



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3731706

Semester – III

Subject Name: **ADVANCED WASTEWATER TREATMENT TECHNOLOGIES**

Type of course: Applied Science

Prerequisite: Knowledge of physic-chemical and biological treatment of wastewater

Rationale: Satisfying the stringent standards for disposal of treated effluents in various sinks and reusing/recycling of treated effluents for different uses requires that the wastewater be given more exhaustive and advanced treatment. Hence this subject aims to give knowledge to the students regarding advanced wastewater treatment technologies.

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	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Need of Advanced Wastewater Treatment, Applications of Advanced Wastewater Treatment	02
2	Nutrient Removal Nitrogen Removal: .Nitrification , Denitrification Simultaneous nitrification and denitrification Phosphorus Removal : Introduction, Phosphorus removal by Chemical, biological methods	04
3	Adsorption Introduction, Fundamentals of adsorption, Type of adsorbents Development of adsorption isotherms: Freundlich, Langmuir, BET Activated carbon adsorption, Granular carbon adsorption	04
4	Membrane Filtration Membrane Process Classification and operation : Microfiltration, Ultrafiltration, Nano filtration, Reverse Osmosis , Electrodialysis Membrane Configurations: Plate-and-frame module , Spiral-wound module , Tubular module , Hollow-fiber module Membrane Fouling: Modes of membrane fouling , Control of membrane fouling Application of membrane processes	08
5	Membrane Bio Reactor MBR Process Description, Types of Membrane Bioreactors, MBR System Features, Membrane Module Design Considerations, Process Applications : Industrial Wastewater	06



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	Treatment, Municipal Wastewater	
6	Ion Exchange: Fundamentals of Ion Exchange, Types of Ion Exchange Resins for wastewater treatment, Theory of Ion Exchange Applications : Removal and recovery of heavy metals , Removal of nitrogen , Removal of phosphorus , Organic chemical removal	04
7	Electrochemical Wastewater Treatment Processes: Introduction, Electro-coagulation : Factors affecting Electrocoagulation, Electrode materials , Reactor configurations; Electro-floatation : Factors affecting electro floatation Comparison with other technology, Reactor configurations; Electro-oxidation : Electro oxidation process, Reactor configurations	08
8	Advanced Oxidation Processes: Theory of advanced oxidation, Types of oxidizing agents, ozone based and non ozone based processes, Fenton and photo-Fenton Oxidation, Solar Photo Catalytic Treatment Systems	06

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	30	30			

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. Waste water Engineering: Treatment and Disposal by Metcalf & Eddy
2. Environmental Engineering- Peavy, Rowe & Tclobaloglous
3. Membrane Systems for Wastewater Treatment –Water Environment Federation
4. Membrane Separation Processes by Kaushik Nath

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1		
CO-2		
CO-3		



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CO-4		
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List of Open Source Software/learning website:

1. Numericals based on Adsorption isotherms
2. Assignment on membrane process
3. Assignment on Ion Exchange process.
4. Assignment on Advanced Oxidation Process.
5. Assignment on Advanced Wastewater Treatment for removal of Nitrogen & Phosphorus.
6. Assignment on Membrane Bioreactor.
7. Assignment of Electrochemical treatment of Wastewater