

THE TEACHING OF UNDERGRADUATE

CHEMICAL ENGINEERING THERMODYNAMICS

A Survey Prepared by the  
Chemical Engineering Education Projects Committee  
American Institute of Chemical Engineers  
November 5, 1992

## INTRODUCTION

This survey is the twenty-first in a series on undergraduate chemical engineering courses that began in 1971.

## I. COURSE MECHANICS

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

### Course Length.

About 19% of the departments responding operate on the quarter system. The quarter lasts just over 10 weeks while the semester is less than 15 weeks long. Both time periods exclude final examinations periods.

COURSE LENGTH

COURSE LENGTH

(Quarter Basis)		(Semester Basis)	
<u>Length</u>	<u>Departments</u>	<u>Length</u>	<u>Departments</u>
9 weeks	1	12 weeks	3
10 weeks	13	13 weeks	8
11 weeks	4	14 weeks	22
		15 weeks	30

Average 14.6 weeks

### Number of Courses

Many departments report two courses in thermodynamics. The first course is often a core course taken by chemical, mechanical and other engineers. The second course is then for chemical engineers only. Other departments report just one course in thermodynamics. In this survey, 46% of the departments reported two courses. However, some replies

NUMBER OF COURSES

<u>Courses</u>	<u>Departments</u>
1	52
2	44

Course Level.

The Chemical Engineering Thermodynamics course is

semesters of the junior year, respectively. An alternative is to teach the courses in the second sophomore semester and the first junior semester. In 1982, 49% of the first courses were taught in the first junior semester and 54% of the second courses were taught in the second junior semes-

**COURSE LEVEL**  
(Two Courses, Semester Basis)

<u>Semester</u>	<u>Course #1</u>	<u>Course #2</u>
Sophomore, Semester 1	7 (10)	
Sophomore, Semester 2	4 (14)	2 (8)
Junior, Semester 1	22 (27)	12 (12)

Junior, Semester 2	12 (10)	18 (31)
Senior, Semester 1	2 (4)	1 (5)

(1982 results in parentheses)

(Two Courses, Quarter Basis)

<u>Quarter</u>	<u>Course #1</u>	<u>Course #2</u>
Sophomore, Quarter 3	5	
Junior, Quarter 1	1	2
Junior, Quarter 2	10	4
Junior, Quarter 3		5
Senior, Quarter 1		1

Class Sessions.

In 76% of the departments, thermodynamics meets for three hours lecture per week. No laboratory experience was reported.

**LECTURE HOURS PER WEEK**  
(Based on 50-minute periods)

Class Sections and Enrollment.

78% of the departments offer one section of Chemical Engineering Thermodynamics annually. 16% offer two sections. Two-thirds of the sections have enrollments of 30 students or less. The average enrollment per section is 45.

**NUMBER OF SECTIONS**  
(1991-92)

<u>Sections</u>	<u>Departments</u>
1	74
2	15
3	3
4+	3

**COURSE ENROLLMENT**  
(1991-92)

<u>Enrollment</u>	<u>Courses</u>
11 - 20	24
21 - 30	36
31 - 40	20
41 - 50	15
51 - 60	16
61 - 80	12
81 - 100	6
100+	14
Average	45

Graduate Assistants

Only four departments used graduate teaching assistants in the thermodynamics course. In each case the TA's gave less than 30% of the lectures.

## II. BACKGROUND

This section examines the technical background of students enrolled in Chemical Engineering Thermodynamics.

### Prerequisites.

The position of Chemical Engineering Thermodynamics in the first or second semester of the junior year is reflected

in the courses students have taken during their freshman and sophomore years. Mass and Energy Balances has been complet

half the students have completed Differential Equations, Physical Chemistry and Organic Chemistry and at least two semesters of Calculus.

### III. COURSE CONTENT

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

#### Textbook.

In almost every survey conducted over the past 20 years one textbook is used in a significant majority of the courses. This survey was no exception. The text by Smith

was used in 30 courses (22%). Six other texts were used in 12 courses.

#### TEXTBOOKS

Smith, J. W., and Van Ness, H. C.: Introduction to Chemical Engineering



Computer Use.

Four questions on the questionnaire dealt with the use of computers in thermodynamics courses.

What computer languages/programs do students use in this course?

	<u>Departments</u>
FORTTRAN	58
Pascal	4
Other	40

Two thirds of the departments require their students to

Because the computer is not used in the department

What percent of the students own a PC?

<u>Percent</u>	<u>Departments</u>
0	34
10	14
20	14
40	6
50+	20

The English system is more widely used than the SI system in solving problems. Many departments (75%) would like to use the SI system over 50% of the time.

<30	8
40	3
50	24
60-70	11
80	24
90	8
100	18

What percent of the problems would you like to see solved in the SI system?

<u>Percent</u>	<u>Departments</u>
<30	10
40	2
50	31
60-70	6
80	19

How many major tests do you give in this course?

<u>Number</u>	<u>Departments</u>
1	7
2	26
3	34
4	24
5	4

Do you cover reaction equilibria in this course?

	<u>Departments</u>
Yes	52
No	44

Do you use self-paced instruction in this course?

	<u>Departments</u>
Yes	4
No	29

er program (such as PRO/II) in this course?

	<u>Departments</u>
Yes	14
No	81

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

	<u>Departments</u>
Yes	12
No	83

experience for a professional engineer's license. The questionnaire sought to determine how many chemical engineering seniors take the first exam, the EIT exam. About half the replies presented data on both the number of B.S. chemical engineering graduates in 1991-92 and the number

Some departments require seniors to take





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