



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering

Subject Code: 3164010

Semester – VI

Subject Name: Water and Waste Water Engineering

**Type of course: Professional Elective Course**

**Prerequisite:** Study of Environmental Science, Environmental Sustainability, Green Chemistry and Environmental Technology

**Rationale:** The water is basic requirement for humans and should be available in pure and potable form to keep the community away from waterborne diseases and treatment of wastewater is absolutely needed to protect the health of people.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
1	<b><u>Water treatment plant:</u></b> 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. <b><u>Collection and conveyance of raw water from source:</u></b> Intakes, types of intakes, conveyance of water, design of pumps and gravity and rising mains	12
2	<b><u>Water treatment processes and treatment units:</u></b> 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
3	<b><u>Distribution system:</u></b> Layouts of distribution networks, Components of distribution system, Newton's and Hardy cross methods for network analysis, storage capacity of ESR and underground reservoir, determination of location and height of ESR. <b><u>Collection of sewage &amp; estimation of its discharge:</u></b> Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance, estimation of wastewater discharge in a sewer in sewerage system, estimation of storm water discharge in urban area, separate and combined sewerage systems, laying and testing of sewers.	8



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4	<b>Unit operations/ processes for wastewater treatment:</b> Layout plan and section of municipal wastewater treatment plant, Physical unit operation 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, an aerobic suspended growth treatment processes, low cost sanitation systems, septic tanks, soak pit, stabilization ponds.	8
5	<b>Design of wastewater treatment units:</b> Design of racks, screens, grit chamber, aeration units, primary & secondary clarifiers, activated sludge plant and trickling filter units, rotating biological contactors, sludge dewatering units, sludge digesters and drying beds.	6

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	20	20	10	5	5

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1. Environmental engineering volume 1 and 2 by S.K.Garg, Khanna publisher
2. Environmental engineering volume 1 and 2 by B.C.Punamia, laxmi publication
3. Environmental engineering volume 1 and 2 by Dr.P.M.Modi
4. Water supply and sanitary engineering by G.S.Birdie and J.S.Birdie
5. Environmental pollution engineering by C.S. Rao wiley eastern
6. Water supply and wastewater engineering by B.S.N Raju, Tata McGraw hill, New Delhi
7. H.S. Peavy, D.R.Row & G.Tchobanoglous, environmental engineering,Mc Graw Hill Intrnational Edition
8. Viesman, Hammer and Chadik, water supply and pollution control, PHI Publication.
9. M.L.Devis and D.A.Cornwell,Introduction to environmental engineering:-2<sup>nd</sup> edition-1997,Mc Graw Hill Intrnational Edition
10. Metcalf and eddy,(revised by G.Tchobanoglous) Wastewater Engineering:Treatment,disposal reuse,Tata-Mc Graw Hill,New Delhi
11. Waste water treatment plants, Planning Design and Operation, Syed Qasim, CRC Press.
12. Water Works Engineering: Planning, Design and Operation, Syed R. Qasim, Edward M. Motley, Guang Zhu, CRC Press

### Course Outcomes:

After learning the course the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Design the water supply system	40
CO-2	Design of waste water treatment systems	40
CO-3	Determine the treatment efficiency of treatment unit	20



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### List of Experiments:

- Introduction to standards, collection and preservation of samples, sampling techniques and laboratory equipment
- Determination of turbidity and jar test
- Determination of DO and BOD
- Determination of COD
- Treatability study of domestic wastewater
- Determination of langelier's saturation index
- Determination of dose of chemicals for removal of hardness of given water sample

### Major Equipment:

- BOD incubator
- COD Apparatus
- Jar test Apparatus
- Auto zero set Burette
- Digital DO meter
- Top Loading Electronic balance
- Aerator

### List of Open Source Software/learning website:

Epanet, relevant websites of IIT's