

BSIE and BSE Assessment Plan
Department of Engineering
Colorado State University-Pueblo

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Schedule of assessment activities

	2005-06			2006-07			2007-08			2008-09			2009-10			2010-11			2011-12		
	FA	SP		FA	SP		FA	SP		FA	SP		FA	SP		FA	SP		FA	SP	
Evaluate membership of Advisory Boards				✓									✓								
Program educational objectives																					
Boards and Faculty evaluate objectives			✓									✓									
Administer alumni survey of 2-4 yr alumni					✓						x						x				
Faculty use survey results to evaluate extent to which objectives are attained							✓						✓								
Program outcomes																					
Faculty review outcomes and course/outcome matrix			✓				✓						✓								
Review student performance in EN 103, EN 215, EN 231			✓		✓		✓				✓			x			x			x	
Review FE and 488 results. Review goals for FE				✓			✓			✓			✓			x			x		
Every semester, assessments are performed according to outcome/course matrix to measure the extent to which that outcome is achieved in that course																					
Faculty review results of assessments and apply to development of the program																					
Outcome a - apply math, science, and en.				✓									x								
Outcome b - experiments and data							✓									x					
Outcome c - design										✓									x		
Outcome d - teams										✓									x		
Outcome e - en problems								✓									x				
Outcome f - ethics				✓									x								
Outcome g - communicate							✓									x					
Outcome h - context											✓									x	
Outcome i - life long learning					✓									x							
Outcome j - contemporary issues								✓									x				
Outcome k - techniques, skills, tools					✓									x							

Constituencies

The Educational Objectives for the BSE and BSIE programs are based on the needs of the following constituencies:

- Students,
- Graduates,
- Faculty,
- Graduate schools, and
- Local and regional industry as employers of graduates.

Our students are mostly local recent high school graduates or nontraditional students. Students are attracted by the content of the programs, including some students from out of state. Some students, especially the nontraditional students, don't want to leave the Pueblo area because of family and work connections here. Some nontraditional students pursue an engineering degree for advancement in their current jobs. A number of students are transfer students from other universities or from community colleges.

Graduates of the program are our final product. Ultimately, they determine the success of the program as they progress in their engineering careers.

Faculty members are the architects and implementers of the program. Their careers are tightly coupled with the success of the program. Our faculty members have diverse engineering backgrounds including mechanical engineering, industrial engineering, and electrical engineering.

We expect some of our program graduates to pursue graduate education. The BSE graduates are well prepared to continue their studies in graduate engineering programs such as automation, robotics, mechanical engineering, electrical engineering, systems engineering, computer engineering, or industrial engineering with only a minimal number of prerequisite courses. The BSIE graduates are well prepared to continue their studies in engineering graduate programs such as industrial engineering, but also graduate MBA programs.

Our primary constituent is local and regional industry, as represented on our Advisory Boards, one for the BSE program and one for the BSIE program.

Educational Objectives

BSIE Educational Objectives

During the first few years after graduation, BSIE graduates should be able to:

1. Identify root causes of symptoms and fix problems in situations where data and resources may be lacking and multiple problems may exist,
2. Function well on teams of engineers with different skill levels,
3. Obtain jobs of increasing responsibility applying industrial engineering skills and knowledge to a wide range of problems in a wide range of industries,
4. Continue their education, for example, in MS, PhD, and MBA programs,
5. Obtain additional certifications, such as Professional Engineer, Six Sigma Black Belt, or Certified Manufacturing Engineer, and
6. Achieve management positions.

BSE-Mechatronics Educational Objectives

During the first few years after graduation, BSE-Mechatronics graduates should be able to:

1. Conduct low-level designs and modifications of mechatronic systems,
2. Trouble shoot and support existing mechatronic systems,
3. Work directly with suppliers and customers of mechatronic systems,
4. Manage small and support large engineering projects,
5. Assume ownership and accountability for engineering projects,
6. Function well on teams of engineers with different skill levels,
7. Implement basic quality control principles,
8. Write sound technical documents such as requests for proposals, grant applications, project specifications and technical reports,
9. Continue their education at the graduate level, and
10. Obtain additional engineering certifications.

Review of performance in EN 103 and EN 215

Each spring, the faculty evaluates the following information about the BSIE and BSE programs:

1. the most recent and long-term performance of BSE and BSIE students in EN 103, Introduction to Engineering,
2. the most recent and long-term performance of BSIE students in EN 215, Introduction to Industrial Engineering,
3. the most recent and long-term performance of BSE and BSIE students in EN 231 and EN 231L, Circuit Analysis

In reviewing student performance in courses, the faculty member who taught the course will present quantitative and qualitative information on how the students did.

The review of EN 103 is to check incoming quality; for example, do students have computer experience and math background to succeed? The review of EN 215 is to check incoming quality of transfer students and preparation of continuing students for the BSIEN program. The review of EN 231 is to check incoming quality of transfer students and preparation of continuing students for the BSE program

Review of performance on FE and in EN 488

Each fall, the faculty evaluates the following information about the previous year's seniors:

1. The performance of BSIE and BSE students in EN 488 in the previous 2 semesters.
2. The performance of BSIE and BSE students who took the FE the previous 2 semesters.
3. The goals set for performance in each section of the FE for BSIE and BSE students.

Goals for the FE exam

Approved by the Engineering faculty 1 November 2006

AM session - unless otherwise noted, all statements apply to both IE and EN students.

“At national average” means the national average plus or minus 5 percentage points.

“Above national average” means 5 or more percentage points above the national average.

- Math. Below national average is ok, but goal is above 50.
- Engineering Probability and Statistics. IE score should be above the national average and certainly above 50; EN score can be below the national average but should be above 40.
- Chemistry. Below the national average is ok, but the goal is above 30.
- Computers. At the national average.
- Ethics. At the national average.
- Engineering economics. IE score should be above the national average and at least 60; EN score should be at the national average.
- Engineering mechanics. IE should be at the national average; EN score should be above the national average.
- Strength of materials. We don't have a goal for this section.
- Material properties. At the national average.
- Fluid mechanics. We don't have a goal for this section.
- Electricity and Magnetism. IE score should be at the national average; EN score should be above the national average.
- Thermodynamics. At the national average.

IE afternoon exam – goals for IE students:

- All should be at the national average.

The Department's Advising Handbook contains advice for BSE students on which afternoon exam to select.

BSIE Alumni survey

The survey is designed to evaluate the extent to which the Educational Objectives have been attained and to obtain information to develop and improve the program.

The survey will include the following questions.

Graduate degrees you have received or are pursuing:

Degree	Graduate school	Year	Received or in progress? Circle one
			R IP
			R IP
			R IP

What remedial work, if any, were you required to take before beginning your graduate degree program?

Certifications (e.g. Six Sigma Black Belt) or licenses (e.g. Professional Engineer) you have received or are pursuing:

Certification/license	Year	Received or in progress? Circle one
		R IP
		R IP
		R IP

Memberships in Professional Organizations:

Organization	Year joined	Leadership positions held

PREPARATION and IMPORTANCE

For each of the areas below, indicate how important that area was to your success and how well your BSIE degree prepared you for that area. Use the following numbers to indicate your answers.

Importance:

5 = very important

4 = important

3 = neither unimportant or important

2 = unimportant

1 = very unimportant

Preparation:

5 = very prepared

4 = prepared

3 = neither unprepared or prepared

2 = unprepared

1 = very unprepared

Description	Importance	Preparation
	Enter a number from 1 to 5	
An ability to identify root causes of symptoms and fix problems in situations where data and resources may be lacking and multiple problems may exist.		
An ability to function well on teams of engineers with different skill levels.		
An ability to take on increasing responsibility.		
An ability to move into management positions.		

Is there any other information you would like to give us about your experience as a graduate of CSU-Pueblo or about yourself?

BSE Alumni survey

The survey is designed to evaluate the extent to which the Educational Objectives have been attained and to obtain information to develop and improve the program.

The survey will include the following questions.

Graduate degrees you have received or are pursuing:

Degree	Graduate school	Year	Received or in progress? Circle one
			R IP
			R IP
			R IP

What remedial work, if any, were you required to take before beginning your graduate degree program?

Certifications (e.g. Six Sigma Black Belt) or licenses (e.g. Professional Engineer) you have received or are pursuing:

Certification/license	Year	Received or in progress? Circle one
		R IP
		R IP
		R IP

Memberships in Professional Organizations:

Organization	Year joined	Leadership positions held

PREPARATION and IMPORTANCE

For each of the areas below, indicate how important that area was to your success and how well your BSE degree prepared you for that area. Use the following numbers to indicate your answers.

Importance:

5 = very important

4 = important

3 = neither unimportant or important

2 = unimportant

1 = very unimportant

Preparation:

5 = very prepared

4 = prepared

3 = neither unprepared or prepared

2 = unprepared

1 = very unprepared

Description	Importance	Preparation
	Enter a number from 1 to 5	
An ability to conduct low-level designs and modifications of mechatronic systems		
An ability to trouble shoot and support existing mechatronic systems		
An ability to work directly with suppliers and customers of mechatronic systems		
An ability to manage small and support large engineering projects		
An ability to assume ownership and accountability for engineering projects		
An ability to function well on teams of engineers with different skill level		
An ability to implement basic quality control principles		
An ability to write sound technical documents such as requests for proposals, grant applications, project specifications and technical reports		

Is there any other information you would like to give us about your experience as a graduate of CSU-Pueblo or about yourself?

Program Outcomes

For both programs, the Department has adopted ABET's (a)-(k).

At the time they graduate, BSIE and BSE graduates should have:

- (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.

This evaluation of the Program Outcomes is done in conjunction with the evaluation of the Educational Objectives so that if the Objectives change, the effect on the Outcomes will be considered at that same time.

Outcome Champions

In Fall 2009, we designated champions for each outcome:

- (a) Apply knowledge of math science and engineering: Prof. DePalma
- (b) Design and conduct experiments, analyze and interpret data:
- (c) Design: Prof. Bloxsom
- (d) Teams:
- (e) Engineering problems: Prof. Bedoya
- (f) Ethics: Prof. Yuan
- (g) Communication:
- (h) Impact of engineering solutions: Prof Fraser
- (i) Life-long learning: Prof Fraser
- (j) contemporary issues: Prof Fraser
- (k) Engineering tools: Prof. Jaksic

The champion is expected to:

- Every third year, according to the specified schedule, review assessments for that outcome and report to the faculty.
- Suggest assessment methods and rubrics to other faculty members.

Design of program to support outcomes

The overall program is designed to ensure support of all Program Outcomes. The matrix “Course support of outcomes” (shown on the next page) summarizes how strongly each course supports each program outcome, where

A = considerable content and Assessment is done for this program outcome.

x = some content concerning this program outcome

blank = no emphasis on this program outcome

This matrix is evaluated by the faculty at the same time that the Educational Objectives and Program Outcomes are evaluated.

Matrix showing course support of outcomes for BSIE

BSIE Program outcome																						
A graduate of the program should be able to:	101	103	107	211	212	215	231	321	324	343	365	420	430	439	440	441	443	471	473	475	477	493
	Intro	Progg	Graphics	Statics	Dynamics	IE Intro	Circuits	Thermo	Materials	Econ	Prob/Stat	Simtn	Project	Hum Perf	Safety	manuf	QC	OR	CIM	Fac Plng	Ops Plng	Seminar
a) apply knowledge of math, science, and engineering	x	x		A	x	x	A	x	A	x	x	x	x	x	x	x	x	x	x	x	x	
b) design and conduct experiments; analyze and interpret data	x	x		x	x	x	x	x	x	x	A	A		A	x	x	A	x	A	x	x	
c) design system, component, process to achieve or improve efficiency, quality, and safety.	x		x			x		x	x	x	x	x		x	x	x	x	x	x	A	A	x
d) function on multi-disciplinary teams	x		x			A	x					x	A	x	x	x		x	x	x	x	x
e) identify, formulate, solve engineering problems	x	x	x	x	x	x	A	x	x	x	x	x	x	x	x	x	x	A	x	x	x	x
f) understand professional/ethical responsibility	A											x	x	x	A		x	x	x	x	x	A
g) communicate effectively	x	x	x	x	x	A	x	x	x		x	x	A	x	x	x	x	x	x	x	x	
h) understand impact of engineering solutions in global & societal context	x					x				A	x	x		x	A	x	x	x	x	x	x	x
i) recognize the need for and be able to engage in life long learning	A	x		x	x	A		x	x	x	x	x		x	x	x	x	x	x	x	x	x
j) use knowledge of contemporary issues	x					x				A	x	x		x	A		x	x		x	x	
k) use techniques, skills, modern engineering tools necessary for engineering practice	x	A	A	x	x	x	x	x	x	x	x	x	x	x	x	x	A	x	x	x	x	

Matrix showing course support of outcomes for BSE

BSE Program outcome	101	103	107	211	212	231	260	263	321	324	343	360	361	362	363	365	430	441	443	460	462	473	493	488
A graduate of the program should be able to:	Intro	Progg	Graphics	Statics	Dynamics	Circuits	Electronic	ElecMech	Thermo	Materials	Econ	Contrl I	DigElec	IntroMech	VirtMach	Prob/Stat	Project	manuf	QC	Contrl II	Robots	CIM	seminar	Sr Proj
a) apply knowledge of math, science, and engineering	x	x		A	x	A	x	A	x	A	x	A	A	x		x	x	x	x	A	x	x		x
b) design and conduct experiments; analyze and	x					x				x		x				A		x	A			A		x
c) design system, component, process to meet needs.	x		x							x		A	x	A				x	x	A	x	x	x	A
d) function on multi-disciplinary teams	x		x			x											A	x				x	x	
e) identify, formulate, solve engineering problems	x	x	x	x	x	A	A	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	A
f) understand professional/ethical responsibility	A																x		x			x	A	x
g) communicate effectively	x	x	x	x	x	x			x	x						x	A	x	x			x		A
h) understand impact of engineering solutions in global & societal context	x										A					x		x	x			x	x	A
i) recognize the need for and be able to engage in life long learning	A	x		x	x				x	x	x			x		x		x	x		x	x	x	A
j) use knowledge of contemporary issues	x										A					x			x					A
k) use techniques, skills, modern engineering tools necessary for engineering practice	x	A	A	x	x	x			x	x	x	x	A	x		x	x	x	A	x	A	x		A

Assessment of Outcomes

The following form is to be completed for each outcome-course combination in which assessment is done. The form is completed each time that course is offered. The completed forms are maintained in notebooks in the Department office.

Semester: _____

Course: _____

Outcome: _____

Problem: _____

Describe the assignment:

Attach the assignment and samples of student work: strong, medium, and weak.

ANALYSIS:

The goal for student performance on this assignment:

The degree to which the goal was met:

Changes implemented this semester to the process for this outcome:

The degree of success of those changes:

Suggestions for improvement for the next semester this course is taught:

Signature: _____ **Date:** _____

The assessments for each outcome are reviewed periodically using the following questions as guidance.

- Is the assessment process for this outcome working well? What can be improved?
- To what extent is this outcome being achieved?
- What changes to the program should be considered based on the results of these assessments?

Review of outcome/course assessments

Is the assessment process for this outcome working well? What can be improved?

To what extent is this outcome being achieved?

What changes to the program should be considered based on the results of these assessments?

Changes

- 20 October 2007, added material from 1 November 2006 department meeting about which FE afternoon test a Mechatronics student should take.
- 5 December 2008, added description of constituencies, as approved at 19 November 2008 department meeting.
- 21 April 2009, changed “above 30” to “above 40” in II of the FE exam goals.
- 9 September 2009, moved advice about which FE afternoon exam to take to the advising handbook.
- 4 December 2009, aligned outcomes with ABET language and added Outcome Champions.