SUMMARY REPORT

TEACHING OF UNDERGRADUATE MASS TRANSFER

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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 schools which had not responded. Of the 172 schools contacted, 122 returned completed questionnaires. This is compared with 110 replies of last years' survey on Fluid Flow and Heat Transfer.

Past surveys have shown that 24-26% of the schools replying operate on the quarter system (10 weeks per semester), while 74-76% are on the semester system (15 weeks per semester). This same apportionment of academic plans was observed in this year's survey.

COURSES AND COURSE LEVEL

The 122 schools responding to the questionnaire reported 190 courses devoted principally to mass transfer. The tables below show that mass transfer is usually taught in the latter half of the junior year.

Course Level - Semester Basis

	1978		1987	
Sophomore Year	4%		0%	
Junior, Semester 1	25%		15%	
Junior, Semester 2	31%		50%	
TOTAL		60%		65%
Senior, Semester 1	30%		22%	
Senior, Semester 2	10%		13%	
TOTAL		40%		35%

Course Level - Quarter Basis

	1978		1987	
Junior, Quarter 1	11%		10%	
Junior, Quarter 2	16%		19%	
Junior, Quarter 3	27%		38%	
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 into the junior year. While 55% of the courses were taught in the first semesters of the junior and senior year in 1978, only 37% are taught in those semesters in 1987. The percentage of the courses taught in the second semester of the junior year has risen from 31% to 50%.

COURSE ORIENTATION

Instructors were asked to judge whether their mass transfer course textbook was oriented toward the unit operations approach, the transport theory approach, a combination of both approaches or neither approach. The replies for 190 courses showed that the unit operations and combined approaches were each used in about 40% of the courses. The transport theory approach was used in 16% of the courses.

Compared with 1978, the unit operations orientation has decreased by 10 percentage points, while the combined approach has increased by 8 percentage points.

Mass Transfer Course Orientation	% of Courses 1978	% of Courses 1987
Unit Operations	53%	43%
Transport Theory	17%	16%
Some of Both	30%	38%
Neither	---	3%

The changes in orientation of the heat transfer and fluid flow courses from the 1986 and 1977 surveys are also shown.

Fluid Flow Course Orientation	% of Courses 1977	% of Courses 1986
Unit Operations	38%	36%
Transport Theory	30%	45%
Some of Both	15%	19%
Neither	18%	---

Heat Transfer Course Orientation	% of Courses 1977	% of Courses 1986
Unit Operations	40%	39%
Transport Theory	35%	42%
Some of Both	25%	19%
Neither	---	---

COURSE ADMINISTRATION

Most schools offer more than one course devoted to mass transfer.

Number of Courses	Schools
One	46
Two	70
Three	6

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-minute lecutes each week. Nineteen percent have 4 50-minute lectures each week.

50-Minute Lectures (Weekly)	1987
Two	2%
Three	75%
Four	19%
Five	4%

About 3/4 of the mass transfer courses are offered only once a year. Only 17% are offered twice a year.

Frequency of Offering	1987
1 section each year	76%
2 sections each year	17%
3 sections each year	5%
4 or more sections each year	2%

The sections of the mass transfer course generally enroll 10 to 30 students.

Section Enrollments	Sections
0-10	27
11-20	48
21-30	54
31-40	29
41-50	18
50+	19
Average Enrollment	26

TEXTBOOKS

A total of 22 textbooks were mentioned 205 times. Twelve were mentioned only one or two times. Seven books were mentioned 10 or more times. These books are listed below.

Authors	Citations	1978 Percent	1987 Percent
Treybal	49	25%	24%
McCabe, Smith & Harriott	44	29%	21%
Henley & Seader	22	---	11%
Bird, Stewart & Lightfoot	15	12%	7%
Welty, Wicks & Wilson	12	4%	6%
King	11	16%	5%
Geankoplis	11	---	5%
Bennett & Myers		11%	4%
Others	41	3%	20%

The textbook usage was also analyzed for the course approach.

Authors	Unit Op	Both	Transport
Treybal	18	24	5
McCabe, Smith & Harriott	26	14	2
Henley & Seader	16	4	2
Bird, Stewart & Lightfoot	--	5	9
Welty, Wicks & Wilson	--	2	9
King	6	4	-
Geankoplis	4	6	1

It is interesting to note the perceived exclusiveness of the unit operations/transport orientation of these text. McCabe et al, Henley et al and King are all used more in courses with the unit operations approach than in courses using both approaches. Some of these are strong in transport courses. Treybal and Geankoplis are more often used in courses with both approaches than in either pure approaches. Finally, Bird et al and Welty et al are strong transport texts. No book was cited more than once in the neither category, so this was omitted in the table.

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 Trasfer 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
Humidification	1.6		2.4	
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		1.9		2.6
Multicomponent		0.5		0.4
Other Unit Operations	4.7		3.6	
Adsorption		0.9		0.38
Ion Exchange		0.3		0.13
Drying		1.2		1.21
Leaching		0.7		1.07
Crystallization		0.4		0.21
Membrane Separations		0.4		0.18
Filtration		0.6		0.43
Other Topics	2.0		2.5	

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?

Percent of Assignments Requiring Computer Solution	No. of Replies 1978	No. of Replies 1987
0%	33	47
1-10%	59	78
11-50%	15	64
50-100%	3	5
TOTAL	110	194

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Treybal, Robert E., "Mass Transfer Operations", 3rd Ed., McGraw-Hill, 1979.

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Wiley, "Heat Transfer".

UNIVERSITY OF AKRON

DISTILLATION METHODS: McCabe-Thiele; Ponchon-Savant; FLOWTRAN

UNIVERSITY OF ALABAMA

DISTILLATION METHODS: McCabe-Thiele; Wang-Henke BP (Department developed PC program); Fenske-Underwood-Gilliland Shortcut.

DESIGN: Distillation column using either program provided or self-written program; packed absorber.

BRIGHAM YOUNG UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele; Ponchon-Savarit; computer solutions developed here; made some use of PROCESS.

DESIGN: Flash separator, plate distillation column, packed absorption (CO_2) column.

BROWN UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele; Ponchon-Savarit; plate-to-plate (written for ones-self); FLOWTRAN is available.

DESIGN: Distillation column design involving a binary with multiple feeds and sidestreams, with follding calculations required, column sizing and costing to determine optimum cost design.

BUCKNELL UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele; Thiele-Geddes.

DESIGN: Standard height-of-column estimates for staged processes using overall efficiency correlations.

UNIVERSITY OF CALIFORNIA-BERKELEY

DISTILLATION METHODS: McCabe-Thiele, Thiele-Geddes.

UNIVERSITY OF CALIFORNIA-DAVIS

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: Distillation or extraction unit.

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF CALIFORNIA-SAN DIEGO

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

DESIGN: Distillation column, absorbers, membrane separators, (some using computer methods).

UNIVERSITY OF CALIFORNIA-SANTA BARBARA

DISTILLATION METHODS: McCabe-Thiele, Instructor's Programs.

DESIGN: Multicomponent Distillation Column, Batch Distillation Column.

CASE WESTERN RESERVE

DISTILLATION METHODS: Chemcad (Coade)

CHRISTIAN BROTHERS COLLEGE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Shortcut Methods, FLOWTRAN.

UNIVERSITY OF CINCINNATI

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: Packed gas absorption column including simplified economic evaluation.

CLARKSON UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

CLEMSON UNIVERSITY

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

COLORADO SCHOOL OF MINES

DISTILLATION METHODS: McCabe-Thiele, Holland-Thiele-Geddes.

DESIGN: 4 component 25 stage Distillation Column (C_3H_8 - C_4H_{10} splitter).

COLORADO STATE UNIVERSITY

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

DESIGN: Multicomponent distillation column using either FLOWTRAN or HYSIM.

UNIVERSITY OF DAYTON

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF FLORIDA

DISTILLATION METHODS: McCabe-Thiele.

GEORGIA INSTITUTE OF TECHNOLOGY

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

DESIGN: NTU-HTU design of a packed distillation column; NTU-HTU design of a packed gas absorbed, using Fair's correlations.

UNIVERSITY OF HOUSTON

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

HOWARD UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF IDAHO

DISTILLATION METHODS: Ponchon-Savarit.

DESIGN: Distillation column, air stripping column.

UNIVERSITY OF ILLINOIS-CHICAGO

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

ILLINOIS INSTITUTE OF TECHNOLOGY

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF ILLINOIS

DISTILLATION METHODS: McCabe-Thiele, Fenske-Underwood-Gilliland, PROCESS.

DESIGN: Purification of Styrene from Ethyl benzene dehydrogenation.

IOWA STATE UNIVERSITY

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

JOHN HOPKINS UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF KANSAS

DISTILLATION METHODS: McCabe-Thiele, Fenske-Underwood-Gilliland, Wang-Henke.

DESIGN: Tridiagonal matrix method for solving a multicomponent distillation problem.

UNIVERSITY OF KENTUCKY

DISTILLATION METHODS: Chemcad software.

LAFAYETTE COLLEGE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

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, Ponchon-Savarit, Fenske-Underwood-Gilliland.

UNIVERSITY OF MICHIGAN

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Thiele-Geddes, FLOWTRAN.

DESIGN: Five design projects are assigned dealing with multicomponent separations.

MICHIGAN STATE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Computer simulations using CHEMSHARE.

DESIGN: Separation of multicomponent hydrocarbon stream using distillation columns and flash units; design of gas absorber.

MICHIGAN TECHNOLOGICAL UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF MISSOURI-ROLLA

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

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 NEW HAMPSHIRE

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

NEW JERSEY INSTITUTE OF TECHNOLOGY

DISTILLATION METHODS: McCabe-Thiele, T Fenske-Underwood-Gilliland (FUG) method of a multicomponent separation, FLOWTRAN, PROCESS.

DESIGN: Binary separation of acetonitrile/water; multicomponent distillation design problem; absorption of SO_2 in water.

UNIVERSITY OF NEW MEXICO

DISTILLATION METHODS: McCabe-Thiele, Underwood, ASPENPLUS.

DESIGN: Groups of 3 are allowed to pick from among several projects. They must research the assignment, do some preliminary calculations, then model it with ASPEN, if appropriate. Group presentations are then made to the rest of the class.

STATE UNIVERSITY OF NEW YORK AT BUFFALO

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

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 primitive optimization of a binary fractionation column; design of a multicomponent fractionation (ideal phase equilibrium).

POLYTECHNIC INSTITUTE OF NEW YORK

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF PUERTO RICO

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

PRINCETON UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

DESIGN: Packed tower absorber with chemical reaction.

PURDUE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Lewis, Matrix, Fenske-Underwood-Gilliland.

DESIGN: Design diameter and spacing of staged column design pack column.

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

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, FLOWTRAN, Micro-Cache PC Methods.

UNIVERSITY OF SOUTH CAROLINA

DISTILLATION METHODS: McCabe-Thiele, Fenske-Underwood-Gilliland, Naphtali-Sandholm.

DESIGN: For the Mass Transfer class, an Absorption column is designed. Spec. sheets, packing used, materials of contruction, Design Report with letter of transmittal required. Over the years, many different systems have been given including Hot Carbonate, Benfield, Aqueous Salt Solution for CO_2 and/or SO_2 absorption.

For the Separations Design class, a multicomponent distillation design is required. Each student has a separate system of at least 4 components two of which are (relatively) nondistributing. A design report with a tray design (using the Glitch manual), Spec. sheets, etc. is required.

UNIVERSITY OF SOUTHWESTERN LOUISIANA

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

DESIGN: Students are asked to prepare a flowsheet (i.e. synthesize a process) to separate the mixture into relatively pure materials.

STANFORD UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit and CaChE separation simulations.

TENNESSEE TECHNOLOGICAL UNIVERSITY

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

DESIGN: One small design problem (PROCESS).

TEXAS A&I UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

DESIGN: Design a distillation column; design an absorption column.

TEXAS A&M UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Numerical Methods-Theta Method.

DESIGN: Binary distillation design only; multicomponent numerical design.

UNIVERSITY OF TEXAS-AUSTIN

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

DESIGN: Optimize a multicomponent distillation problem.

TEXAS TECH UNIVERSITY

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

DESIGN: Require development of computer programs (student choice of PC or mainframe) for: single-feed McCabe-Thiele; isothermal flash with dew and bubble T, P; column condenser selection; Fenske-Underwood-Gilliland shortcut multicomponent distillation.

TUSKEGEE UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF TOLEDO

DISTILLATION METHODS: McCabe-Thiele, FLOWTRAN.

DESIGN: Multicomponent adiabatic flash system with two feed streams; simulation of a large countercurrent extraction cascade in which the two liquid phases form non-ideal mixtures. (Both projects have to be solved using FLOWTRAN system.)

UNIVERSITY OF TULSA

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

VILLANOVA UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF VIRGINIA

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

VIRGINIA POLYTECHNIC INSTITUTE

DISTILLATION METHODS: McCabe-Thiele, some computer simulation-internally generated software.

DESIGN: Distillation and sometimes other processes.

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.

DESIGN: Design of the ethylenelethane and propylene/propane separation loop in a polyethylene/polyproylene plant.

WIDENER UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, FLOWTRAN, CHEMCAD, Ponchon-Savarit.

DESIGN: A distillation column with auxiliaries. Does not include costing.

UNIVERSITY OF WISCONSIN

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

WORCESTER POLYTECHNIC INSTITUTE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

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, Ponchon-Savarit.

UNIVERSITY OF BRITISH COLUMBIA

DISTILLATION METHODS: McCabe-Thiele, Underwood-Fenske, Tridiagonal, Matrix.

DESIGN: Design of an absorption-stripping system for O_2-enriched air for medical purposes.

LAKEHEAD UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

LAVAL UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, Simulation program.

DESIGN: Design of a distillation unit.

MCMASTER UNIVERSITY

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

UNIVERSITY OF NEW BRUNSWICK

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

TECHNICAL UNIVERSITY OF NOVA SCOTIA

DISTILLATION METHODS: McCabe-Thiele.

UNIVERSITY OF OTTAWA

DISTILLATION METHODS: McCabe-Thiele.

QUEEN'S UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF SASKATCHEWAN

DISTILLATION METHODS: McCabe-Thiele, Fenske-Underwood, Wang-Henke.

UNIVERSITE DE SHERBROOKE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit, PROSEP I.

UNIVERSITY OF TORONTO

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: Simple distillation column for binary mixture.

UNIVERSITY OF WATERLOO

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

DESIGN: Design of packed absorption towers.

UNIVERSITY OF WESTERN ONTARIO

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

STEPHENS INSTITUTE OF TECHNOLOGY

DESIGN: Packed-column design; tray-column design.

UNIVERSITY OF TENNESSEE

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

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

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

MCGILL UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

OKLAHOMA STATE UNIVERSITY

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

UNIVERSITY OF ARIZONA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

UNIVERSITY OF IOWA

DISTILLATION METHODS: McCabe-Thiele, Ponchon-Savarit.

CORNELL UNIVERSITY

DISTILLATION METHODS: McCabe-Thiele, PROCESS.

DESIGN: Selection of separation process and design of contacting equipment.

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 achieve a specific goal. Generally, 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 given freedom regarding the unit operations chosen and the selection of other details of the process flow sheet.

UNIVERSITY OF LOWELL

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: One of the projects we assign is to ask the student to visit a nearby maple syrup plant and come up with an improved design.

UNIVERSITY OF COLORADO

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

DESIGN: Multicomponent distillation column.

HARVEY MUDD COLLEGE

DISTILLATION METHODS: McCabe-Thiele.

DESIGN: CO_2 absorber/stripper.

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 their choice in groups of 1 to 3. They present their results in a 15 minute oral report and a 5-10 page written report. They are evaluated by the class and the instructor.

LOUISIANA TECH UNIVERSITY

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