GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Computer Aided Process Design

Subject Code: ME02072011

Subject Name: Computer Aided Design In Mass Transfer

W.E.F. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Core Course

Prerequisite:	Mass Transfer, Process Equipment Design
Rationale:	Mass transfer deals with the principle of mass transfer, mass transfer coefficient as they occur in the mass transfer equipment of the engineering process. This approach brings better focus to the importance of the concentration gradient between the two fluids, which is, after all, the driving force whereby the transfer of mass is accomplished. Chemical industries deal with Distillation Column, Absorption Column, Extraction Column, Mixer Settler etc. Detailed study of process design of these equipment is important.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Students will be capable to do process design the distillation column useful for different applications.	50
CO-2	Students will be capable to do proper selection of chemical equipment for mass transfer requirement	20
CO-3	Absorber and Extraction Column can be designed by the students	30

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content:

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	**Computer aided Process design of Distillation Column:** Introduction, Criteria of selection, Selection of equipment for distillation, Distillation column design, Selection of key components for multicomponent distillation, Determination of operating pressure for distillation column, Advantages & disadvantages of vacuum distillation, Determination of nos. of theoretical stages for binary distillation by McCabe Thiele method & Ponchon-Savarit method, Determination of nos. of theoretical stages for multicomponent distillation by Fenskey-Underwood-Gilliland's method, Selection of trays, Calculations for tower diameter & pressure drop of sieve tray tower, Checking of conditions for weeping, downcomer flooding, liquid entrainment, etc, tray efficiency, Jet Flooding & downcomer Flooding, Different types of weirs & downcomers of tray tower, their selection criteria, Process design of Batch distillation, simple batch distillation & batch distillation with rectification. Preparation of software for solving above mentioned problems of process design of distillation column.	24	50
2	**Computer aided Process design of Absorbers**: Introduction, Criteria for selection among different types of absorption equipment, Process Design of packed tower type absorber: Determination of actual amount of solvent, Selection of packing, Determination of tower diameter & pressure drop, Determination of *NtoG*, *HtoG* & height of packing, Process design & selection criteria of liquid distributors, redistributors & packing support, Process design of Spray chamber or spray tower type absorber, Venturi Scrubber, Process design of falling film absorber. Process design of absorption column involving chemical reaction. Preparation of software for solving above problems of process design of absorbers.	11	25

3	**Computer aided Process design of Extractor**: Industrial applications of liquid-liquid extraction, choice of solvent, Process design of counter current multistage extractor, Selection criteria among different types of extractor, Process design of mixer-settler type extractor & packed tower type extractor. Preparation of software for solving above problems of process design of extractor.	7	17
4	**Computer aided Process design of Cooling Tower:** Fundamentals of humidification operations. Simultaneous mass and heat transfer. Process design of cooling tower. Preparation of software for solving process design of cooling tower.	3	8
	Total	**45**	**100**

Reference Books:

1. Introduction to Process Engineering and Design by S B Thakore and B I Bhatt, Tata McGraw Hill, 2nd Edition.
2. Mass Transfer Operations by R E Treybal, Tata McGraw Hill, 3rd Edition.
3. Chemical Engineering, McGraw Hill, Coulson and Richardson, Vol.6

List of Experiments:

1. Tutorials/Presentation/Practical based on above topics.
2. Process design of Distillation Column for binary mixture
3. Process design of Distillation Column for Multicomponent mixture
4. Process design of Scrubber
5. Process design Absorption column involving chemical reaction
6. Process design of Single stage Extraction column
7. Process design of Multi stage Extraction column
8. Process design of Cooling Tower

List of Open Source Software/learning website:

1. Students can refer to video lectures available on the websites including NPTEL lecture series.
2. Students can refer to the CDs available with some reference books for the solution of problems using softwares/spreadsheets. Students can develop their own programs/spreadsheets for the solution of problems.

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