

GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL MANAGEMENT (18)

WATER & WASTEWATER TECHNOLOGIES

SUBJECT CODE: 2711808

SEMESTER: I

Type of course: Engineering and Technology

Prerequisite: Student shall have studied basics of water & wastewater engineering

Rationale: To provide knowledge related to the requirement of water and wastewater treatment technologies and its design

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
		ESE			OEP	PA	RP			
3	2#	2	5	70	30	3	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Characteristics of Water & Wastewater, Basis of Permissible Limits, Interpretation of Analysis Report of Water, Wastewater, Sludge and Soil.	4	10
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.	4	10
3	Theory of Discrete Particle Settling Stock's Law Applied to Fluids, Design Settling Tanks, Efficiency of Sedimentation Units, Types of Sedimentation Tanks.	4	10
4	Coagulation – Flocculation: Colloids and Their Stability, Mechanisms of Destabilization, Limitations, Mechanical & Hydraulic Flocculation, Coagulation Agents and Their Recycling.	4	10
5	Filtration: 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.	4	10
6	Physico – chemical removal of dissolved, organics, sorption mechanisms and isotherms, estimation of sorbent requirements	4	10
7	Biological Parameters: Biological Method of Analysis, Parameters Affecting BOD, BOD Equation, Methods of Estimating BOD, COD Procedures	4	10
8	Treatment Kinetics: Zero, First, Second Fractional and Executive Order Reactions in Biological Treatment, Time and Temperature Effects.	5	10
9	Reactor Design: Kinetics of Oxidic Treatment CSTR and Plug Flow Reactors,	4	10

	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.	5	10

Reference Books:

1. Wastewater Engineering, Treatment and Reuse by Metcalf and Eddy, Tata McGraw- Hill Publication, New Delhi, 2003
2. Water & Waste Water Engineering by Fair and Gayer.
3. Introduction to Environmental Engineering by Mackenzie
4. Physicochemical processes for water quality control by Weber, W.J., John Wiley and sons, Newyork, 1983.
5. Environmental Engineering by Peavy, H.S., Rowe, D.R. and Tchobanoglous, G., McGraw Hills, New York 1985.
6. Water Quality and Treatment (A handbook of community water supplies 5th edition): Published by American Water Works Association.

Course Outcome:

On completion of this course you will also be able to:

- Recognise and define the quality parameters typically used to characterize wastewater
- Describe various types of process units used for preliminary and primary treatment, e.g. screening, equalisation, primary settling and explain their functions
- Describe and explain how biological wastewater treatment removes pollutants
- Describe various biological wastewater treatment processes and recognise pros and cons of each process
- Explain the principles of the suspended and attached growth biological processes and the factors that influence and control these processes
- Recognise emerging technologies for advanced wastewater treatment and water recycling
- Design a disinfection process in terms of contact time and chemicals usage
- Discuss wastewater treatment excess sludge handling, treatment, disposal and biosolids applications
- Draw schematics of typical water and wastewater treatment plants.

List of Experiments: ---

1. Introduction to Standards, collection and preservation of samples, sampling techniques and laboratory equipment
2. Physical Parameters of water & wastewater quality like turbidity, conductivity, colour and odour etc.
3. Major Chemical Characteristics of water & wastewater like Solids, DO, Chlorides, Hardness, Acidity, Alkalinity, etc. using most modern instruments
4. Major Biological parameters of water using Presumptive, confirmative and completed test using appropriate culture media and microscope
5. Experimentation based on Optimum doses required for different field condition turbidity
6. Experiment on BOD and COD of water and wastewater
7. Model of water & wastewater treatments

Design based Problems (DP)/Open Ended Problem:

- Design of Screens, Sedimentation tank, Clariflocculator, Oxidation Ponds, Activated Sludge Process, Trickling Filter, Sludge Digesters, Sludge Drying Beds etc.

Major Equipments:

- Jar Test Apparatus
- Titration Apparatus
- pH meter
- Conductivity Meter
- Hot Air Oven
- BOD Incubator
- Dissolved Oxygen Meter
- Turbidity meter
- Microscope
- Autoclave

List of Open Source Software/learning website:

- <http://nptel.ac.in/>
- <http://elearning.vtu.ac.in/>