SUMMARY REPORT

TEACHING OF UNDERGRADUATE PROCESS DYNAMICS AND CONTROL

A mini-session presented at the

Annual Meeting

American Institute of Chemical Engineers

Los Angeles, California

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Committee Members

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[redacted]

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INTRODUCTION

The appended questionnaire was sent in May, 1975 to the Chairman of each Electrical Engineering Department in the United States and Canada, together with

TEXTBOOK SELECTION (Cont'd)

[redacted]

Smith, C.L., "Digital Computer Process Control", Intext, 1972.

[redacted]

1965.

Tyner, M. and May, F.P., "Process Engineering Control", Ronald, 1968.

Weber, T.W., "Introduction to Process Dynamics and Control", Wiley, 1973.

NUMBER AND LEVEL OF COURSES

[redacted]

textbooks indicate an increasing interest in digital simulation and direct

need for practical applications of process control was also frequently cited.

About 1/3 of the courses use classroom demonstrations and audio-visual aids to reinforce class lectures. Three-fourths of the courses rely on laboratory work to complement classroom lectures.

LABORATORY CONTENT

The table below lists the percentage of universities offering no laboratory work in the designated area, and the average number of hours per semes-

STUDENT REACTION (Cont'd)

this course, and some students are turned off by having to dredge up knowledge from past courses for use in this one. Most of the students who are at least moderately conscientious, though, feel the course is good for them"

"50% think it's great, relevant, etc.; 25% think it's a waste of time."

[redacted]

[redacted] but without any antagonism.

"Enjoy 'practical' part of course, no theory."

"Everything seems foggy or hazy."

"It was difficult. Co-op students with industrial experience seem to more appreciate the significance of control and process dynamics. First [illegible] application of differential equa-

UNDERGRADUATE PROCESS DYNAMICS AND CONTROL

1. Identification

   Instructor _____ University _____

8. Course Title(s)

	Class Hr/Week	Lab Hr/Week
1. _____	_____	_____
2. _____	_____	_____

9. Level of Course

   Course 1 (Circle 2): Jr/Sr 1st/2nd Semester 1st/2nd/3rd Quarter

10. Text(s) and Resources (Author/Title)

1. Area(s) of primary instructional emphasis (circle answers)

   A. Mathematical modeling-analytical
   B. Mathematical modeling-empirical
   C. Control
   D. Instrumentation
   E. Others (please specify)

2. Do you reinforce class lectures with any of the following (circle answer)?

   A. Classroom demonstrations
   B. Audio-visual aids
   C. Laboratory experiments
   D. None of the above
   E. Others (please specify)

3. For the areas of question 2, are any of the following used (circle

[redacted]

   A. Hardware type experiments

[redacted]

UNIVERSITY OF AKRON

I: "Process Dynamics and Control"
(Sr, Qtr 2) 3/3
ex. Coughanowr & Koppel

OBJECTIVES
a. Modeling of physical systems.
b. Convey analogies between systems.
d. Achieve good background in

TEXT
Practical applications are needed -
"how it is really done."

ALT. COVERAGE
None
OBJECTIVES

CATHOLIC UNIVERSITY OF AMERICA

I: "Process Instrumentation and Control" (Sr. Sem 2) 3/0

OBJECTIVES
a. Principles of operation of process instruments. b. Process control strategy. c. Installation, calibra-

DIFFICULT CONCEPTS
Frequency response & root locus, both because of poor training in complex numbers.

UNIVERSITY OF MASSACHUSETTS

I: "Process Dynamics & Control"
(Sr, Sem 2) 3/3

MICHIGAN STATE UNIVERSITY

I: "Process Dynamics & Control"
(Sr, Qtr 2) 3/0

[redacted] ALT. COVERAGE [redacted] ALT. COVERAGE

[redacted]

[redacted] "Chemical Engineering Design" OBJECTIVES [redacted] TEXT

[redacted] Analyze simple chemical processes [redacted] Problems are generally math exercises

UNIVERSITY OF OKLAHOMA

I: "Process Dynamics & Control"
(Sr, Sem 2) 3/0 (Self-paced)
TX: Notes

[redacted]ULT CONCEPTS

RENSSELAER POLYTECHNIC INSTITUTE

I: "Chemical Process Control"
(Sr, Sem 2) 3/0
TX: Coughanowr & Koppel

DIFFICULT CONCEPTS

OBJECTIVES

a. Mathematical modeling. b. Limitations of linear model. c. Transfer functions. d. Block diagrams and simple feedback loops. e. Stability, Bode, Nyquist, root locus design.

NIVERSITY OF TEXAS - AUSTIN

"Automatic Process Control"
(Sr, Sem 2) 3/0
TX: Hougen: "Measurements and Control Applications"

ICULT CONCEPTS
equency response; learning to think in the frequency domain; visualization of process behavior.
ALT. COVERAGE

TULANE UNIVERSITY

I: "Process Dynamics & Control"
(Sr, Sem 1) 3/0
TX: Harriott: "Process Control"
II: "Mathematics of Control"
(Jr, Sem 1) 3/0
TX: Coughanowr & Koppel

DIFFICULT CONCEPTS
Frequency response analysis.

OBJECTIVES
a. Principles of process control applicable to single loop linearization systems. b. System characterization and stability. c. Control and analytical hardware, and their capabilities and limitations.

WASHINGTON UNIVERSITY

I: "Chemical Process Dynamics and

WAYNE STATE UNIVERSITY

UNIVERSITY OF WYOMING

OBJECTIVES
a. Controls. b. Mathematical modeling.
c. Frequency response techniques.
d. Stability. e. Control design.

I: "Industrial Instrumentation"
(Sr, Sem 1) 2/3
TX: Coughanowr & Koppel

DR. D. W. HUBBARD, [redacted]

Fall 1973

Course Policy

Instead of the usual dog and pony show -- lectures and exams -- we are going to use a mastery oriented instruction method for CM416. The method has been used at MIT, Michigan State, University of North Carolina, Bucknell, Harvard, and more than 100 other places. Most students having taken a course by this method choose to take other courses by the same method rather than by the lecture method. They say they learn more and have more fun than in courses in which lectures are used as the main

work of the tutors and be the final judge when there is a disagreement about the results of a quiz. He will always be available to help you learn by discussing the

more than two quizzes on any single unit.

There will be a senior tutor -- a graduate student -- who will give out

quizzes and maintain the course records. There will also be junior tutors who

Table 1. Grading Scheme Details

Passing a study unit - 10 points; maximum possible	+ 120
Exam Score	
maximum possible	+ 12
Penalty points for passing a study unit more than one week late -- subtract 1 point per unit; maximum possible	− 12
Assisting as a tutor - 2 points/week; maximum possible	+ 14

Grading Scale

A+ ≥ 200 ← A student getting this score will receive a certificate

Final Examination

A final examination will be given during the final examination period in November. This examination will cover a sampling of all of the objectives stated for the course. Every student must take the final examination. For those students who finish all the study units early, there will be an early final [illegible]

[redacted]

his score, he may take the regular final examination and use the better of the two examination scores for computing the final course grade.

Hours

List of Study Units

1. Differential equations revisited

   A review of essential mathematics

2. Transport phenomena strikes again

   Conservation principles and control system terminology

3. The LDEWCC meets its Waterloo at the hands of Laplace

   More mathematical methods

4. Everything you want to know about first-order systems

   Simple open loop system behavior

5. Ditto for higher order systems

   More complex open loop system behavior

6. Closing the loop again

   Describing closed loop systems

7. A little about valves and more about controllers

   Describing loop closing devices

8. Control system response -- back to mathematics at last

   Closed loop system behavior

9. Solving differential equations (*)