Academic Learning Compact

Chemical Engineering
Description of the Major
The chemical engineering program will enable you to apply knowledge of mathematics, science and engineering principles to chemical engineering problems; to design and conduct chemical engineering experiments and to analyze and interpret the data; to design a chemical engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints; and to communicate technical data and design information effectively in speech and in writing to other chemical engineers. This is a nationally accredited ABET program. Additional information is available from your major's website.
Before Graduating You Must
• Pass an assessment by two or more faculty and/or industry practitioners of performance on a major design experience. • Pass assessment in two courses of individual assignments targeted to each learning outcome. Assessment will be provided by the instructor of the course according to department standards. • Complete an exit interview in your final semester. • Satisfy the Florida statutes for the College-Level Academic Skills Requirement.>* • Complete requirements for the baccalaureate degree, as determined by faculty.
Skills You Will Acquire in the Major (SLOs)
1. Apply knowledge of mathematics, science and engineering principles to chemical engineering problems. 2. Design and conduct chemical engineering experiments and analyze and interpret the data. 3. Design a chemical engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints. 4. Communicate technical data and design information effectively in writing and in speech to other chemical engineers.

Achievement of the Student Learning Objectives (SLOs) is assessed on yearly basis by various methods including

a. Direct assessment of students' performance on homework, quiz or exam problems
b. Employer evaluation (Co-op/internship, interview recap)
c. Student survey (juniors and seniors)
d. Exit survey/interview (graduating seniors)
e. Course evaluations

The results of assessment conducted during the academic year 2008-2009 are summarized below for each SLO:

SLO-1: *An ability to apply knowledge of mathematics, science, and engineering principles to chemical engineering problems*

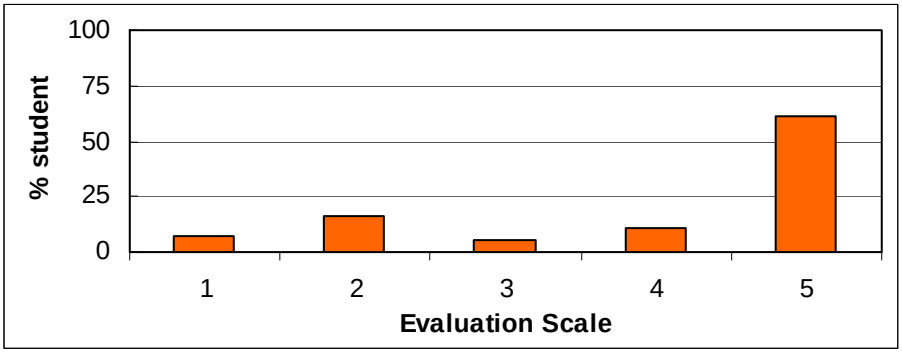
1) Direct Assessment

Direct assessment of SLO-1 was conducted by 4 courses (ABE2062, ECH3023, ECH3101, ECH4604). A summary of an assessment by ECH4604 (Process Economics and synthesis) in Fall 2008 is given here as an example.

The following course objectives of ECH4604 that are linked to SLO-1 were assessed using homework assignment #4:

- *Understand the concept related to "time value of money" such as simple and compounded interest, annuities, and depreciation*
- *Draw and interpret cash flow diagrams*
- *Perform cash flow analysis*
- *Analyze alternatives to determine the most cost effective equipment/process*

If more than 70% of the students were to receive 3 or more on the evaluation scale from 1 to 5, the outcome would be considered to be achieved, and the result was as follows:

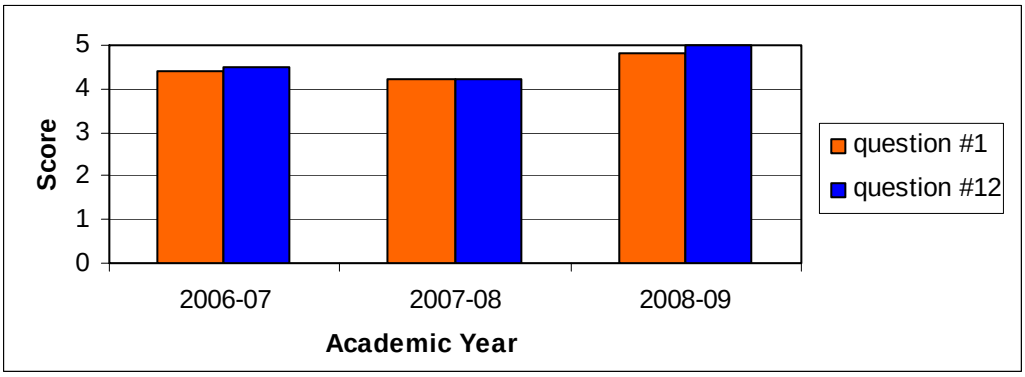


77% of the students earned a score 3 or above meeting the target.

2) Co-op/internship evaluation

Questions #1 and #12 of the Co-op and Internship Evaluation Questionnaire for employers are linked to SLO-1, and the results are as follows:

- *Question #1: Ability to apply knowledge in mathematics, science, and engineering*
- *Question #12: Ability to apply knowledge to practice*

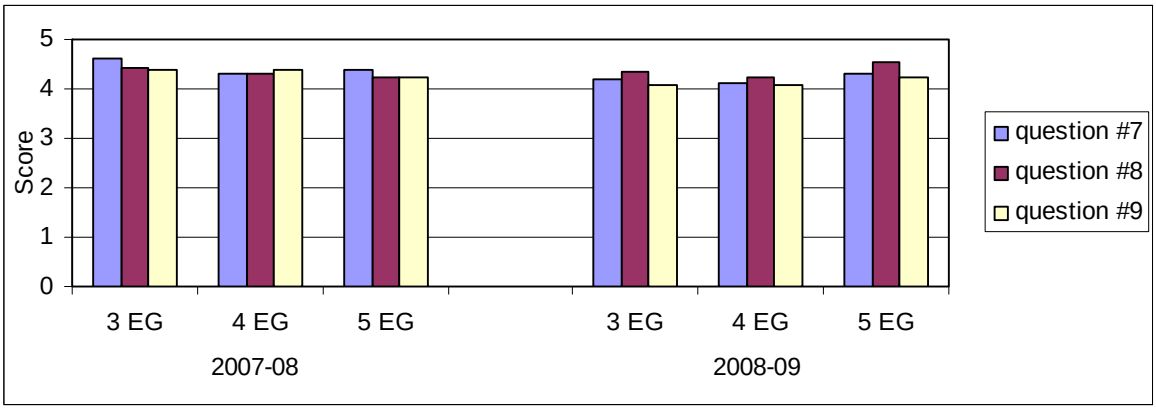


The scale for the score is from 5 to 1, with 5 being outstanding, 4 very good, 3 average, 2 below average, and 1 marginal.

3) Student survey

Questions #7, #8 and #9 of the student survey questionnaire are linked to SLO-1, and the results are as follows:

- *Question #7: I am completely capable of applying my knowledge of mathematics.*
- *Question #8: I am completely capable of applying my knowledge of science.*
- *Question #9: I am completely capable of applying my knowledge of engineering.*



1-5 scale with 5 indicating strong agreement with the statement, 3 neither agreement nor disagreement, and 1 strong disagreement.

Students are classified as 3, 4 and 5 EG (engineering students) based on the number of credits earned rather than juniors and seniors.

These results indicate that SLO-1 is achieved.

SLO 2: *an ability to design and conduct experiments as well as to analyze and interpret data*

1) Direct assessment:

Direct assessment of SLO-2 was conducted by three courses (ECH3101, ECH3223 and ECH4224L). A summary of the assessment by the Filtration lab of ECH4224L (Fluid and Energy Transfer Operations Laboratory) in Spring 2008 is given here as a sample.

The following course objectives of ECH4224L that are linked to SLO-2 were assessed by interviewing the student teams and reviewing their preliminary and final lab reports:

- *understanding of the fundamental concepts*
- *ability to translate the physical understanding into a mathematical model*
- *ability to obtain parameters of the model by fitting data obtained in the lab to the model*
- *ability to scale-up based on the model*
- *ability to communicate the results in an effective manner*

If more than 70% of the students were to receive a grade of 85 or better, the outcome would be considered to be achieved, and the result was as follows:

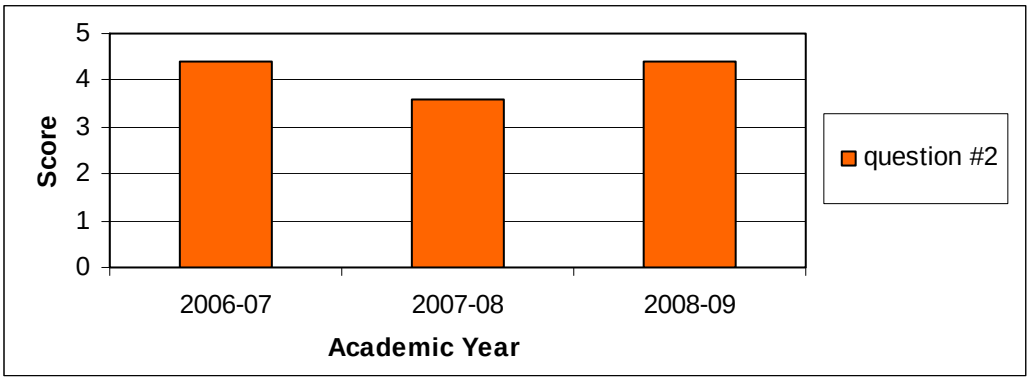
Score	No. of students
0-80	4 (12.5%)
80-85	4 (12.5%)
85-90	8 (25%)
90-95	8 (25%)
95-100	8 (25%)

75% of the students earned a score of 85 or more meeting the target.

2) Co-op/Internship evaluation

Question #2 of the Co-op and Internship Evaluation Questionnaire for employers is linked to SLO-2, and the results are as follows:

- *Question #2: Ability to design/conduct experiments; analyze and interpret data*

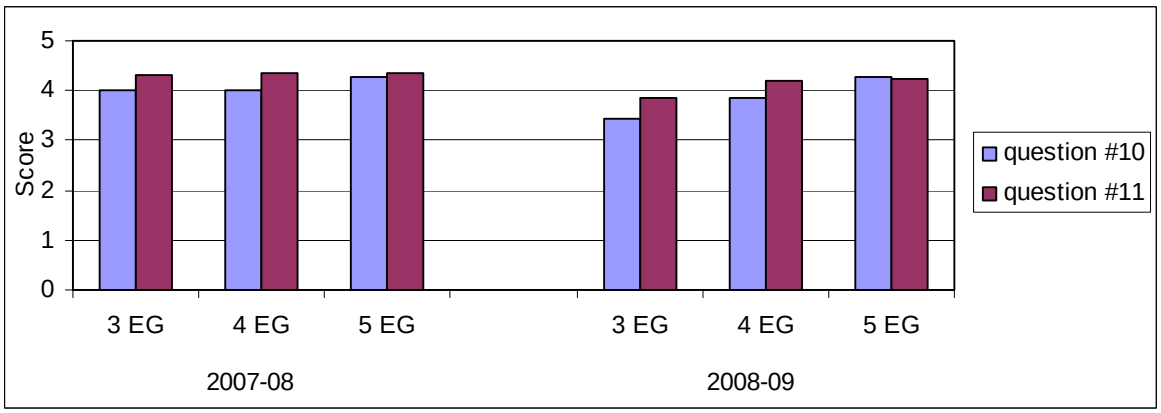


The scale is from 5 to 1, with 5 being outstanding, 4 very good, 3 average, 2 below average, and 1 marginal.

3) Student survey

Questions #10 and #11 of the student survey questionnaire are linked to outcome (b), and the results are as follows:

- *Question #10: I am completely capable of designing and conducting experiments.*
- *Question #11: I am completely capable of analyzing and interpreting data.*



1-5 scale with 5 indicating strong agreement with the statement, 3 neither agreement nor disagreement, and 1 strong disagreement.

These results indicate that SLO-2 is achieved.

<u>SLO-3:</u> *An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability*

1) Direct assessment:

Direct assessment of SLO-3 was conducted by two courses (ECH3203, ECH4123). A summary of an assessment by ECH4123 in Spring 08 is given here as an example. The course objectives that are linked to SLO-3 are:

- *Understand the fundamental basis of phase and chemical equilibria.*
- *Apply the criteria for equilibrium to predict equilibrium states in pure and multiple component systems under reactive and non-reactive conditions.*
- *Solve equilibrium problems by hand calculation and using software.*

and these objectives were assessed using three exams in series.

After Exam 1, the instructor introduced a detailed method for formulating problems involving chemical and phase equilibrium. The instructor followed this method repeatedly in class and

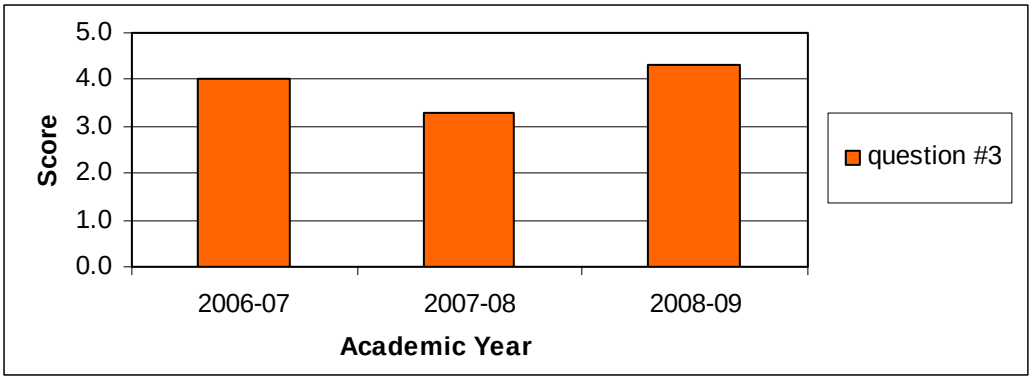
insisted that students follow the same outline in solving homework problems. This approach appeared to be particularly helpful in reducing mistakes arising from students paying insufficient attention to the problem statement.

If more than 70% of the students were to receive 60% or more on the final exam (Exam 3), the outcome would be considered to be achieved, and the following result indicated that the target was met:

Exam 1: 14 students scored over 60%, 28 did not (33% reached target)
Exam 2: 21 students scored over 60%, 18 did not (54% reached target)
Exam 3: 28 students scored over 60%, 11 did not (72% reached target)

2) Co-op/Internship evaluation
Question #3 of the Co-op and Internship Evaluation Questionnaire for employers is linked to SLO-3, and the results are as follows:

- *Question #3: Ability to design a system, component or process*

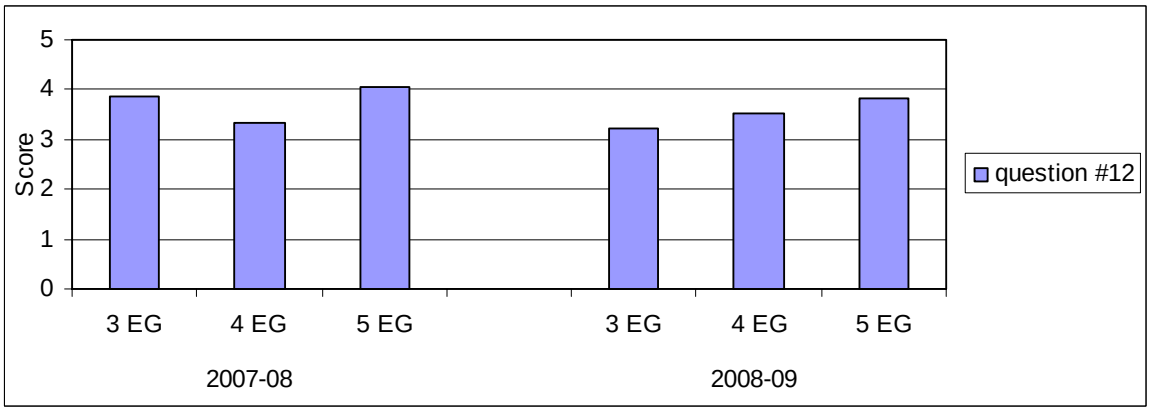


The scale is from 5 to 1, with 5 being outstanding, 4 very good, 3 average, 2 below average, and 1 marginal.

3) Student survey

Question #12 of the student survey questionnaire is linked to outcome (c), and the results are as follows:

- *Question #12: I am completely capable of designing a system, component or process to meet desired needs.*



1-5 scale with 5 indicating strong agreement with the statement, 3 neither agreement nor disagreement, and 1 strong disagreement.

These results indicate that SLO-3 is achieved.

<u>SLO-4</u>: *An ability to communicate effectively*

1) Direct Assessment

Direct assessment of SLO-4 was conducted by two courses (ECH3023 and ECH4934). A summary of the assessment by ECH3023 (Material and Energy Balances) in Spring 2008 is given here as an example.

The following course objective of ECH3023 that is linked to SLO-4 was assessed by evaluating students' presentations on a case study:

- *Work ethically with other students, both engaging in discussions and group reports and working independently.*

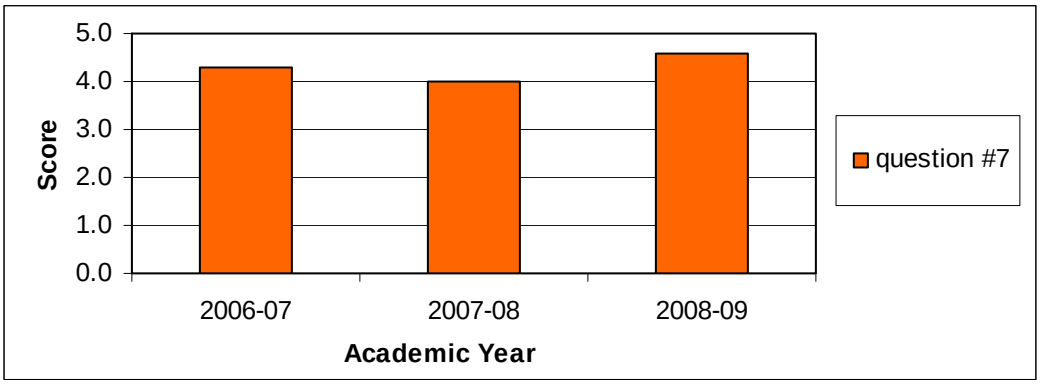
The class was divided into 8 groups of four or five students each, and each group was assigned to work on a case study (removal of sulfur dioxide from power plant flue gas by scrubbing with limestone slurry) for a period of 3 weeks. Students were required to submit three group reports and were required to make two group presentations. Presentation materials prepared by students (mostly Power Point files) were also reviewed and graded.

If more than 70% of the groups receive 90% or more on the overall project score, the outcome would be considered to be achieved. 7 groups received a 90% or above on the project, and 1 group received a score of 85% implying more than 70% of the groups received 90% or more, thus meeting the target.

2) Co-op/Internship evaluation

Question #7 of the Co-op and Internship Evaluation Questionnaire for employers is linked to SLO-4, and the results are as follows:

- *Question #7: Ability to communicate effectively*

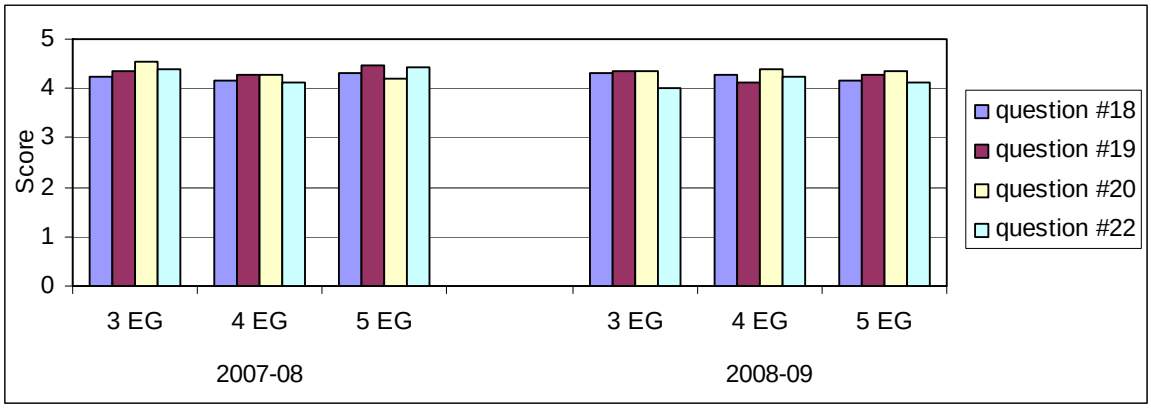


The scale is from 5 to 1, with 5 being outstanding, 4 very good, 3 average, 2 below average, and 1 marginal.

3) Student survey

Questions #18 to #22 of the student survey questionnaire are linked to SLO-4, and the results are as follows:

- *Question #18: I can clearly communicate orally.*
- *Question #19: I can clearly communicate in writing*
- *Question #20: I can listen effectively*
- *Question #22: I can easily correspond using the latest communications technology*



1-5 scale with 5 indicating strong agreement with the statement, 3 neither agreement nor disagreement, and 1 strong disagreement.

These results indicate that SLO-4 is achieved.