Assessment Process Template:
Bioengineering Degree Program

Identifying Information

School/College: College of Engineering

Undergraduate Degree/Major Program Name: Bioengineering Bachelors of Science Degree

Faculty Director Contact/Title: Assessment Lead, Jenny Amos

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Step 1: Assessment administration in the department

1. **Who will lead the assessment work?**
   (identify an individual or team who will coordinate the implementation of the plan)

   Our department assigns a faculty member as the assessment lead. This role is assigned by the department head and works closely with the undergraduate administration to accomplish the goals of the program.

2. **How will assessment information be shared within the department/program?**
   (typically during an annual meeting of the program faculty and staff; note that at this meeting the program may want to review enrollment information, course progression, degree completion, and other structural features of the student experience in addition to the evidence about student learning)

   The Undergraduate Curriculum Committee is the primary audience for assessment, but at the 3 year point, all data and discussion is shared with the faculty at our annual retreat ahead of time to fuel discussion.

3. **What is the plan for production of an annual summary report?**
   (the annual summary report includes the materials that form the basis of discussion at the annual meeting of the program faculty and staff, along with any recommendations made after considering the student learning assessment information presented; a template will be provided to collect this information)

   The assessment lead and Undergraduate Curriculum Committee will be charged with providing the annual report for review by the department head. This information will be available to the faculty and discussed at a faculty meeting.

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Step 2: Student Learning Outcomes

In this section, please **list** the program's student learning outcomes.

- Look to the campus student learning outcomes as a resource for program-level outcomes. Not all campus learning outcomes need to be present in the program outcomes, and a program may have more than one outcome under a campus outcome.
- The learning outcomes should represent what students are able to do or know as a result of the program.
- Most programs have 3 to 5 learning goals. Space to list the program learning outcomes is available below; add rows as necessary.

Student Learning Outcomes

Bioengineering graduates will 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 in 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.

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Step 3: Undergraduate Degree Program Curriculum Mapping

This worksheet, or similar document, **must be included** with the submission of the program's assessment plan.

- **Learning Outcomes** – Enter the academic degree program learning outcomes identified in the assessment plan on the top row of the following chart. Feel free to add columns if the academic degree/major program has more than five learning goals.
- **Degree/Major Program Courses/Experiences** – List all degree requirements (in some cases co-curricular experiences may also be included if required by every student). Feel free to add rows as needed.
- Indicate where the course or learning experience contributes to each of the learning goals. Courses may contribute to multiple learning goals.
    - May indicate with an X
    - Or, A= Attained; R= Reinforced; M= Mastered, (F) = Formal Feedback w Graded work and rubric

	Curriculum Map											
	Degree Program Courses	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
First year	**BIOE 120**						A		A	A		
Second year	**BIOE 201**	A (F)		A (F)	A (F)	A (F)			A (F)			
	BIOE 202		A (F)					A (F)		A (F)		A (F)
	BIOE 205	A (F)										A
	BIOE 206						A	A		A (F)	A (F)	
	BIOE 220	R										
Third year	**BIOE 302**	M (F)				M		R (F)				
	BIOE 303		M (F)									R (F)
	BIOE 310		M (F)						R			R (F)
	BIOE 360	M (F)				M					M	
Senior year	**BIOE 414**	M (F)				M			R		R	
	BIOE 415		R		R		R			R	R	R (F)
	BIOE 420	M	M			M						M
	BIOE 435	M	M	M	M	M	M	M	M	R	R	M
	BIOE 436	M	M (F)	M	M	M	M	M	M	M	M	M
	BIOE 476		M		R		R	R	R	R	R	

Step 4: Previous Assessment Activities

What use has your program made of assessment evidence (formally or informally collected) in the last 5 years? Please outline what actions (if any) that your program has taken in the last five years that responded to assessment evidence. The actions may include: any changes that impact the degree program, such as changes to curriculum, instruction strategies, or co-curricular activities (such as internships, study abroad) ***and*** any decision to continue a current practice that evidence shows is effective. Please also explain what evidence was used to inform your department's practice.

Table Student Outcomes Review Cycle

Item	Frequency	Reviewers
Collect data for analysis	Every 3 years (2012-2013, 2015-2016, 2018-2019)	Assessment Lead Directs Faculty to Collect
Assess data and Recommend Action Items	Every 3 years(2012-2013, 2015-2016, 2018-2019)	Assessment Lead and Curriculum committee
Evaluation	Annually at retreats	All faculty
Address concerns	Annually at retreats	All faculty
Action items	Annually at committee meetings	Curriculum committee

DIRECT ASSESSMENT

Student works that have been deemed good examples of desired student outcomes are collected from all Bioengineering core course offerings. Examples of student work collected are homework assignments, exams, projects, lab reports, and poster displays. Once all data are collected, the student example data are analyzed according to the rubric by the ABET program director and curriculum committee for the specific outcome and level of achievement on the desired question or assignment is tabulated. The data are presented to the faculty at the annual faculty retreat for discussion of levels of attainment and suggestions are made for changing or keeping the current measurement tools. Data analysis and action items are presented in the accreditation self-study.

Graduation Exam

We have created a graduation exam for seniors to test retention of knowledge of the core curriculum. The test consists of 1-2 questions that represent key concepts from each course. The first graduation exam was piloted in Spring 2012 with 15% of the graduating class taking the exam

and all students passing and has been offered every 3 years after this. The results are presented to the faculty at the annual retreat and we have decided to mandate the exam and use it in our evaluation process as a measure of student retention of knowledge.

Performance Indicators

We have split the student outcomes into performance indicators for success. Most performance indicators have two levels of achievement for our students, attainment of skills and mastery of skills that represent different levels in the curriculum. Student work is analyzed against a rubric for how many student achieve high performance on a given performance indicator (typically 85-90% score, depending on the rubric). A detailed breakdown for each outcome is made available for faculty and reviewers. Since we gather data across the curriculum, we aim to achieve 50-70% of students achieving high level of performance by the junior/senior year for any given performance indicator and use the lower level course attainment scores as formative feedback on how students are progressing in the desired skill. Goals of attainment corresponding to each outcome are located on the tables for each student outcome. Action items resulting from review of outcomes from the cycle are summarized.

INDIRECT ASSESSMENT

Minutes from student advisory board meetings and comments from alumni advisory boards are collected and presented for review by the curriculum committee. Minutes were made available for review during the site visit.

Course Evaluations

After each offering of a Bioengineering course, faculty fill out a self-evaluation of the course offering, which includes a description of the offering and if any changes were made, future changes to the course, key scores from feedback from Instructor and Course Evaluation System (ICES) forms. Self-evaluations were made available in the course binders during the site visit. Since 2010, all data has been collected and analyzed annually after each course offering for review. This cycle was deemed necessary to help develop the curriculum and determine student knowledge. We moved to a 2 year cycle after the 2012-2013 school year since the curriculum has stabilized and course offerings are set for all core subjects.

Chancellor's Senior Survey Results

The Chancellor's Senior Survey is administered online to graduating seniors at UIUC each spring. The results presented here are for 2009 and 2011 and are typical of other recent years. The response rate for BIOE seniors was approximately 40% and that rate is very high when compared to the campus as a whole. Several of the questions in the survey and the open comments relate directly to Program Outcomes (a) – (k). However, the vast majority of the questions relate to student experiences with course registration, recreational facilities, campus safety, etc. and is not directly attributable to the BIOE program. Data are received in the summer and evaluated at the faculty retreat. Data analysis and action items are presented in the ABET accreditation self-study.

We expect an 80% (4.0/5.0) achievement of outcome related indicators upon graduation or a 20% improvement in student self-rated performance between entering as freshmen and leaving as graduates.

Bioengineering Senior Exit Satisfaction Survey

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We decided to implement an annual survey of graduating seniors and graduate students in order to gather more specific data than the general senior survey. The survey was designed to access the level of satisfaction with programs offered in the college and department that directly impacted their educational experience. The survey also had open-ended questions about challenges, improvements that they'd like to see, and what we can do to better promote the department. We had a 49% response rate for the first issue in spring of 2012. Results and comment summaries were shared with faculty and external reviewers.

Students are asked to rate personal experiences specific to the Bioengineering program on a 1-5 scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). We expect that seniors will express a 4.0/5.0 or 80% satisfaction for curriculum, opportunities for research, lab conditions, degree met expectations, professional and research development opportunities, and educational experience.

During review of both direct and indirect data, the Undergraduate Curriculum Committee considered the following questions,

> Do the data point to any issues that may threaten the quality of program, i.e., the ability of its graduates to function effectively as engineers?
>
> What performance targets could we set to drive improvement in the program?
>
> What process of review and criteria are best for making these judgments?
>
> Do the data raise any other concerns?

Example Indirect Assessment Data with Resulting Action Items

Performance Criteria	Desired Performance	Instrument Used	2011-2012 % of students achieving desired performance	Evaluation/Action
Analyze possible solutions before identifying the best design solution	Draw conclusions after weighing evidence, facts, ideas	Entering ability Exiting Ability	74% 94%	Students rate a roughly 20% improvement in ability to draw conclusions based on data, <u>no action needed</u>
Contributes appropriate amount toward team workload	Works co-operatively in groups	Entering ability Exiting Ability	78% 94%	Students rate a roughly 20% improvement in ability to work co-operatively in teams <u>no action needed</u>
Appreciates cultural differences and thrives in	Understand/appreciate culture ethnicity, etc.	Entering ability	70%	Students rate a roughly 10% increase in exposure

multidisciplinary teams		Exiting Ability	80%	to different cultures, no action needed

Summary of all Senior Survey Results: The goal of the department is to enhance skills during time in the program and achieve an 80% self-rated ability for each skill assessed. Students report ability of skills relating to student outcomes, which exceed the goal of 80% attainment.

Example Direct Assessment Data with Resulting Action Items

Performance Criteria	Desired Performance	Instrument Used	2015-2016 % of students achieving desired performance	Evaluation/Action
Designs experiments from a problem statement or client need	Can select appropriate measurement systems for evaluating success when given a data set	BIOE 201 Project	80%	The results show a high level of attainment, no action needed
	Can effectively select an appropriate measurement system for evaluating success to test a given hypothesis	BIOE 435 Six Sigma	95%	
Conduct informative experiments	Performs experiments according to manual or given protocol and understands why each step is being performed	BIOE 202 Lab Reports	86%	The results show a high level of attainment, there is some question as to the retention of these techniques but have no way to test after BIOE 202. No action needed.
Student understands how to effectively analyze collected data	Can tabulate data, perform statistical analysis, correlate data, and uses appropriate formulas to manipulate data	BIOE 415 Lab Reports	50%	Definite lack of stats and extrapolation to real world applications in students. Consider moving stats earlier in curriculum.
Student understands how to interpret data	Understands results of statistical analysis, can	BIOE 476 Project	40%	Definite lack of stats and

and can relate data to real world examples	draw insightful conclusions based on the results			extrapolation to real world applications in students. Consider moving stats earlier in curriculum.

Summary for Outcome b: Statistics was considered a weak point across many aspects of data analysis. During discussion, it was revealed that some students wait until senior year to take BIOE 310. This causes a lack of skills in other courses. We need to move stats content earlier in the curriculum and also emphasize assessment in applications of stats to datasets in each subsequent course.

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Step 5: Assessment Planning

What questions, issues, or concerns about student learning in the degree program do you want to address? Looking at your program's student learning outcomes write at ***least three questions*** you would like to pursue to learn more about student learning at the program level. Describe what information you need to answer the questions and the timeline it would take you to answer the question. While not every learning outcome needs to be assessed every year, all need to be assessed over a 5-8 year period. The expectation is for some assessment work to take place every year, such as collecting evidence, interpreting evidence, or implementing changes. Add more rows if needed.

Question 1:	Need to look at lab skills needed in curriculum, engage with EAB and alumni to expand skillsets for industry related careers.	
	Student Learning Outcome:	*b and k*
	Sources/Methods for acquiring evidence:	*Lab reports, student and advisory board surveys*
	Timeline:	*Start 2016, finish 2018*
Question 2:	Statistics is a weakness and needs to move earlier in the curriculum, particularly before lab courses. Should statistics be integrated or a stand-alone course?	
	Student Learning Outcome:	a and b
	Sources/Methods for acquiring evidence:	Student work examples, student surveys
	Timeline:	*Start 2016, finish 2018*
Question 3:	In the project-based curriculum, our students are constantly defining and solving open-ended problems. Emphasis on modeling is key to maintaining rigor in the projects. We need to make sure that modeling is included in projects throughout the curriculum.	
	Student Learning Outcome:	c and e
	Sources/Methods for acquiring evidence:	Student work examples
	Timeline:	*Start 2016, finish 2018*