Department of

Chemical and Biomedical Engineering

Fenn College of Engineering

Annual Report

Program Assessment

Masters of Science in Chemical Engineering

Academic Year 2008-2009

Prepared by: Dhananjai B. Shah /Jorge E. Gatica
Department of Chemical and Biomedical Engineering, *July 2009*

A. Background Information

[What information about your program or unit is it important for assessment reviewers to understand?]

1. Degree Titles

The program assessment below pertains to the Masters of Science in Chemical Engineering (MS ChE).

2. Program Modes

The MS ChE program is offered in two modes:
1. Thesis option
2. Project option

The assessment metrics are collected only for those students following the Thesis option.

3. Contact Information

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B. Program Educational Outcomes [or Goals]

[What are your programs' or units' goals? How and when were your unit's goals of student learning developed? Who was involved? Have you reviewed your goals? Have they been modified based on assessment information?]

ABET's Glossary
Program Outcomes: List of topics/skills that students are expected to know/have after completing the program curriculum.

The following description of Chemical Engineering and our specific program educational objectives is quoted from our departmental publications such as brochures, flyers, CSU graduate catalog (http://www.csuohio.edu/gradcollege/catalog/) web pages, etc.

The graduate program in chemical engineering provides advanced training in core areas and allows the student to take courses on an advanced level in specific areas of interest.

The master's program is designed to meet the needs of both part-time and full-time students. It provides an opportunity for students to hold full-time employment and further their education on a part-time basis. Full-time students can complete the program in one year. The program meets the needs of students planning to continue their studies at the doctoral level as well as students terminating their formal studies at the M.S. level.

Research activities of the faculty provide many opportunities for students to select projects applicable to a Master's Thesis (CHE 699) or a Master's Project (CHE 698). Research areas include reaction engineering, process modeling and control, tribology and surface phenomena, biochemical and biomedical engineering, material synthesis and processing, combustion, adsorption and diffusion in zeolites, transport phenomena, fluid mechanics, separation processes, statistical mechanics, glass forming, thermodynamics, and management of technology. The department is particularly strong in applications involving materials sciences and biomedical engineering.

(Program Educational Outcomes)

The goals of this program are to develop in the student:

1. A more general and fundamental understanding of the principles underlying a particular field of study, as well as those underlying related fields.
2. A familiarity with advanced methods of analysis and synthesis that are more powerful and more generally applicable than those taught at the undergraduate level.

3. The ability to independently read and understand the significance and limitations of the relevant literature.
4. The ability to formulate, initiate, and complete new and innovative research projects that contribute to the advancement of the field.
5. To communicate effectively in written and oral form.

These program objectives are mapped into specific elements evaluated during the assessment of the Thesis and its oral defense (cf. assessment process detailed below).
Significant constituencies of MS ChE program are the faculty advisors, employers, and thesis committee members.

Employers/Companies:
The main mode of soliciting input from external constituencies is through the departmental Industrial Advisory Committee (IAC). The IAC is comprised of practicing engineers. We intentionally set up the visiting committee to cover fairly new engineers (about 5 years of school) to higher-ranking individuals with 20-plus years of experience. Some of the members are our own alumni.

The visiting committee members receive announcements, news, etc. during the year. The main half-day meeting occurs once a year. There is an agenda set before the meetings and supplementary materials are sent to the members beforehand. The meeting minutes are transcribed and distributed to the committee members, faculty and others (e.g. the Dean) after the meeting.

Faculty (Advisor and Thesis Committee):
The Program Educational Objectives were originally outlined by departmental faculty after a year of deliberations in 2000. Curricular matters as well as Program Assessment of all Engineering graduate programs are overseen by their respective Department and the Engineering Graduate Affairs Committee. The major ongoing role of the faculty is to analyze and evaluate the input from the IAC, the GAC, and biannual alumni surveys, and combine these inputs with their own assessment of the program. These are discussed yearly at a faculty retreat.

C. Description of Assessment Tools [or Research Methods]

[What indirect *and* direct *evidence have you gathered to measure accomplishment of your goals? What testing instruments, methods, and processes do you use to collect assessment data? Have these instruments been modified since your last report? If so, why?]*

The major instrument used for the assessment of the Program Outcomes is a questionnaire completed by the Thesis Committee members and any faculty present at the Thesis oral defense. (a copy of the questionnaire and mapping into Program Outcomes is attached to this report).

This questionnaire has been modified since the last report to include a detail of presentations made at National and International Symposia from materials derived from Masters Thesis Research.

1. Description of Assessment Methodology

All results are compiled and analyzed by the Graduate Program Director or Graduate Program Committee. The results are normalized from 0 to 3. Results below 1.5 are highlighted as areas requiring action; results below 2.0 are identified as areas requiring attention, while results above 2.0 are considered satisfactory.

The compiled results are presented to the department faculty at the Department Annual Retreat (in November). The areas identified as critical are analyzed again and any discrepancies (stemming from results from different methods) are resolved. The Department Retreat is where possible actions are recommended and approved, with specific decision about timelines and responsibilities for implementation.

A summary of the Department Retreat is compiled by the Engineering Criteria Department Coordinator and circulated among faculty for accuracy. Curriculum changes are then officially brought before the Department, College and University committees for approval and implementation.

This year some changes were instituted to ensure that all Thesis defenses contribute to the assessment process (the questionnaires for this AY assessment were not received in a timely manner, questionnaires corresponding to some Theses defenses were never made available for assessment).

D. Findings

Materials corresponding to three (3) Masters Theses defenses and thirteen (13) Masters Projects presentations were collected. The questionnaires reported no presentations made at International Symposia or publications in peer-reviewed journals. [Note that the assessment of Masters Projects was an action decided in the AY 2005-2006]

The results for the 2007-2008 Academic Year are tabulated below

Objectives Criteria	Exemplary	Satisfactory	Unacceptable	Average
1				**2.30**
1a	5	10		2.33
1b	5	9	1	2.27
2				**2.27**
	5	9	1	2.27
3				**2.13**
	5	7	3	2.13
4				**2.18**
4a	3	12		2.20
4b	6	9		2.40
4c	2	11	2	2.00
4d	5	7	3	2.13
5				**2.54**
5a	7	7	1	2.40
5b	7	8		2.47
5c	9	5	1	2.53
5d	12	3		2.80
5e	8	6	1	2.47
5f	9	6		2.60

These results suggest that although most outcomes have been satisfactorily met, there is clearly some room for improving the attainment of some of the goals of the program. Particularly in areas such as:

[**Goal 3:** The ability to independently read and understand the significance and limitations of the relevant literature.]

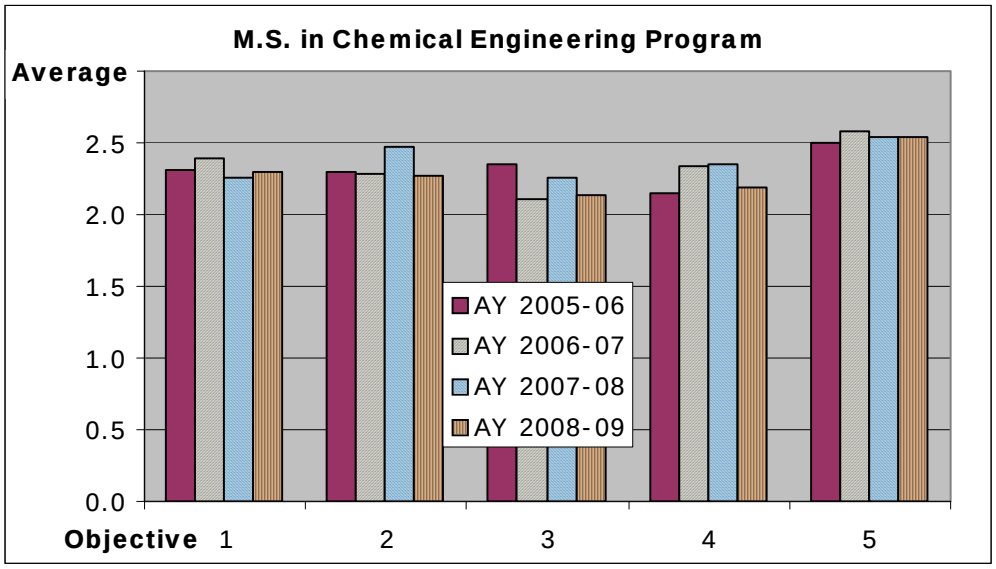
[**Goal 4:** The ability to formulate, initiate, and complete new and innovative research projects that contribute to the advancement of the field.]

4.c. Adequacy of the depth of the research

4.d. Novelty of the research

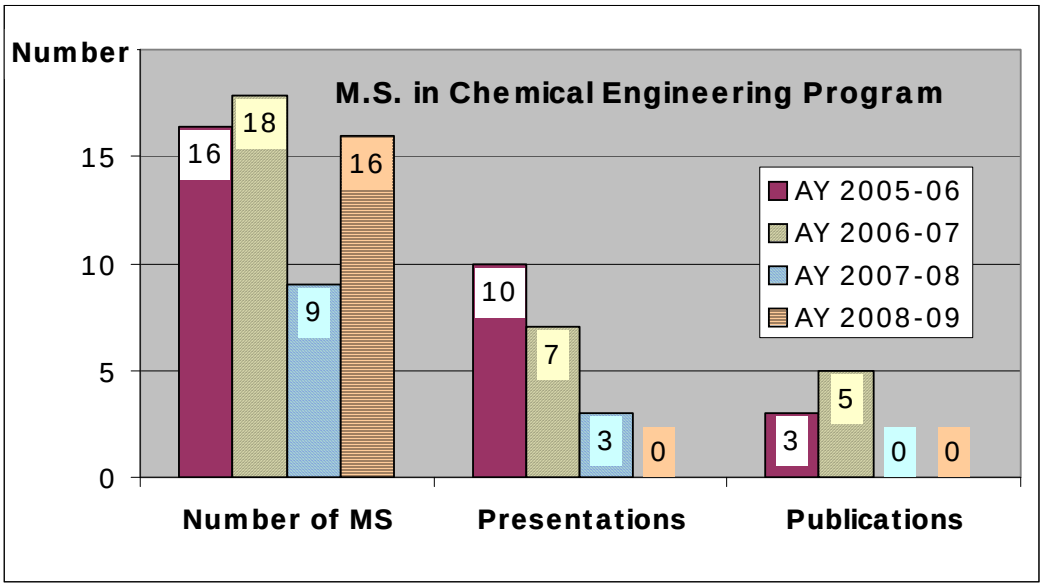
Trends

The following trends [traced back to the previous Academic Year] can be reported



Student Academic Achievement Objectives trends for Graduate Program

One could speculate that there is a downwards trend in the metrics for Goal 2, but since each [AY] bar represents different populations any trends observed are only qualitative indicators. In general, no appreciable changes are observed in the metrics for most goals.



Trends in Graduate Program

While the trends seem to indicate no significant changes in improvement in the achievement metrics, the data might not be amenable for a complete statistical analysis of trends. Overall, a qualitative analysis of the program trends does not point to any deficiencies.

There is a clear decrease in technical production (in terms of “presentations at Technical Symposia” and “Publications in Peer-reviewed Journals”). This might be an indication on the quality of program graduates, change in standards for peer-reviewed publications, lack of funding to support student professional development, diversion of resources to doctoral students, etc. These results require further in-depth analysis by faculty and they will be discussed at the next Department Retreat (anticipated for November 2009).

F. Review

As mentioned above, these results, trends and possible remedial actions will be discussed at the next Department Retreat (November 2009).

CSU's Office of Student Learning Assessment (OSLA)

The OSLA's Review for the 2008-2009 Report included the following observations

As stated in the previous year's review, you might consider stating the program goals in more general terms so that you could align them with the outcomes you have in place. Right now it is difficult to operate a distinction between the two. However, the three paragraphs above the goals section contain information that could represent general goals of the program.

Also stated in last year's review, you should involve program faculty in identifying appropriate assessment tools to measure directly as well as indirectly the learning of your students, thus enriching the data sets you currently collect.

Strengths: *Outcomes are clearly stated in terms of what students know, are able to do, and/or demonstrate as dispositions*

Limitations: *Reliance on a single assessment tool.*

Recommendations: *Emphasize program-wide actions related to how student learning is measured, evaluated, and interpreted by means of a range of assessment tools.*

G. Actions

In response to findings and reviews there are two issues that will be discussed at the next Annual Department Retreat:

1. The lack of distinction between "program goals" (or educational objectives) vs. "program outcomes" has been identified as a shortcoming in our assessment plan. The College-wide Doctor of Engineering Program is undergoing a re-definition of its goals. Once this re-formulation is finalized and approved by the College of Engineering, the MSCE Program will mirror the DRE goals by re-defining its own program goals.
2. The reliance on a single assessment tool is a clear weakness of most Graduate Programs in our College. The Engineering College Graduate Affairs Committee (GAC) is working on implementing supplementary assessment tools in consultation with the individual programs.

APPENDIX

Questionnaire used for Program Goals and Student Academic Achievement Assessment

M.S. in Chemical Engineering Program
Assessment of Student Academic Achievement Objectives

This evaluation is to be completed by each member of the student's thesis or project committee, upon completion of the defense or oral presentation. Return form to the department secretary. Please check the appropriate box in each row.

The objectives of this program, are to develop in the student:	**Level of Achievement**		
Objectives/Criteria for Evaluation	**Exemplary**	**Satisfactory**	**Unacceptable**
1. A more general and fundamental understanding of the principles underlying a particular field of study, as well as those underlying related fields.			
a. Depth of knowledge	☐ Student shows excellent understanding of fundamental pples. directly related to the project.	☐ Student displays good understanding of fundamentals directly related to project.	☐ Understanding of fundamental principles directly related to the project is weak.
b. Breadth of knowledge	☐ Student shows good understanding of related principles.	☐ Knowledge of related subjects is adequate.	☐ Knowledge of related subjects is weak.
2. A familiarity with advanced methods of analysis and synthesis that are more powerful and more generally applicable than those taught at the undergraduate level.	☐ Student is competent in the most advanced techniques needed for research in the field. Student can synthesize and integrate results and relate them to the hypothesis.	☐ Student is competent in experimental/analytical techniques needed for research in the field. Student can accept or reject hypotheses.	☐ Student is competent in analytical techniques, with little understanding of the principles underlying the techniques. Student has difficulty in addressing the hypothesis.
3. The ability to independently read and understand the significance and limitations of the relevant literature.	☐ Student actively searches all works directly and indirectly related to the project. Student can identify the strengths and limitations of various methods.	☐ Student has read the literature related to project, and understands how project fits into the literature.	☐ Student has read only some of the articles related to the project.
4. The ability to formulate, initiate, and complete new and innovative research projects that contribute to the advancement of the field.			
a. Impact on advancement of the field	☐ Work has strong impact on the field.	☐ Work has incremental impact on field.	☐ Work has no impact on the field.
b. Adequacy of the scope of the research	☐ Work has examined many facets of the problem.	☐ Amount of work is adequate.	☐ Amount of work done is inadequate.
c. Adequacy of the depth of the research	☐ Work has probed deeply the principles behind the problem.	☐ Work answers the basic questions of the problem.	☐ Work only touched the surface of the problem.
d. Novelty of the research	☐ The thesis is an innovative idea from the student; student shows creativity in designing experiments and solving problems.	☐ Student contributed originality to designing experiments and solving problems.	☐ The student followed directions from his/her advisor.

Over Please →

5. To communicate effectively in written and oral form.			
a. Quality of the writing style	☐ Written sentences are complete and grammatical, and they flow together easily. Words are chose for their precise meaning.	☐ Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	☐ Writing contains grammatical errors.
b. Organization of the written Thesis	☐ Thesis is logically organized and easy to follow.	☐ Thesis organization is clear.	☐ Thesis is poorly organized.
c. Organization of the presentation	☐ Presentation is clear, logical and organized. Listener can follow line of reasoning. Pacing is correct for the audience.	☐ Listener can follow and understand the presentation.	☐ Talk is poorly organized. Speaker jumps around from topic to topic.
d. Clarity of language usage	☐ Speaker is comfortable in front of the group and can be heard by all.	☐ Grammatical errors and use of slang are evident. Some sentences may be incomplete.	☐ Speaker is difficult to understand or hear.
e. Ability to answer questions	☐ Answered questions directly and clearly.	☐ Student can answer questions, but with some difficulty.	☐ Students had difficulty understanding questions and answering clearly.
f. Quality of slides	☐ Slides enhance the presentation and are prepared in a professional manner.	☐ Slides are adequate for the presentation.	☐ Slides are inadequate (writing too small, too much or too little information per slide).

To be answered by the research advisor only:

Have any results from the Thesis work been presented at National or International Symposia? _____Yes _____No No. of Presentations ____
If possible, add the details of the publications (or e-mail them to Becky to be filed with the Assessment Data)

Have any papers resulting from the Thesis work been accepted for publication in peer-reviewed journals? _____Yes _____No
If possible, add the details of the publications (or e-mail them to Becky to be filed with the Assessment Data) No. of Publications ____