



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171310

Semester – VII

Subject Name: Advance Water Treatment Technologies

Type of course: Professional Elective Course

Prerequisite: Knowledge of subjects Physico-chemical treatments of water

Rationale: Satisfying the standards for drinking water requires advance treatment. Hence this subject aims to give knowledge to the students regarding advanced water treatment technologies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	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	Introduction : - Health and Environment Concern - Constituents of emerging concern - Evolution of water treatment technologies - Selection water treatment plant - Water quality standards and regulations	03
2	Removal of Selected Constituents: - Arsenic removal - Iron and Manganese Removal - Softening - Nitrate removal - Radionuclides	04
3	Membrane filtration: - Classification of Membrane Processes - Application of Membrane filtration in water Treatment - Membrane Module Configuration - Properties of Membrane Materials - Particle Capture in Membrane Filtration - Membrane Fouling	06
4	Reverse Osmosis: - Classification of Membrane Processes - Applications for Reverse Osmosis - Reverse Osmosis Process Description - Reverse Osmosis Fundamentals	05



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	Fouling and Scaling	
5	Disinfection: - Disinfection Kinetics - Disinfection with Ozone - Disinfection with Ultraviolet Light	04
6	Chemical Oxidation and Reduction Processes - Introduction to Use of Oxidation Processes in Water Treatment - Fundamentals of Chemical Oxidation and Reduction - Conventional Chemical Oxidants - Photolysis	04
7	Advanced Oxidation Processes: - Introduction to Advanced Oxidation - Ozonation as an Advanced Oxidation Process - Hydrogen Peroxide/Ozone Process for Potable Water - Hydrogen Peroxide/UV Light Process - Sonolysis	06
8	Air Stripping and aeration: - Introduction - Gas Liquid Equilibrium: Henry's Law - Classification of Air Stripping and Aeration system - Packed tower Air stripping - Spray aerators, Spray towers, diffused aeration and mechanical aeration	05
9	Ion Exchange: - Evolution of Ion Exchange Technology - Synthetic Ion Exchange Media - Properties of Ion Exchange Media - Ion Exchange Equilibrium - Ion Exchange Kinetics - Ion Exchange Process Configurations	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	30	10	10	00

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.



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Reference Books:

1. Water Treatment Principles and Design by R. Rhodes Trussell Ph.D., P.E., BCEE, NAE, John C. Crittenden Ph.D., P.E., BCEE, NAE, David W. Hand Ph.D., BCEE, Kerry J. Howe Ph.D., P.E., BCEE
2. Fundamentals of Water Treatment Unit Processes by David Hendricks.
3. Principles of Water Treatment by Kerry J. Howe, Ph.D., P.E., BCEE David W. Hand, Ph.D., BCEE, John C. Crittenden, Ph.D., P.E., BCEE, NAE, R. Rhodes Trussell, Ph.D., P.E., BCEE, NAE, George Tchobanoglous, Ph.D., P.E., NAE

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand fundamentals of advance treatment processes and removal mechanism of specific constituents.	15
CO-2	Implement new technologies for water treatment, including membrane technologies and disinfection.	35
CO-3	Evaluate oxidation-reduction and advanced oxidation processes for water treatment.	25
CO-4	Explain principles and applications of air stripping, ion exchange processes for water treatment.	25

List of Experiments:

1. Performance evaluation of RO Unit.
2. Nitrate removal using Ion-Exchange.
3. Arsenic removal using Adsorption process.
4. Fluoride removal using Adsorption Process.
5. Fluoride removal using Electro coagulation
6. Nitrate removal using Electro coagulation.
7. Desalination using electro dialysis.