

INTRODUCTION

This survey is the nineteenth in a series on undergraduate chemical engineering courses that began in 1971. Each survey attempts to present the current text materials, course credits, curriculum placement, student enrollments, topical content and special features of one of about ten standard chemical engineering courses. The first cycle began with Mass and Energy Balances in 1971 and ended with Chemical Engineering Electives in 1980. The second cycle

~~on Mass and Energy Balances last year~~ This 1990 survey .

on Mass and Energy Balances begins the third cycle.

I. COURSE MECHANICS

This section of the report summarizes administrative factors. These include student enrollments and the time

Course Length.

About 19% of the departments responding operate on the quarter system. In every earlier survey, about 24% of the departments used the quarter system. Perhaps this reflects a trend from the quarter system to the semester system. The quarter lasts just over 10 weeks while the semester is less than 15 weeks long. Both time periods exclude final examinations.

COURSE LENGTH (Quarter Basis)		COURSE LENGTH (Semester Basis)	
<u>Length</u>	<u>Departments</u>	<u>Length</u>	<u>Departments</u>
9 weeks	1	13 weeks	12
10 weeks	18	14 weeks	31
11 weeks	4	15 weeks	47
12 weeks	6	16 weeks	9
		17 weeks	1
Average	10.5 weeks	Average	14.4 weeks

NUMBER OF COURSES (Quarter Basis)		NUMBER OF COURSES (Semester Basis)	
<u>Number</u>	<u>Departments</u>	<u>Number</u>	<u>Departments</u>
one	12	one	86
two	13	two	22

Course Level.

The Mass and Energy Balance course is usually taught at the sophomore level. Within the sophomore year, there is a preference for the first semester and the first quarter.

COURSE LEVEL
(Semester Basis)

<u>Semester</u>	<u>Courses</u>
Freshman, Semester 1	6
Freshman, Semester 2	4
Sophomore, Semester 1	63
Sophomore, Semester 2	45
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Junior, Semester 1	7
Junior, Semester 2	2

(Quarter Basis)

<u>Quarter</u>	<u>Courses</u>
Sophomore, Quarter 1	20
Sophomore, Quarter 2	13
Sophomore, Quarter 3	5
Junior, Quarter 1	4

Class Sessions.

In 70% of the departments, the course meets for three

week. Just under half the departments offer no "laboratory" hours. 26 departments have 1 laboratory hour and 22 departments have two laboratory hours each week. Questionnaire responses show that the laboratory sessions are devoted to problem sessions.

Hours	Departments
1	2
2	26
3	89
4	11
Average	2.85

MATERIAL COVERED IN THE
PROBLEM LABORATORY

Homework
Computer programming instruction
Case studies
Approaches to problems

ADDITIONAL TEXTBOOK TOPICS

Safety
Computers
Open-ended problems
Environmental concerns
Combined mass and energy problems
Psychology of problem solving
Economics
Ethics

TEXTBOOK SELECTION

Felder, Rousseau	96
Himmelblau	18
8 other texts	20

63% of the departments offer one section of Mass and Energy Balances annually. 25% offer two sections. Half of the sections have enrollments of 11 to 25 students.

NUMBER OF SECTIONS
(1989-90)

<u>Sections</u>	<u>Departments</u>
1	85
2	34
3	9
4	3
5	2
6	2

COURSE ENROLLMENT
(1989-90)

<u>Enrollment</u>	<u>Courses</u>
1 - 10	17
11 - 15	28

31 - 35	15
36 - 40	9
40 - 50	5
51 +	26

II. BACKGROUND

This section examines the technical background of students enrolled in Mass and Energy Balances.

Prerequisites.

Mass and Energy Balances in the first

Do you offer a formal course in computers to chemical engineering students?

	<u>Departments</u>
Yes	101
No	22

In which year is the course offered?

	<u>Departments</u>
Freshman year	71
Sophomore year	28
Junior year	0

Which classes of programming are covered in the computer course?

Departments

Word Processing	36
BASIC	30
Pascal	17
Symbolic Math	15
Other	17

III. COURSE CONTENT

This section deals with several aspects of the course content. These include textbook selection, problem solving and design content.

Textbook.

In almost every survey conducted over the past 20 years, one textbook is used in a majority of the courses.

seau was used in 96 courses. Nine other texts were men-

STRENGTHS AND WEAKNESSES OF THE TEXTBOOK

Clarity
Example problems
Typographical errors
Case studies
Greater detail
Language
Problems
Notation
Computer problems
Tables

Most departments (90%) encourage their students to use the computer in solving assignments in this course. However, most text problems are more appropriately solved with a calculator than a computer. This text course (65%)

the computer for less than 30% of the assignments. PC ownership is not widespread among chemical engineering students. 60% of the departments report that 30%

their students own PC's.

Do you encourage students to use the comput-

What percent of the students own a PC?

<u>Percent</u>	<u>Departments</u>
0	30
11	60
30	12
40	4
50+	18

SI system is more widely used than the English system in solving problems. Many departments use both systems equally. Where one system is favored over the other, the SI system is usually favored.

What percent of the problems you assign are solved in the SI system?

<u>Percent</u>	<u>Departments</u>
-40	19
50	46
60	14
70	15
80	20
90+	20

What percent of the problems would be solved in the SI system?

The inclusion of design in the Mass and Energy Balances course was examined through the next four questions. Most

the text. 28% assign projects lasting one month or longer and 32% use case studies from the text. 36% of the departments claim no ABET design credit for the course. 40% claim 1/2 or 1 credit and 16% claim 1 1/2 or more credit.

If open-ended design problems were included in the text would you assign them

	<u>Departments</u>
Occasionally	80
Often	31
Never	16

Do you assign a project lasting one month or longer in this course?

Departments

Do you use case studies from the textbook?

	<u>Departments</u>
Yes	43
No	90

How many ABET design credits do you assign to this course?

<u>Credits</u>	<u>Departments</u>
0.0	48
0.5	11
1.0	44
1.5	4
2.0	6
3.0	9
4.0	1

CASE STUDY IMPLEMENTATION

The following responses from the questionnaire indicate how different case studies are used at different universities.

We solve several case studies (at least two per semester) that involve

I assign one of the case study problems in the text. It usually involves the mass and energy balances for the preliminary design project at the beginning of the

COMPARISONS WITH THE 1981 SURVEY

The 1981 questionnaire asked fewer and different ques-
 tions compared with the 1980 survey.

are limited. The course level for the Mass and Energy course has changed very little. It is still an early sophomore course. In both years, a problem laboratory was included in 51% of the courses.

<u>Semester</u>	COURSE LEVEL (Semester Basis)	
	<u>% of Courses</u>	
	<u>1990</u>	<u>1981</u>
Freshman, Semester 1	4	4
Freshman, Semester 2	3	8
Sophomore, Semester 1	50	47
Sophomore, Semester 2	35	34
Junior, Semester 1	6	8
Junior, Semester 2	2	2

A more significant difference occurs in the prerequisites for the course.

