township and creation contour of loudness
- 6 Exercise on Thermal sources and discharge in the receiving waters
- 7 Visit to field for noise and thermal pollution
- 8 Preparation report of field visit
- 9 Presentation of report

Reference Books:

- 1.Environmental Engineering Hand Book Lee and Liptak Chilton Book Co., Philadelphia.
- 2.Environmental Protection by Chanlett - McGraw Hill
- 3.Energy its physical Impact on Environment by Delbert W. Devins

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name **Major Elective3.2**
AIR POLLUTION CONTROL

Sr.No	Course content
1	Air Pollution : Natural and Anthropogenic Sources, Types, Effects of air pollutions.
2	Methods of Measurements of Air Pollutants :Sampling modes, Sampling system ,Sampling analysis for Grit and Dust, Smoke, Sulphur oxide, Carbon monoxide, Hydrocarbon, Oxides of nitrogen, Ozone and other air pollutants .
3	Ambient Air Quality Standards :International and Indian Standards , Specifications and methods.
4	Transport of Air Pollutants :Meteorology and topography affecting Pollutant dispersion, Models of pollutant dispersion .
5	Height and Design of Chimney :Height, Flue gas quality and temperature, Thermal shocks, Lateral dimension, Reduction of heat losses, Choice of materials
6	Control equipments :Theory of control for particulate and gaseous pollutants. Types, features and operations, Selection and application.
7	Control of Gaseous Pollutants :.Absorption, Adsorption, Combustion , and catalytic processes.
8	Control of Particulate Matters :Types, Features, Operations, Selection of Equipments and applications.
9	Vehicular Pollution and Control :Types Sources of Automobile Air Pollution . Control of Air Pollution by Automobiles Vehicle emission standards and fuel quality, Inspection and certification programme.

List of Experiments.

1. Meteorological parameters and their measuring instruments
2. Use of sampling instruments for collection and analysis of parameters like SPM , RSPM, and other parameters
3. Determination of Gaseous pollutants like CO, CO₂ , NO_x and SO_x and other pollutants with most recent method of sampling and analysis
4. Use of Exhaust gas analyser with IR and other technique based on line and off line instruments
5. Demonstration of Stack Monitoring Unit
6. Field experiments of vehicular traffic induced air pollutants
7. Experiment on pollutant dispersion with artificially created air pollution
8. Problems based on Diffusion equation and other related topics
9. Project on Air pollution Problem of an area

Reference Books:

1. Air Pollution by Perkins H.C. - Tokyo, McGraw Hill
2. Air Pollution and its Origin & Control by Wark & Warner C.F. - New York, IEP, A Dun Donnelley Publication - 1976
3. Air Pollution Control Theory by Crawford - Tata McGraw Hill
4. Industrial Air Pollution Hand Book by Albert Parker - McGraw Hill Book Co.
5. Air Pollution by M.N. Rao McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name **Major Elective 3.3CAD FOR ENVIRONMENTAL ENGINEERING**

Sr.No	Course content
1	Introduction of Computer Systems: Hardware, Software, Computer input output devices etc.
2	System Analysis : Algorithm or flow chart preparation, philosophy and policy, Introduction to computer languages for handling data, Fortran, Database, Basic, C, Pascal, their comparison.
3	Computer Languages : Languages for preparation of computer aided drawing and designs, autocad and other softwares
4	Preparation of Design for Water Supply Systems : Pipe designs for water tree or dead end system, Pipe network analysis, for water supply and sewerage collection system. Computer aided design of unit of treatment for water supply : - intake, jackwell, clariflocculater computer aided design of wastewater treatment units – screens and grit chambers, clarifier secondary treatment units.

List of Experiments: EXERCISES

1. Lab oratory of CAD and introduction to computer processing
2. Experimental work in laboratory on Auto cad
3. Experimental work in laboratory on Auto cad
4. Experimental work in laboratory on Auto cad
5. Exercise on solution of Design of water treatment system
6. Exercise on solution of Design of water treatment system
7. Exercise on solution of Design of waste water treatment system
8. Exercise on solution of Design of waste water treatment system
9. Preparation on Project on CAD application

Reference Books:

(i)Computer programming in Fortran & Other Languages by Rao P.V.S.Tata McGraw
(ii)Computer Programming by Dr. A.K. Jain - Roorkee Prakashan, Roorkee. (iii)CAD / CAM Handbook by Teicholz E McGraw Hill. (iv)Computer Application in Civil Engineering by Spindel P.B.van Nastrand Co.(V)**Manual of Water Supply – 1991 Edition and Manual of Waste Water Treatment (Latest Edition to be used)** by Ministry of Urban Development.(vi)CAD / CAM Technique by Hordeski M.F. - Virginia Restore Pub.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Master of Environmental Engineering

Subject Name **Inter Disciplinary 2 Environmental and Occupational Health and Safety (for Other than Students of Environmental Engineering Specialization)**

Sr.No	Course content
1	Introduction to Occupational Health :Objectives, Occupational environment, Occupational hazards, Occupational diseases, Basic health statistics.
2	Safety Engineering :Causes of accidents, risk in work places, first aid, technical equipments, safety requirements for machinery, Work place climate, lighting & noise, Chemical risks to health.
3	Study on Human Ergonomics, Ways to improve work organization, Hours of work, Daily activities for safety, Accident presentation signs
4	Fire and electrical safety, Radiation safety, Emergency plan, Personal protective equipment
5	International Standards For Environmental management ISO – 14000 s Introduction to ISO and Detail ISO 14001,2,3,4,5 Etc. ISO 14000 – 14009 : Environmental Management Systems ISO 14010 – 14019 : Environmental Audit ISO 14020 – 14029 : Environmental Labeling ISO 14030 – 14039 : Environmental Performance Evaluation ISO 14040 – 14049 : Life Cycle Assessment ISO 14050 – 14059 : Terms and Definitions ISO 14060 : Environmental Aspects in Product Stand
6	Environmental standards for occupational health and safety.

List of Experiments:Exercise

- 1.Exersice on the data collection for different occupational where human interaction with inbuilt and outdoor environment.
2. Exercise on the safety related norms and other provisions
3. Occupational risk analysis and accidental events.
4. Occupational exposure to disease causing materials and etiological agents
- 5.Satey norms for different occupations and industry
- 6 Field visit of industry , trade and professional oraganisation.
7. Report preparation for exposures to risk with specific case study of related branch
- 8 Presentation of report to the continuous assessment committee

Reference Books:

- 1.American Management Association - Hand Book for Safety Managers
- 2.Encyclopedia for Occupational Health published International organization UNO.
- 3.Industrial safety By Dr.K.U. Mistry

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 3

Master of Environmental Engineering

Subject Name **Major Elective 4.1 DESIGN OF WATER AND WASTEWATER SYSTEM**

Sr.No	Course content
1	Wastewater Characteristics :Sampling, composition and variations and preservation of samples , Physical, Chemical and biological characteristics, and analysis of wastewater.
2	Pollution of Natural Waters: Emission and receiving body standards. Stream pollution. Ocean disposal.
3	Reactor Design :Types, Kinetics, Selection of different reactors used for waste water treatment.
4	Wastewater Treatment Fundamentals :Flow sheets, Physico-chemical and biological processes. Screens comminutors. Grit chambers, Sedimentation, Equalization, Neutralization , Flootation and chemical treatment of waste waters.
5	Biological Treatment Processes :Fundamentals of Monods Kinetics and application in bioreactor Design Aerobic and anaerobic, Suspended – growth and attached – growth treatments, Types, Modifications, Activated – sludge unit, Trickling filters, Aerated lagoons, Stabilisation ponds, Oxidation ditches, Aerators. Theory of sludge handling treatment and disposal.
6	Sludge Treatment :Treatment system Chemical ,Biological, Incineration and disposal of sludge solids
7	Advances in Wastewater Treatment : Nitrification, Denitrification, Phosphorous and other nutrient removal treatment processes , Total dissolved solid removal methods Introduction Use members and nano-technological -processes for waste water treatment
8	Reuses of waste water :- Industrial , Agricultral and domestic reuses . Concept of Gray water and uses . Green houses and buildings

List of Experiments:

1. Waste Water Sampling , Preservation and storage . Exposure Integrated , Composite and grab sampling techniques and instrumentation
2. Major Physical Parameter Testing of Sewage and Industrial waste waters
3. DO and BOD testing using conventional laboratory methods.
4. Determination rate constant of BOD utilization and oxygenation
5. Determination of COD with modification for different special waste water
6. Determination of parameters of major chemical parameters like Nitrogen compounds , Phosphorous compounds
7. Model of aeration waste treatment and its performance.
8. Report of Performance evolution of a waste water treatment plant

9. 9 Demonstration of Viruses and microorganisms using Elecrtion microscope
10. 10 Exercise on Monods kinetics
11. Exercise on Micribial metabolisms

Reference Books:

1. Wastewater Engineering Disposal & Reuse by George Tchobanoglous by Tata Metcalf & Eddy - McGraw Hill 2003edition or later
2. Water and Wastewater Treatment by Schroeder - McGraw Hill
3. Water & Wastewater Engineering – II by Fiar, Geyer & Okun - John Wiley
4. Standard Methods of Testing Water and Waste water Latest Edition Published jointly APHA, AWWWA,WPCF

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 3

Master of Environmental Engineering

Subject Name **Major Elective4 .2 : MEMBRANE TECHNOLOGY**

Sr.No	Course content
1	Membrane Process :Principal, Types, Classification, Selection, Application, Configuration..
2	Electrodialysis : Industrial applications, Membrane and their characterization, Electrodialysis stack and its various components.
3	Design Considerations of Electrodialysis System :Determination of ION exchange capacity, membrane potential, Electrical resistance of ion exchange membrane.
4	Reverse Osmosis :Theory, Membrane materials, Devices and configurations. Design Consideration of Reverse Osmosis System :Applications of RO, Costs, Capital and Operating.
5	Reverse Osmosis Membrane Bio Fouling :Bio fouling and its prevention, Membrane cleaning, Analysis of foulants, RO concentrate disposal methods.
6	Other Membrane Processes :Ultra filtration, Nano filtration and their applications

List of Experiments: Exercises

1. Waste Water and Waste water Demand projection and generation using different forecasting methods
2. Physical Unit design for water Treatment
3. Chemical Treatment Unit System Design For water.
4. Preparation of project Report of water Treatment System .
5. Physical Unit design for Waste water Treatment
6. Chemical Treatment Unit System Design For Waste water.
7. Biological Waste water treatment System.
8. Preparation of project Report of Waste Water Treatment System .

Reference Books:

1. Wastewater Treatment Plant Design by WPCF (USA) - Manual of Practice
2. Water & Wastewater Treatment by Schroeder - McGraw Hill
3. Wastewater Treatment & Disposal by S.J. Arceivala - Marcel Dekker
4. Manual of Water Supply by Ministry of Urban Development - Manual of Wastewater Treatment – 1991 Edition (Latest Edition is under preparation)
5. Treatment Disposal Reuse, Waste Water Engineering by Metcalf & Eddy
Incorporation and Waste Water Engineering Disposal & Reuse by McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 3

Master of Environmental Engineering

Subject Name **Major Elective4 .2 : MEMBRANE TECHNOLOGY**

Sr.No	Course content
1	Membrane Process :Principal, Types, Classification, Selection, Application, Configuration..
2	Electrodialysis : Industrial applications, Membrane and their characterization, Electrodialysis stack and its various components.
3	Design Considerations of Electrodialysis System :Determination of ION exchange capacity, membrane potential, Electrical resistance of ion exchange membrane.
4	Reverse Osmosis :Theory, Membrane materials, Devices and configurations. Design Consideration of Reverse Osmosis System :Applications of RO, Costs, Capital and Operating.
5	Reverse Osmosis Membrane Bio Fouling :Bio fouling and its prevention, Membrane cleaning, Analysis of foulants, RO concentrate disposal methods.
6	Other Membrane Processes :Ultra filtration, Nano filtration and their applications

List of Experiments: Exercises

1. Waste Water and Waste water Demand projection and generation using different forecasting methods
2. Physical Unit design for water Treatment
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3. Wastewater Treatment & Disposal by S.J. Arceivala - Marcel Dekker
4. Manual of Water Supply by Ministry of Urban Development - Manual of Wastewater Treatment – 1991 Edition (Latest Edition is under preparation)
5. Treatment Disposal Reuse, Waste Water Engineering by Metcalf & Eddy Incorporation and Waste Water Engineering Disposal & Reuse by McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 4

Master of Environmental Engineering

Subject Name Major Elective5.1 Environmental System Engineering

Sr.No	Course content
1	Basic Phenomena: Introduction to Physical, Chemical and Biological Phenomena
2	Introduction to Systems Engineering System Analysis: Design, synthesis , applications to environmental engineering Systems for Water Quality management, Waste Water Reuse System and Solid waste management
3	System Processes :- Use of Systems of collection ,transport and treatment.
4	Role of optimization models- Deterministic models/Linear programming, Dynamic programming, Separable and Nonlinear programming models. Ecological Model , Probabilistic models - fuzzy models - Simulation models, Time Series analysis , management Systems, Modern tools - Expert systems - Neural networks - Genetic Algorithm - Case studies
5	Evolution of objective functions and constraints for environmental engineering planning and design.

List of Experiments: Exercises

1. Exercise shall consists of simple system like sedimentation
2. exercise on slightly more complex physical phenomenal
3. Experimentation on theoretical models of gas transfer
4. Exercises to be given in the order of followings in subsequent turns
5. Exposure to Chemical phenomena.
6. Exposure to Bio- chemical phenomena.
7. Exposure to biological phenomena.
8. Exercises on the softwares
9. preparation of a case study
10. Presentation of study problem.

Reference Books:

- (i) Rich L.G., Environmental Systems Engineering, McGraw Hill, (latest Edition)
- (ii) Thoman R.V., Systems Analysis & water Quality control, McGraw Hill, (use latest edition)

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 4

Master of Environmental Engineering

Subject Name ENVIRONMENTAL LEGISLATIONS AND MANAGEMENT

Sr.No	Course content
1	Environmental policies and programmes of the Government of India :Provisions made in the Indian Constitution for Environmental Protection. Duty of citizens
2	Environmental Legislations :Need for environmental legislation, National and state level legislation for prevention of air water and land pollution. All Rule related Environmental Rules related Environmental Protection enacted in India .
3	Pollution Control Boards :Functions of water and air pollution control boards of national and state level , difficulties encountered in enforcing legislation, Environmental pollution monitoring.
4	Environmental Audit :Objectives, Concepts, Methodologies and benefits.
5	International Standards For Environmental management :ISO – 14000 s Introduction to ISO and Detail ISO 14001to 14060 Etc.
6	Introduction to Environmental Impact Analysis Terms-environmental: ,Impact and assessment, concept of EIA, Environmental settings, Prediction and assessment of impact on physical, biological and socio-economic environment.
7	Methods of Analysis of Impacts on Environment : Various methods used in EIA : Adhoc , Checklist,Matrix,Network,environmental Media quality Index Method, Cost Benefit Analysis,
8	Public Participation in Environmental Management :Concept, Public hearing procedure and guidelines Practical ConsiderationsEconomic development and environmental degradation. Practical consideration in impact assessment.

This is end of the semester iv The reader may correct if there is need

List of Experiments: Exercises

1. Exercise shall consists of simple system of Indian Legislations
2. exercise on slightly more complex on Indian Policy
3. Exercises to be given in the order of followings in subsequent turns
4. On Environmental Legislations
5. . Exercise on Delphi technique for assigning significance to Environmental Attributes
6. Exercise on IMPASS game using example of EIA of Engineering Project
7. Exercise on Adhoc Method of EIA
8. Exercise on, Matrices, Method of EIA

9. Exercise on, Network, Method of EIA
10. Exercise on, Overlays c Method of EIA
11. Visit to a Project site/ Office of EIA expert
12. Collection data of Environmental attributes of project ongoing nearby
13. A report of EIA is to be prepared by a student on the project of his specialization

Reference Books:

- (i) Pollution Control Acts, Rules and Notification Thereunder : Published by central pollution control board 2004 onwards
- (ii) Environmental Law and Policy In India by Armin Rosencranz, Shyam Diwan and Martha I Noble Tripathi publisher in association with The book review Literary Trust , New Delhi
- (iii) Environmental Impact Assessment by Canter - McGraw Hill
- (iv) Environmental Law by Bouwer - McGraw Hill
- (v) Environmental Impact Analysis by R.K. Jain, L.V. Urban, G.S. Stacey - Van Nostrand Reinhold, New York
- (vi) Environmental Impact Analysis – Handbook by John G. Ray and David C. Wooten