SUMMARY REPORT

TEACHING OF UNDERGRADUATE MASS TRANSFER

American Institute of Chemical Engineers

New York, New York

November 18, 1987

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McNeese State University

INTRODUCTION

This survey is the seventeenth in a series on undergraduate chemical engineering courses that began in 1971. Each survey has sought to present the current text materials and teaching techniques in one of about nine standard chemical engineering courses.

A four-page questionnaire was sent in March, 1987 to the Chairman of each chemical engineering department in the United States and Canada, together with a cover letter asking that the appropriate faculty member(s) complete and return the questionnaire. A follow-up letter was sent in May to those

Course Level - Quarter Basis

	1978	1987
Junior, Quarter 1	11%	10%
Junior, Quarter 2	16%	19%
TOTAL	54%	67%
Senior, Quarter 1	31%	19%
Senior, Quarter 2	13%	6%
Senior, Quarter 3	2%	8%
TOTAL	46%	33%

Compared with 1978, there is a trend to move mass transfer

the first semesters of the junior and senior year in 1978, only

The changes in orientation of the heat [illegible]

Fluid Flow Course Orientation	% of Courses 1977	% of Courses
Unit Operations	38%	36%
Transport Theory	30%	45%
Neither	18%	

Heat Transfer Course Orientation	% of Courses 1977	% of Courses 1986

It is likely that some courses using the transport approach may include momentum and energy transport.

Weeks of Mass Transfer	Replies
All	110
13-15	5
11-12	3
9-10	14
7-8	7
5-6	11
3-4	16
1-2	10

Seventy five percent of the courses are given with 3.50

lectures each week.

TEXTBOOKS

A total of 22 textbooks were mentioned 205 times. Twelve were mentioned only one or two times. Seven books were mentioned

[redacted]

Authors	Citations	1978 Percent	1987 Percent
Treybal	40	[redacted]	

MASS TRANSFER

TOPIC TIME ALLOCATIONS

Molecular Diffusion	4.5		4.5	
Gases		2.2		2.8
Liquids		1.4		2.0
Solids		0.9		0.7
Mass Transfer Coefficients	4.8		6.0	
Laminar Flow		1.5		2.0
Turbulent Flow		1.6		2.0
Local/Overall		1.7		2.0
Equilibrium Stage Operations	6.0		7.5	
Principles		3.4		4.0
Equipment		1.1		2.2
Heat and Mass Transfer		1.5		1.3
Gas Absorption				
Single Component, isothermal		3.1		4.9
Multicomponent		0.8		0.9
Non-isothermal		0.7		1.1
Distillation	6.8		12.3	
Differential		1.7		1.7
Multistage		1.7		6.9
Multicomponent		2.8		2.9
Azeotropic		0.6		0.8
Liquid Extraction	5.1		6.2	
Equipment		0.8		0.9
Equilibria		1.1		1.2
Single Stage		0.8		1.1
Multistage		1.8		2.6

OTHER QUESTIONS

1. Do you use problems dealing with biotechnology in this course?

	Replies
Yes	48
No	151

2. Would you use problems dealing with biotechnology if they were available?

	Replies
Yes	157
No	35

3. What percent of the assignments require the use of a PC or mainframe computer?

BIBLIOGRAPHY

Bennett and Myers, "Momentum, Heat and Mass Transfer", 2nd Ed., McGraw-Hill, 1976.

Bird, Stewart and Lightfoot, "Transport Phenomena", Wiley & Sons

Brian, "Staged Cascades in Chemical Processing", Prentice-Hall.

Cussler, E. L., "Diffusion: Mass Transfer in Fluid Systems",

Fahien, R. W., "Fundamentals of Transport Phenomena", McGraw-Hill, 1983.

Foust, Alan S., "Principles of Unit Operations", 2nd Ed., Wiley & Sons, Inc., 1980.

Geankoplis, Christie J., "Transport Process and Unit Operations", 2nd Ed., Allyn, 1983.

Henley and Seader, "Equilibrium Stage Separation Operations in Chemical Engineering", Wiley and Sons, Inc., 1981

Henley and Staffin, "Stagewise Process Design".

Wankat, P. C., "Equilibrium-Staged Separations", Elsevier, 1987.

Wiley, "Heat Transfer".

UNIVERSITY OF AKRON

DISTILLATION METHODS: McCabe-Thiele;

UNIVERSITY OF CALIFORNIA-DAVIS

DISTILLATION METHODS: McCabe-Thiele

UNIVERSITY OF ALABAMA

DESIGN: Distillation or extraction unit.

CLEMSON UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, FLOWTRAN, ASPEN, Design II.

COLORADO SCHOOL OF MINES

DISTILLATION METHODS: McCabe-Thiele

[redacted]

Holland-Thiele-Geddes.

DESIGN: 4 component 25 stage Distillation Column (C H C H splitter)

COLORADO STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Fenske-Underwood, FLOWTRAN, HYSIM

[redacted]

DESIGN: Multicomponent distillation column using either FLOWTRAN or HYSIM.

UNIVERSITY OF IDAHO

DISTILLATION METHODS: Ponchon-Savarit.

DESIGN: Distillation column, air stripping column.

UNIVERSITY OF ILLINOIS-CHICAGO

[redacted]

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, CHEMSHARE.

ILLINOIS INSTITUTE OF TECHNOLOGY

[redacted]

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF ILLINOIS

DISTILLATION METHODS: McCabe-Thiele

[redacted]

DESIGN: Purification of Styrene from Ethyl benzene dehydrogenation.

LAMAR UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, shortcut and rigorous methods for multiple components system.

DESIGN: Multi-component distillation problem by B-P method; multi-component absorption problem by S-R method.

UNIVERSITY OF LOUISVILLE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit and some computer solutions (in-house programs).

MANHATTAN COLLEGE

DISTILLATION METHODS: McCabe-Thiele,

UNIVERSITY OF MISSISSIPPI

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

MONTANA STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

UNIVERSITY OF NEBRASKA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: In 361, I assigned one project using McCabe-Thiele (on a computer) and one project in multicomponent distillation (3 components).

UNIVERSITY OF NORTH DAKOTA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

OHIO STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele.

OREGON STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, ASPEN.

DESIGN: Detailed design of a sieve-tray absorber; design multicomponent distillation tower.

PENNSYLVANIA STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Fenske equation, Underwood stripping factor method, Gilliland correlation.

DESIGN: Design and optimization

RENSSELAER POLYTECHNIC INSTITUTE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

RICE UNIVERSITY

DISTILLATION METHODS: Ponchon-Savarit, McCabe-Thiele, Fenske-Underwood-Gilliland.

DESIGN: Two projects require considerable programming (in APL or FORTRAN). The projects must be done individually. Students are encouraged to use APL for many of the homework problems requiring numerical solutions.

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: Distillation column; absorber.

UNIVERSITY OF SOUTH ALABAMA

UNIVERSITY OF SOUTHWESTERN LOUISIANA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, in-house computer programs.

DESIGN: Students are asked to prepare a

TEXAS TECH UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Fenske-Underwood-Gilliland.

DESIGN: Require development of computer

UNIVERSITY OF WASHINGTON

DISTILLATION METHODS: McCabe-Thiele, FLOWTRAN.

DESIGN: Designed a separation of essential oils using CO_2 as the separating agent.

WASHINGTON STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele.

WEST VIRGINIA INSTITUTE OF TECHNOLOGY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, FLOWTRAN, Wang-Henke, Napthali-Sandholm.

DESIGN: Small unit designs.

WEST VIRGINIA UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

UNIVERSITY OF WYOMING

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Lewis-Matheson, Thiele-Geddes-Holland.

DESIGN: Usually 1 or 2 projects; old AIChE student contest problems.

YOUNGSTOWN STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: Design of an absorption column or a drying system.

UNIVERSITY OF ALBERTA

DISTILLATION METHODS: McCabe-Thiele,

UNIVERSITY OF BRITISH COLUMBIA

DISTILLATION METHODS: McCabe-Thiele,

TECHNICAL UNIVERSITY OF NOVA SCOTIA

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF TENNESSEE

DISTILLATION METHODS:

DISTILLATION METHODS: McCabe-Thiele.

QUEEN'S UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF SASKATCHEWAN

DISTILLATION METHODS: McCabe-Thiele

DESIGN: Design and cost analysis on a packed and a plate tower for separate specified applications.

UNIVERSITY OF SOUTH FLORIDA

DESIGN: Design of a packed column for an air pollution problem.

UNIVERSITY OF CALGARY

UNIVERSITY OF ALABAMA-HUNTSVILLE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, CHEMSHARE.

DESIGN: Design of a sieve tray for absorption; design of a humidification tower; design of an absorption tower; deisgn of distillation tower using P-S and CHEMSHARE.

NORTHEASTERN UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, PROCESS.

UNIVERSITY OF ROCHESTER

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: The problem usually involves the integration of two unit operations to

the problem is specified in terms of the goal to be achieved (e.g. recovery of product of a given purity with minimum energy consumption at a specified cost) and the students are

UNIVERSITY OF UTAH

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: Design of individual equipment items (staged or continuous-contact apparatus).

NEW MEXICO STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: Design a separation system for a given feed flowrate and composition, and a required product purity.

UNIVERSITY OF FLORIDA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit

DESIGN: Students are given 3 weeks to design any process of their choosing-distillation, extraction, membranes, using any calculation method(s) of