Student Outcomes

Student outcomes for the Swalm School of Chemical engineering are as follows:

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) 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
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice."

The outcomes relate to the abilities, skills, and attributes that the graduates of our program will need to be competitive in the chemical engineering profession. These outcomes are benchmarks continuously improving course materials and for evaluating the need for change or improvement of the curriculum.

Table 3.1 Relationship Among University Mission, Chemical Engineering Mission and Program Educational Objectives

MSU Educational Philosophy	Chemical Engineering Mission	Program Educational Objectives	Measurable Outcomes	Assessment Methods	Evaluation metrics
Mississippi State's primary responsibility is to provide a high quality educational opportunity to all adequately prepared students in the state and region. It seeks to inculcate in its students a lifelong love of learning; an appreciation of the cultural, intellectual, and historical impact of the search for truth and knowledge; the opportunity for professional specialization; and emotional and social development through out-of-class experiences. All students are expected to master the skills that enable them to communicate clearly, to use mathematics, and to understand their cultural heritage and that of others. The University seeks to develop in its students the ability to think independently, to accept responsibility, to interact with people different from themselves, to assess ideas, to challenge orthodoxies, and to criticize opinions in order to achieve the intellectual, ethical, and aesthetic maturity expected in educated citizens. Mississippi State affirms the right of all students to achieve an educational level limited only by their own commitment and ability.	The mission of the Swalm School of Chemical Engineering is to produce graduates who have the ability to apply the principles of the physical sciences, together with the principles of economics and human relations, to fields that pertain directly to processes and process equipment that treat material to effect a change in state, energy content, or composition. Graduates will receive a broad education that will enable them to become leaders in industry, the profession, and the community. Those graduates that excel academically will be prepared for entry to graduate studies.	Chemical Engineering graduates will 1) Successfully enter the chemical engineering profession as design and process engineers (and related designations) with prominent companies in the chemical process industries, petroleum and petro-chemical industries, pulp and paper industry, consulting or other, related industries. 2) Demonstrate an ability to address unstructured problems specific to chemical engineering technical specialties by identifying and implementing solutions using the proper tools, practical approaches and flexible thinking. 3) Pursue post-baccalaureate degrees in chemical engineering and related fields, business and professional programs including medicine and law. 4) Demonstrate proficiency in chemical engineering practice, technical and leadership development by advancing in their chosen fields to supervisory and management positions.	(a) an ability to apply knowledge of mathematics, science and engineering (b) an ability to design and conduct experiments, as well as to analyze and interpret data (c) 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 (d) an ability to function on multidisciplinary teams (e) an ability to identify, formulate and solve engineering problems (f) an understanding of professional and ethical responsibility (g) an ability to communicate effectively (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context (i) a recognition of the need for, and an ability to engage in life-long learning (j) a knowledge of contemporary issues (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	• ABET visits • Senior Exit Interviews • Alumni Surveys • Educational Benchmarking Institute™ survey data • Co-operative Education Employer Feedback • Employer surveys • Faculty course/curriculum reviews • Concept Inventories • External Advisory Board Reviews • Senior Seminar • Fundamentals of Engineering Exam	1. ABET accreditation 2.

*Letters refer to ABET "a-k" criteria. **See Table 3.2 for relevant courses.

Relation of Chemical Engineering Outcomes to Criterion 3 Outcomes

ABET Criterion 3 a-k outcomes constitute the chemical engineering program learning outcomes and are mapped to the curriculum in the table below.

Table 3.2.Table of Required Engineering Course Outcomes Mapped Against ABET Minimum Competencies

Outcomes	a	b	c	d	e	f	g	h	i	j	k
CHE 1101 Freshman Seminar						X	X	X	X	X	X
CHE 2213 Analysis	X	X	X	X	X	X	X	X	X	X	X
CHE 2114 Mass & Energy	X	X	X		X	X	X	X	X		X
CHE 3113 Thermo I	X	X	X		X						X
CHE 3123 Thermo II	X	X	X		X						X
CHE 3203 Fluids Operations	X	X	X	X	X	X	X	X	X	X	X
CHE 3213 Heat Transfer Operations	X		X	X	X						X
CHE 3222 Lab I	X	X			X	X	X		X	X	X
CHE 3223 Mass Transfer Ops.	X		X		X	X		X		X	X
CHE 3232 Lab II	X	X	X	X	X		X	X			X
CHE 3331 Prof. Dev. Seminar											
CHE 3413 Materials	X		X		X		X	X			X
CHE 4113 Reactor Design	X	X	X								X
CHE 4134 Process Design	X	X	X	X	X	X	X	X		X	X
CHE 4223 Process Controls	X		X								X
CHE 4233 Plant Design	X		X	X	X	X	X	X		X	X
Engineering Mechanics and EE Systems removed from grid because some concentrations do not require											
IE 3913 Engineering Economy	X		X		X						
General Education							X	X	X	X	
Math/Basic Science	X	X						X			X

The Chemical Engineering program and course offerings are tailored for delivery of the necessary a-k components of the program outcomes.

(a) an ability to apply knowledge of mathematics, science, and engineering.
(b) An ability to design and conduct experiments as well as to analyze and interpret data.
(c) 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.
(d) An ability to function on multi-disciplinary teams.
(e) An ability to identify, formulate, and solve engineering problems.
(f) An understanding of professional and ethical responsibility.
(g) An ability to communicate effectively.
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
(i) A recognition of the need for, and an ability to engage in life-long learning.
(j) A knowledge of contemporary issues.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Input Processes and Discussion of Results

Input for evaluation of the educational objectives is collected from several different sources. Chemical Engineering has developed three survey methods that are providing excellent, timely information on the quality of the program. The university's Co-Op program provides the Co-Op employer input. Other less formal methods are also used and are discussed.

- Senior exit survey and interview.
- Alumni survey.
- Course assessment forms.
- Co-Op employer evaluations.
- FE exam results.
- One-on-one exchange between faculty and student.
- External evaluation of presentations.
- Participation in student professional activities, presentation of technical papers, attendance at professional meetings; activity in AIChE, SPE, and/or TAPPI.

It is very important to use survey methods that minimize time and effort required by both the requestor and the respondent. It is also important that information be received in a timely fashion, processed rapidly, and fed back to the system while it is still new.

Senior Exit Survey and Interview - The Graduating Senior Exit Survey and Interview has been carried out since 1996 and has been a very positive activity.

For the students, it provides the opportunity to express their opinions of the faculty, specific courses, the program, and support staff. For Chemical Engineering, it provides very timely information on the program from students. A copy of the current survey instrument is included as Figure 3.1 at the end of this section. Nominally, graduating seniors take the survey and have a one-on-one interview with the School's director within one week of graduation. Responses and comments from the interview process are transcribed to an anonymous list and distributed to the faculty members. These comments are on file and available for inspection.

Data from the survey for the past eight cycles in shown in Table 3.3. Overall, the trends appear to be fairly consistent with some dips and peaks in opinions. As a result of these surveys, the Analysis and Simulation course, which had been taught in the Junior year, was perceived to score low, 2.1 in Spring of 2002. The course was altered for delivery in the Sophomore year beginning in 2003, with a corresponding adjustment in course content. Results indicate an upward trend in satisfaction, from the low score of 2.1 in Spring of 2002 to 2.9 in the Spring of 2005.

Other observations were that the non-technical topics such as ethics, impact of engineering on society, global awareness, diversity and entrepreneurism tend to rate low. In some cases, course delivery has been altered. In other cases, for the topics of entrepreneurism and diversity, it is suspected that there is difficulty in asking a question and expecting the student to respond with an answer that is indicative of the actual level of material that had been delivered in the course. In other words, since we do not have required courses that are named diversity and entrepreneurism, it appears that the students natural response is to rate the subject low, where in reality, these topics were covered in some courses.