

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BRANCH NAME: ENVIRONMENTAL MANAGEMENT**  
**SUBJECT NAME : WATER AND WASTEWATER TECHNOLOGIES**  
**SUBJECT CODE: 3711808**  
**M.E. 1<sup>st</sup>SEMESTER**

**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)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Introduction:</b> Wastewater sources and characteristics, components & analysis of wastewater flow rates, constituent mass loading, Concentration & selection of design flow rates, Reactors used for treatment of water & wastewater, Types of unit Processes & operations, Types of treatment, Conventional water & wastewater treatment units.	<b>06</b>	<b>14</b>
2	<b>Screening and Grit removal:</b> Classification & Applications of different types of screens, Head loss Calculations, Grit Characteristics, Types of Grit chambers.	<b>04</b>	<b>10</b>
3	<b>Mixing &amp; Flocculation:</b> Rapid Mixing & its types, Flocculation & types of flocculator. Power requirement calculations.	<b>02</b>	<b>05</b>
4	<b>Coagulation:</b> Colloid Stability & destabilization, coagulation chemistry for different coagulants and dose Calculations, Coagulant Aids	<b>04</b>	<b>10</b>
5	<b>Softening:</b> Different methods of softening & its reaction chemistry, Dose calculations.	<b>02</b>	<b>05</b>
6	<b>Sedimentation:</b> Concept of sedimentation, Application and types of sedimentation Phenomenon, Zones of sedimentation tank, types of sedimentation tank, High rate clarification, Tube settlers, Lamella plate clarification, Swirl & vortex separator, design considerations.	<b>04</b>	<b>10</b>
7	<b>Filtration:</b> Concept, Types of filters for water, Grain size Characteristics, Filter Hydraulics Calculation.	<b>02</b>	<b>05</b>

8	<b>Disinfection :</b> Purpose & properties of Disinfectants, Disinfection Kinetics , Different types of disinfection with their chemistry.	<b>02</b>	<b>05</b>
9	<b>Biological treatment:</b> Wastewater Microbiology, bacterial bio chemistry for aerobic , Anaerobic and Anoxic decomposition, Reaction rate kinetics, Conventional Activated sludge process, Cyclic Activated sludge system , Integrated fixed film activated sludge System, Biotower & Rotating Biological contractor, Conventional anaerobic treatment, High rate anaerobic reactors, Staged multiphase anaerobic treatment, membrane bioreactors.	<b>10</b>	<b>22</b>
10	<b>Sludge treatment :</b> Sources & characteristics of various sludge, solids calculation, sludge thickening, sludge stabilization, sludge conditionings, sludge dewatering, sludge disposal.	<b>06</b>	<b>14</b>

### 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.
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**List of Experiments:**

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

**Major Equipment:**

- 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/>