GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Chemical Engineering
Minor Degree: Waste Treatment Technology
Subject Code: 115AB01
Semester – V
Subject Name: Advanced Industrial Waste Treatment Technology

Type of course: Minor Degree Course

Prerequisite: A good understanding regarding the industrial wastewater and environmental impacts is required.

Rationale: The main objective of this subject is to study the advancement in industrial waste treatment technology. This subject provides knowledge regarding the different processes involved in the treatment of industrial waste water coming from the different industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	0	30	0	100

Content:

Sr. No.	Content	Total Hrs	%weightage
1	**Industries & Environment:** Industrial scenario in India - Industrial activity and Environment - Uses of water by industry - Sources and types of industrial wastewater - Industrial wastewater and environmental impacts - Industrial wastewater generation rates, characterization and variables - Toxicity of industrial effluents.	11	25
2	**Treatment of Industrial Wastewater:** Role of unit processes in waste water treatment chemical coagulation –Chemical precipitation for improved plant performance, chemical oxidation – Neutralization – Chemical Storage.	10	21
3	**Management of Treatment Plants:** Individual and Common Effluent Treatment Plants - Joint treatment of industrial wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse - Industrial reuse - Disposal on water and land - Residuals of	12	27

	industrial wastewater treatment - Management of RO rejects.		
4	**Practical Application in Industries:** Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for textiles, electroplating, pulp and paper, petroleum refining, pharmaceuticals, sugar and distilleries, fertilizers and thermal power plants.	**12**	**27**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**10**	**10**	**0**

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. Wastewater Engineering: Treatment and Reuse, Metcalf & eddy; McGraw Hill Book Company, 4th Ed, 2002.
2. Environmental Pollution and Control engineering, Rao C. S. -Wiley Eastern Limited, India, 1993.
3. Water Treatment Plants: Planning, Design & Control, S R Qasim, Technomic Pub. Co., 1999.
4. Industrial Water Pollution Control, Eckenfelder W.W.; McGraw Hill Book Company, 3rd Ed, 2000.
5. Environmental Engineering, Kiely G.; McGraw Hill Book Company, 1998.
6. Pollution control in process industries, S.P. Mahajan TMH., 1985.
7. Waste water treatment, M.Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.
8. Industrial Pollution Control and Engineering, Swamy AVN, Galgotia publications, 2005.
9. Environmental Engineering (Vol. II) - Sewage disposal and Air pollution, S.K Garg & Rajeshwari Garg, Khanna Publishers, 27th Edition, 2013.

10. Environmental Engineering and Sanitation: Joseph A. Salvato, John Wiley & Sons, 4th Ed. 2003.
11. Water Supply and Sanitary Engineering, Birdie and Birdie, Dhanpatrai and Sons, 1996.
12. Environmental engineering (Vol. I) - Water Supply Engineering S.K Garg & Rajeshwari Garg, Khanna Publishers, 23rd Edition, 2013.

Course Outcomes:

Sr. No.	CO Statement	Marks % Weightage
CO-1	To understand the industrial scenario in of water usage India, waste water generation, toxicity and environmental impact point of view.	25
CO-2	To understand the various treatment methods of industrial waste water treatment.	21
CO-3	To analyze the various features of common effluent treatment plant, zero effluent discharge, reuse and/or disposal of waste water including RO rejects.	27
CO-4	To understand the industrial manufacturing processes along with the aspects of waste water generation with possibilities of waste reduction at source.	27

List of Experiments: (Minimum 6 experiments need to be performed)

1. Determination of pH of waste water.
2. To determine the color intensity of dye contaminated water by using spectrophotometer.
3. Determination of turbidity of waste water sample.
4. To study the adsorption of dye from aqueous solution on any adsorbent
5. Determination of electrical conductivity of waste water.
6. Determination of total solids, volatile solids and fixed solids of waste water
7. Determination of total hardness of given waste water sample
8. To study membrane separation technique by micro filtration

Major Equipments

pH meter, spectrophotometer, conductivity meter etc.

List of Open Source Software/learning website:

Reference to NPTEL lectures can be made for a better understanding regarding the waste water treatment.