The University of Michigan
College of Engineering
Curriculum Committee
Faculty Meeting Report
April 06, 2010

Agenda Items

For Vote

Proposed Updates to the BSE Chemical Engineering Program

Revised Undergraduate Educational Mission

To: College Curriculum Committee, Marina Epelman, chair
From: ChE Undergraduate Program Committee, Jennifer Linderman chair
Re: Proposed updates to the BSE Chemical Engineering Program
Date: March 18, 2010

The ChE undergraduate program committee requests consideration of an updating of our BSE Chemical Engineering program as outlined below. Key points of the program change include a redistribution of our 6 credits of technical electives and 10 credits of general electives. The current technical electives requirements are:

"Technical electives must include a minimum of 2 credits of engineering elective, with the other 4 credits coming from engineering electives, advanced science, or advanced math courses. See department for list of courses that meet the engineering electives, advanced science and advanced math requirements. At least one course must be outside of Chemical Engineering. Engineering courses are to be at the 200 or higher level. Courses in AOSS are not considered engineering courses for this purpose. See department for other exceptions."

The new curriculum, attached, redistributes the 6 credits thus:

- Add a 1 credit required course, ChE 485, Chemical Engineering Process Economics.
- Replace the 6-credit tech elective requirement with 3 credits of engineering electives. Engineering courses are to be at the 200 or higher level and cannot include seminar courses. Courses in AOSS are not considered engineering courses for this purpose. Research credits at the 400 level or higher may be used to satisfy this requirement. Up to 8 credits of ChE 490 or ChE 695 research may be taken for a grade. Beyond that, ChE 490 or 695 credits must be taken pass/fail.
- Change our general electives from 10 credits to 12 credits.

This program change will incorporate a much needed focus on engineering process economics, with a class that was planned in consultation with our alumni advisory board, and put our general elective credits in line with the official college requirement of 12 credits, giving our students greater flexibility in course selections. A suggested schedule is attached.

Proposed BSE Chemical Engineering curriculum Fall 2010

	Hours	1	2	3	4	5	6	7	8
Subjects required by all programs - 53 credits									
Mathematics 115+,116+,215+,216 +	16	4	4	4	4				
Engineering 100, Introduction to Engineering+	4	4							
Engineering 101, Intro to Computers & Programming +	4		4						
Chemistry 130+	3	3							
Physics 140+/141+, 240+/241+	10		5		5				
Humanities and Social Sciences	16	4				4		4	4
(to include a course in economics)									
Advanced Chemistry – 11 credits									
Chem 210, 211, Struct and Reactiv I and Lab +	5		5						
Chem 215,216, Struct and Reactiv II and Lab +	5			5					
Chem 261, Introduction to Quantum Chemistry +	1					1			
Related Technical Subjects – 11 credits									
Biology/Life Science elective [1]	4						4		
Materials elective (MSE 250 or MSE 220)+	4							4	
~~**Technical**~~ **Engineering Electives** [2]	~~**6**~~ **3**								3
Program Subjects – 41 credits									
ChemE 230, Material & Energy Balances +	4			4					
ChemE 330, Thermodynamics +	4				4				
ChemE 341, Fluid Mechanics +	4				4				
ChemE 342, Heat and Mass Transfer +	4					4			
ChemE 343, Separation Processes +	4					4			
ChemE 344, Reaction Engr and Design +	4						4		
ChemE 360, ChemE Lab I +	4						4		
ChemE 460, ChemE Lab II	4								4
ChemE 466, Process Dynamics and Control	3							3	
ChemE 485, Chem Eng Process Economics	**1**						1		
ChemE 487, Chem Proc Sim and Design	5								5
General Electives – 12 credits	~~**10**~~ **12**			3		3	3	3	
Total	128	15	18	16	17	16	16	14	16

(1) See department for list of courses that satisfy the Biology/Life Science elective requirement.
(2) Three credits of engineering elective credit. Engineering courses are to be at the 200 or higher level and cannot include seminar courses. Courses in AOSS are not considered engineering courses for this purpose. Research credits at the 400 level or higher may be used to satisfy this requirement. Up to 8 credits of ChE 490 or ChE 695 research may be taken for a grade. Beyond that, ChE 490 or 695 credits must be taken pass/fail.
(+) Students must earn a "C-" or better in prerequisite courses indicated by the (+)

Proposal 1: Revised Undergraduate Educational Mission

The following text describes the mission and objectives of our undergraduate educational programs at a high level, and should be placed on the web and in the CoE Bulletin. The Objectives and Outcomes portion of this text have been prepared with an eye towards ABET's requirements for these elements of our mission. This text is designed to replace http://www.engin.umich.edu/bulletin/uged/index.html

Educational Objectives

A UM undergraduate engineering graduate will be prepared to generate value for society through a lifetime of technical and professional creativity. Our graduates will display reasoning skills and proficiency in problem definition, problem solving, and quantitative expertise, a respect for measurement and data, and the wisdom of experience. Our graduates will use these skills to achieve the following objectives within a few years of graduation:

- Contribute to technical engineering practice
- Pursue graduate education in engineering or science, either following a path towards a professional masters degree and practice, or a doctoral degree
- Pursue careers in law, medicine, education, or other fields, bringing engineering problem solving skills—honed through practice in problem definition and quantitative problem solving—to bear in those disciplines

Michigan Engineers will excel in all of these areas of endeavor, and will be prepared to become successful managers, leaders, entrepreneurs, and philanthropists.

To prepare our students for the jobs of the 21st century, whether they continue in engineering or pursue other paths after graduation, our undergraduate programs support our students in developing:

- An understanding of the fundamental knowledge in a discipline
- An ability to recognize and define a problem, and the vision to see a solution
- An ability to identify, understand, and solve ill-defined problems even in the face of uncertainty and imperfect information
- Strong quantitative and qualitative problem solving skills
- A mindset and skills that support continued learning both during and long after their CoE career
- Personal attributes of success including:
    - high personal expectations
    - persistence
    - the ability to work in teams
    - the ability to plan a project and carry it out
    - the ability to gather resources and overcome barriers to success
    - the ability to manage risk
    - the ability to communicate professionally

- An understanding of the human, social, and environmental dimensions of engineering practice
- A drive and capability to make a difference by bringing their solutions into production

Our graduates must understand that solutions, especially for society's most critical needs, are not just technical in scope but depend on many disciplines working together, and that as engineers their core contribution will include bringing data-driven, quantitative problem solving skills to the table. We also understand that our students have many varied aspirations, and that our primary duty is to provide them with a foundational education that they can carry forward into any of the career paths they may follow over the decades of their careers.

Many of the College's undergraduate degree programs are accredited by ABET. Each such program has statements of educational objectives and outcomes that are based on the College's mission and on the needs of its constituents. Those constituents include our alumni, students, employers of our students, and the graduate schools at which many of our students later study.

Educational Outcomes

Graduates of the College's undergraduate programs will be able to:

1. Apply their knowledge of mathematics, science, and engineering within their chosen field. (a)
2. Recognize and define engineering problems and develop practical solutions using the techniques and skills of modern engineering practice. (e,k)
3. Design products and processes applicable to their chosen field. (c)
4. Design, conduct, and interpret the results of engineering experiments. (b)
5. Work effectively in diverse teams and provide leadership to teams and organizations. (d)
6. Communicate effectively using oral, graphic, and written forms. (g)
7. Understand the impact of engineering decisions in global, social, economic, and environmental context. (h)
8. Understand professional and ethical responsibility and apply ethical reasoning to their work. (f)
9. Engage in life-long learning and recognize the importance of doing so. (i)
10. Understand and make a contribution to society. (j)

(letters) are references to ABET EAC outcomes a—k.