GUJARAT TECHNOLOGICAL UNIVERSITY

Environmental Engineering (17)

MEMBRANE TECHNOLOGY
SUBJECT CODE: 2721714
M.E. 2nd SEMESTER

Type of course: Membrane Science and Technology

Prerequisite: Knowledge of fundamentals in chemical engineering and membrane technology

Rationale: Understand membrane-based separation problems by acquiring in-depth knowledge in the area of membrane technology

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T/P	P	C	Theory Marks		Tutorial/ Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	0	4	70	30	30	0	10	10	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Learning Objectives:

- To introduce the concept and principles of membrane separation and its applications in water and wastewater treatment and process

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Membrane Process:** Principal, Types, Classification, Selection, Application, Configuration.	6	15
2	**Electro dialysis:** Membrane and their characterization, Electro dialysis stack and its various components.	6	15
3	**Design Considerations of Electro dialysis System:** Determination of ION exchange capacity, membrane potential, Electrical resistance of ion exchange membrane.	8	20
4	**Reverse Osmosis:** Theory, Membrane materials, Devices and configurations. **Design Consideration of Reverse Osmosis System:** Applications of RO, Costs, Capital and Operating.	8	20
5	**Reverse Osmosis Membrane Bio Fouling:** Bio fouling and its prevention, Membrance cleaning, Analysis of foulants, RO concentrate disposal methods.	6	15
6	**Other Membrane Processes:** Ultra filtration, Nano filtration and their applications	6	15

Reference Books:

1. Wastewater Treatment Plant Design by WPCF (USA) - Manual of Practice
2. Water & Wastewater Treatment by Schroeder - McGraw Hill
3. Wastewater Treatment & Disposal by S.J. Arceivala - Marcel Dekker
4. Manual of Water Supply by Ministry of Urban Development - Manual of Wastewater Treatment – 1991 Edition (Latest Edition is under preparation)
5. Treatment Disposal Reuse, Waste Water Engineering by Metcalf & Eddy
6. Incorporation and Waste Water Engineering Disposal & Reuse by McGraw Hill

Course Outcome: After successful completion of the course the students shall be able to

- Basic competence within separation processes and membrane technology.
- Select a membrane process and design components to carry out a specific separation to advancement of membrane techniques to solve environmental problems.
- Evaluate the most suitable techniques for membrane separation/purification of various liquid streams, depending on the liquid composition and selected process parameters such as temperature and pressure.
- Knowledge about how to minimize any concentration polarization and fouling of the membrane
- To design a suitable membrane separation process for the liquid stream.
- knowledge about all types of membrane separation processes which are suitable for liquid separation (MF, UF (electro)dialysis, RO and PRO)

List of Experiments:

1. Waste Water and Waste water Demand projection and generation using different forecasting methods
2. Physical Unit design for water Treatment
3. Chemical Treatment Unit System Design For water
4. Preparation of project Report of water Treatment System
5. Physical Unit design for Waste water Treatment
6. Chemical Treatment Unit System Design for Waste water.
7. Biological Waste water treatment System.
8. Preparation of project Report of Waste Water Treatment System

Design based Problems (DP)/Open Ended Problem: --

Demonstrating RO membrane unit and practically designing the same

Cleaning of membrane which is fouled – learning the practical way of it

List of Open Source Software/learning website:

- http://elearning.vtu.ac.in/
- www.nptel.iitm.ac.in/courses/