GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL SCIENCE AND TECHNOLOGY (35)
UNIT OPERATIONS-II
SUBJECT CODE: 2163506
B.E. 6th SEMESTER

Type of course: Environmental Science & Technology

Prerequisite A good fundamental backup of Unit Operations for Pollution prevention

Rationale: This subject is intended to make students aware about environmental Unit Operations system applicable for quality control. It also makes them aware about various equipments used for environmental unit operations.

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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**Fluidization**- Characteristics of Fluidized Systems, Liquid-Solid and Gas-Solid Systems, Applications of the Fluidized Solids Technique **Size Enlargement** - Principles of agglomeration palletizing (cone and disk), press and tabulating machines and extrusion and granulating machines.	10	20
2	**Storage and Transportation of Solids:** Storage of solids -silos and hoppers. Storage and transport of powders. Different conveyers- belt conveyer, screw conveyer, pneumatic and hydraulic conveyer etc. Environmental applications.	15	30
3	**Drying:** Principle, Basic terminology of drying, Drying rate curve, Material balance for dryer, Industrial dryers- tray dryer, tunnel dryer, fluidized dryer, rotary dryer etc. **Environmental Unit Operations**- Introduction of Clarifocculator, Carbon filter, Sand filter, Double chamber incinerator, Scrubber ,Aeration Tank, UASBR, ESP.	15	30
4	**Membrane Separation Operations**:- Reverse Osmosis (R.O.),Concept of Osmosis & Reverse Osmosis, Different types of Membrane modules and membrane material used for R.O., Advantages & Disadvantages, Environmental applications of R.O. b. Microfiltration: Concept & working principal, Commercial applications**.**	14	25

Suggested Specification table with Marks (Theory):

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

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1) Unit Operations of Chemical Engg. by W.L. McCabe, J. C. Smith & Harriott, 6th Edition Mc-Graw Hill international.
2) Membrane separation processes. By Dr Kaushik Nath; PHI publication.
3) Principals of mass transfer and separation processes. by Binay K Dutta; Estern Economy Edition.
4) Chemical Engineering Volume-2, by J. F. Richardson, J. H. Harker and J. R. Backhurst,4th edition, Butterworth-Heinemann International.
5) Introduction to Chemical Engineering by W. L. Badger& J.T. Banchero.
6) Principles Of Unit Operations, 2nd Edition, By Alan S. Foust, Leonard A. Wenzel, CurtisW. Wiley-India Publishers.
7) Waste Water Engineering, MatCalf & Eddy, 3rd edition.
8) Air pollution control, CS Rao.

Course Outcome:

After learning this course the students would have:

1) Proper understanding of Fluidization and Size Enlargement.
2) Knowledge about Storage and Transportation of Solids.
3) Proper understanding of Environmental Unit Operation sand Drying.
4) Knowledge of Membrane Separation Operations

List of Experiments:

1. To Study Characteristics of fluidize bed.
2. To perform experiment on tray dryer
3. Perform experiment of reverse osmosis filtration.
4. To study performance efficiency of fluidize dryer
5. To study Membrane separation technique by micro filtration.
6. To Perform experiment on Electrostatic Precipitator
7. To perform experiment on cyclone separator
8. To study experiment on UASB.

Design based Problems (DP)/Open Ended Problem:

1. Prepare model of carbon filter.(OEP)
2. Fabricate prototype model of send filter.(OEP)
3. Design aeration tank (OEP)

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.