

Branch Name:	Civil Engineering
Program Code:	ET106
Course Name:	Water and Wastewater Engineering
Course Code:	2ET1060503T
Pre-requisite Subject:	Study of Basic Environmental Engineering

Course Objective:

- To develop a student's skills in designing the water treatment process which can provide potable water to the community in accordance with the water demand
- To understand waste water collection, treatment and disposal which are essential for maintaining the quality to the water sources and to reduce effects of water pollution.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Water Treatment Plant: Layout plan and section of water treatment plant; Estimation of raw water discharge for treatment plant; Design period and factors considered for selection of design period; Treatment plant site selection, factors considered, future stages of expansion, selection of treatment train.	5	10	
2	Collection and Conveyance of Raw Water from Source: Intakes, types of intakes; Conveyance of water; Design of pumps; Gravity and rising mains.	5	10	
3	Water Treatment Processes and Treatment Units: Plain sedimentation, aeration; Sedimentation tank & its design; Sedimentation with coagulation, types of coagulants, optimum dose of coagulants, mixing devices, design of flocculation unit. Theory of filtration, types of filters and their comparison, design of rapid sand filter, washing of filter. Methods of disinfection, methods of removing hardness; Computation of dose of chemicals for removal of hardness.	8	20	
4	Distribution System: Layouts of distribution networks; Components of distribution system; Storage capacity of ESR and underground reservoir; Determination of location and height of ESR.	4	10	
5	Collection of Sewage & Estimation of its Discharge: Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance; Estimation of wastewater discharge in a sewerage system; Estimation of storm water discharge in urban areas; Separate and combined sewerage systems; Laying and testing of sewers.	6	15	
6	Unit Operations/Processes and Design for Wastewater Treatment: Layout plan and section of municipal wastewater treatment plant. Physical unit operations -	8	20	

	screening, flow equalization, mixing, flocculation, sedimentation. Chemical unit processes - chemical precipitation. Biological unit processes - Aerobic attached growth and aerobic suspended growth treatment processes, anaerobic suspended growth treatment processes; Low-cost sanitation systems. Treatment of sludge, Design of racks, screens, grit chambers, aeration units.		
7	Advanced Water & Wastewater Treatment Methods: Advanced Oxidation Processes (AOP); Membrane technologies such as Nanofiltration (NF), Ultrafiltration (UF), Microfiltration (MF), Reverse Osmosis (RO); Applications and design considerations.	6	15

List of Text Books:

1. Garg, S. K., *Water Supply Engineering*, Khanna Publishers, 2020.
2. Garg, S. K., *Sewage Disposal and Air Pollution Engineering*, Khanna Publishers, 2020.
3. Punmia, B. C., Jain, A. K., & Jain, A. K., *Water Supply Engineering*, Laxmi Publications, 2019.

List of Reference Books:

1. Metcalf & Eddy, *Wastewater Engineering: Treatment and Resource Recovery*, McGraw Hill Education, 5th Edition, 2014.
2. Hammer, M. J., & Hammer Jr., M. J., *Water and Wastewater Technology*, Pearson, 8th Edition, 2017.
3. Peavy, H. S., Rowe, D. R., & Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Education, 1st Edition, 2013.
4. Droste, R. L., & Gehr, R. L., *Theory and Practice of Water and Wastewater Treatment*, Wiley, 2nd Edition, 2019.
5. AWWA, *Water Quality and Treatment: A Handbook of Community Water Supplies*, McGraw Hill Education, 6th Edition, 2010.

Course Outcomes

After completing this course, students will be able to:

1. Analyze and design water treatment plants and their components.
2. Design systems for the collection and conveyance of raw water.
3. Understand the physical, chemical, and biological processes in water and wastewater treatment.
4. Solve network analysis problems in water distribution systems.
5. Design wastewater collection systems and estimate discharge.
6. Apply advanced treatment technologies to enhance wastewater quality.

E-Resources:

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

Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Analyze and design water treatment plants and their components.	L3
CLO2	Design systems for the collection and conveyance of raw water.	L6
CLO3	Understand the physical, chemical, and biological processes in water and wastewater treatment.	L2
CLO4	Solve network analysis problems in water distribution systems.	L5
CLO5	Design wastewater collection systems and estimate discharge.	L4
CLO6	Apply advanced treatment technologies to enhance wastewater quality.	L3

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1	M								M		M				
CLO2	M						M		M		M		M		
CLO3	M	M		M			M				M		M		
CLO4		M		M							M			M	
CLO5							M		M		M			M	
CLO6			M												

H: High, M: Medium, L: Low