GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: ENVIRONMENTAL ENGINEERING (17)
SUBJECT NAME: FUNDAMENTALS OF WATER AND WASTEWATER TREATMENT
SUBJECT CODE: 3711701
M.E. 1st 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	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Teaching Hrs	% Weightage
1	**Quality and Quantity of Water:** Quantity and quality of water, Water demand, Drinking water standards, waste water effluent standards, water quality index, impurities in water and physical, chemical and biological characteristics of water.	6	14
2	**Types of Wastewater Treatment:** Unit operations, physical process, chemical process, biological process, primary, secondary and tertiary treatment, water supply scheme, design period, layout of water and wastewater treatment plant, treatment plant selection	7	15
3	**Physico-chemical Treatment of Water & Wastewater**: Aeration and gas transfer, Coagulation, Rapid mixing and flocculation, coagulation processes, stability of colloids, destabilization of colloids, transport of colloidal particles, Jar test, Types of settling, Clariflocculation, Softening	5	14
4	**Filtration:** Theory of granular media filtration, classification of Filters, slow sand filters and rapid sand filters, Mechanism of filtration, modes of operation and operational problems, negative head and air binding: dual and multimedia filtration, pressure filters, principle of working	6	14
5	**Disinfection:** Disinfection mechanism, Factors affecting disinfection, Disinfection agents, ozonation, UV radiation	5	13
6	**Biological Treatment for Wastewater**: Types of biological treatment: Suspended & attached Growth Processes, Design Parameters for Biological Treatments, Activated sludge and trickling filter processes, rotating biological Contactor, UASB	7	15
7	**Advanced Water & Wastewater Treatment Methods :** Ion Exchange process, Membrane Processes, Reverse Osmosis, Microfilteration, Nano-filteration, Dialysis and Electrodialysis and Nanotechnology	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:

After learning the course the students should be able to:

1. Recognize and define the quality parameters typically used to characterize wastewater
2. Describe various types of process units used for preliminary and primary treatment, e.g. screening, equalization, primary settling and explain their functions
3. Describe and explain how biological wastewater treatment removes pollutants
4. Describe various biological wastewater treatment processes and recognize pros and cons of each process
5. Explain the principles of the suspended and attached growth biological processes and the factors that influence and control these processes
6. Recognize emerging technologies for advanced wastewater treatment and water recycling
7. Describe a disinfection process in terms of contact time and chemicals usage
8. Discuss wastewater treatment excess sludge handling, treatment, disposal and biosolids applications
9. 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, heavy metals etc. using most modern instruments
4. Jar Test for determining optimum dosage of coagulant
5. Major Biological parameters of water using Presumptive, confirmative and completed test using appropriate culture media and microscope
6. Experimentation based on Optimum doses required for different field condition turbidity
7. Experiment on BOD and COD of water and wastewater
8. 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
- Spectrophotometer

List of Open Source Software/learning website:

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