

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ENVIRONMENTAL ENGINEERING (17)

WATER & WASTEWATER TECHNOLOGIES

SUBJECT CODE: 2711707

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	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	20	10	10	10	150

### Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<b>Water Quality:</b> Physical, chemical and biological parameters of water- Water Quality Requirement - Potable water standards -Wastewater Effluent standards -Water quality indices.	6	14
2	<b>Water Treatment Processes/ Water purification systems in natural systems :</b> Physical processes-chemical processes and biological processes-Primary, Secondary and Tertiary treatment-Unit operations-unit processes, Water supply scheme	6	14
3	<b>Sedimentation:</b> Types, Aeration and gas transfer, Coagulation and flocculation, coagulation processes, stability of colloids, destabilization of colloids transport of colloidal particles, Clariflocculation	6	14
4	<b>Filtration :</b> theory of granular media filtration; Classification of filters; slow sand filter and rapid sand filter; mechanism of filtration; modes of operation and operational problems; negative head and air binding; dual and multimedia filtration, pressure filters, principle of working and design	6	14
5	<b>Theory of disinfection:</b> Factors affecting disinfection, Disinfection - chlorine dioxide; chloramines; ozonation; UV radiation.	6	14
6	<b>Waste Water Treatment:</b> Biological unit processes: Activated sludge and trickling filter processes, rotating biological contactors, sludge digesters and drying beds	6	15
7	<b>Miscellaneous methods:</b> Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano-filtration, Ultrafiltration and Electrodialysis	6	15

### **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:

- Recognize 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, equalization, 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
- Recognize 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/>