B.S. in Biological and Agricultural Engineering (BAE)
Assessment of Student Learning Plan
Kansas State University

A. College, Department, and Date

College: Engineering
Department: Biological and Agricultural Engineering
Date: November 1, 2004

B. Contact Person(s) for the Assessment Plans

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C. Degree Program

B.S. in Biological and Agricultural Engineering (BAE)

D. Assessment Plans for the Student Learning Outcome(s) that will be addressed in the Next Three Years

1. Student Learning Outcomes

The BAE Department will consider all of the 15 student learning outcomes (SLOs), in accordance with the program review by the Accreditation Board for Engineering and Technology (ABET) in Fall 2005. The approved SLOs are as follows:

Graduates of the B.S. degree program in BAE will demonstrate the following:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Knowledge of agricultural sciences, biological sciences, chemical sciences, natural resource topics.
- Competency in fields such as biological materials, computer and automated systems, information systems, machine systems, processing systems, biological systems, modified environment design, natural resource systems, biological kinetics, structural design.
- Professional engineering practice/ registration.
- Research and advanced studies.

Table 1 summarizes the relationship of the above SLOs to the KSU SLOs.

Table 1. Relationship to KSU student learning outcomes.

Program SLOs	KSU Undergraduate SLOs					Conceptually different from KSU SLOs
	Knowledge	Critical Thinking	Communi-cation	Diversity	Academic & Professional. Integrity	
Ability to apply knowledge of math, science & engineering	X					
Ability to design and conduct experiments, as well as to analyze and interpret data	X	X				
Ability to design a system, component, or process to meet desired needs	X	X				
Ability to function on multi-disciplinary teams			X	X		
Ability to identify, formulate, and solve engineering problems	X	X				
Understanding of professional and ethical responsibility					X	
Ability to communicate effectively			X			
Broad education necessary to understand the impact of engineering solutions in a global and societal context	X			X		
Recognition of the need for, and an ability to engage in life-long learning						X
Knowledge of contemporary issues				X		
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	X	X				
Knowledge of agricultural sciences, biological sciences, chemical sciences, natural resource topics	X					
Competency in fields such as biological materials, computer and automated systems, information systems, machine systems, processing systems, biological systems, modified environment design, natural resource systems, biological kinetics, structural design	X	X				
Professional engineering practice/ registration						X
Research and advanced studies						X

2. How will the learning outcome(s) be assessed? What groups will be included in the assessment?

Student work in required courses and performance in the Fundamentals of Engineering (FE) exam will be the primary means of assessment. Other assessment measures, including senior exit interviews, Industrial Advisory Councils' feedback, graduate placement data, and significant accomplishments of undergraduates (e.g., student design competitions), will be used as secondary evidence or indirect measures. Table 2 lists the courses and co-curricular activities or experiences where SLOs are learned by the students in the program. The list is considered dynamic and is anticipated to change as the assessment process is conducted. A collection of student work in these courses or experiences will be used as evidence of the SLOs. Examples include course assignments or problem sets, laboratory notebooks and reports, technical reports, documents related to design projects, presentations, specific exam questions, in-class exercises, etc.

Table 2. Summary of assessment measures.

Program SLOs	Measures			Who will be assessed?
	Direct[1]	Indirect	Not Sure	
Ability to apply knowledge of math, science & engineering	BAE 350 FE Exam[2]	Senior Exit Interview, Feedback from Industrial Advisory Council, Graduate placement data, Significant accomplishments of students		The instructor of each required course will select at least one assignment or activity (e.g., laboratory report, project report, etc.) and consider all BAE students in the assessment. However, only a few samples of student work will be presented as evidence, as indicated in item 3 below.
Ability to design and conduct experiments, as well as to analyze and interpret data	BAE 500			
Ability to design a system, component, or process to meet desired needs	BAE 536			
Ability to function on multi-disciplinary teams	BAE 200			
Ability to identify, formulate, and solve engineering problems	BAE 535			
Understanding of professional and ethical responsibility	FE Exam[2]			
Ability to communicate effectively	BAE 536			
Broad education necessary to understand the impact of engineering solutions in a global and societal context	Capstone Design[3]			
Recognition of the need for, and an ability to engage in life-long learning	Capstone Design[3]			
Knowledge of contemporary issues	Capstone Design[3]			
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Capstone Design[3]			
Knowledge of agricultural sciences, biological sciences, chemical sciences, natural resource topics	BAE 530			
Competency in fields such as biological materials, computer and automated systems, information systems, machine systems, processing systems, biological systems, modified environment design, natural resource systems, biological kinetics, structural design	BAE 536 BAE 640			
Professional engineering practice/registration	BAE 020 FE Exam[2]			
Research and advanced studies	Honors program, Undergraduate research			

[1]Course descriptions are listed in Appendix 1.
[2]Appropriate sections in the Fundamentals of Engineering exam.
[3]BAE 636 (Agricultural Engineering Design II) or approved capstone design course.

3. When will these outcomes be assessed? When and in what format will the results of the assessment be discussed?

The BAE Undergraduate Programs Assessment Committee, in cooperation with the Course and Curriculum Committee and the Undergraduate Teaching Faculty, are collecting and compiling the assessment data for all 15 SLOs in preparation for the upcoming ABET visit and review in Fall 2005 (Table 3). After the ABET review and starting in Spring 2006, one-third of the program outcomes (5 of 15) will be assessed each year (for example, the first five outcomes in Tables 1 and 2 in 2006; the next five in 2007; and the last five in 2008). Assessment data will be compiled and summarized every three years. Assessment results will be applied to continuously develop and improve the undergraduate BAE program. If necessary, the assessment plan will be revised in accordance with the ABET recommendations.

The assessment process will involve the following activities: (a) preparation of notebooks for selected courses, (b) preparation of SLO notebooks, (c) assessment of SLOs by the Assessment Committee, (d) action by the Course and Curriculum Committee, and (e) action by the BAE Faculty and Department Head. The first three activities are described briefly below; the last two are described in item 4.

Preparation of notebook for each required BAE course. In Spring 2005, the Undergraduate Programs Assessment Committee will ask BAE instructors to submit a notebook for each of the required BAE courses (i.e., BAE 020, BAE 200, BAE 350, BAE 500, BAE 530, BAE 535, BAE 536, BAE 636, and BAE 640). The course notebook will contain the following information:

- Catalog course description
- A list of the specific SLOs that the course addresses and the assessment tools that are used to assess whether or not each of the listed SLOs is met
- Course syllabus
- List or summary of course handouts and/or supplementary materials
- Representative examples of student work (exams, assignments and/or problem sets, technical reports and/or laboratory reports, students' presentation materials, etc.)

Preparation of SLO notebook. Each instructor will select representative samples from the course notebook that document how the course or class experience addresses and meets each of the applicable SLO. These samples will be compiled into the appropriate SLO Notebook. There will be one notebook for each SLO. For each material that is selected for the SLO Notebook, the instructor will fill out a SLO Assessment sheet, which will identify the applicable SLO and include a statement on how the material meets the applicable SLO.

The Undergraduate Programs Assessment Committee will also collect and summarize data from other co-curricular activities and other measures, including fundamentals of engineering exam, honors research, senior exit interview, feedback from Industrial Advisory Council, graduate placement data, and significant accomplishments of undergraduates (e.g., student design competitions).

Assessment by the Undergraduate Programs Assessment Committee. The Undergraduate Programs Assessment Committee will use the SLO notebook and other assessment information identified in item 2 above. The Committee will analyze and interpret the data, present the findings to the BAE Course and Curriculum Committee in Summer 2005, and recommend changes that may be needed to improve student learning. Recommendations may deal with changes in curriculum, pedagogies, and advising strategy; refinement of the assessment tools, assessment process, and SLOs; among others.

Table 3. Timetable for assessment of student learning outcomes.

Program SLOs	Year			Baseline created?
	2005	2006	2007	
Ability to apply knowledge of math, science & engineering	All SLOs will be assessed in Spring 2005 and Summer 2005, and the self-study report will be prepared in Spring and Summer 2005 in connection with the ABET review in Fall 2005. Some of the assessment data have been collected since the last ABET review in 1999.	After the ABET review and depending on the recommendation, assessment data will be collected for the first five learning outcomes in Spring, Summer, and Fall 2006.		Baseline data created in Fall 2007.
Ability to design and conduct experiments, as well as to analyze and interpret data				
Ability to design a system, component, or process to meet desired needs				
Ability to function on multi-disciplinary teams				
Ability to identify, formulate, and solve engineering problems				
Understanding of professional and ethical responsibility			After the ABET review and depending on the recommendation, assessment data will be collected for the next five learning outcomes in Spring, Summer, and Fall 2007.	
Ability to communicate effectively				
Broad education necessary to understand the impact of engineering solutions in a global and societal context				
Recognition of the need for, and an ability to engage in life-long learning				
Knowledge of contemporary issues				
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice				
Knowledge of agricultural sciences, biological sciences, chemical sciences, natural resource topics				
Competency in fields such as biological materials, computer and automated systems, information systems, machine systems, processing systems, biological systems, modified environment design, natural resource systems, biological kinetics, structural design				
Professional engineering practice/ registration				
Research and advanced studies				

4. What is the unit's process for using assessment results to improve student learning?

As mentioned in item 3, the assessment process will involve the Undergraduate Programs Assessment Committee, Course and Curriculum Committee, faculty, and Department Head. The Course and Curriculum Committee will review the Assessment Committee's findings and recommendations in terms of overall curriculum impacts, share the results of the process with and get feedback from key constituencies (i.e., current students, Advisory Council, alumni, etc.), formulate a report and recommendations, and present the recommendations to the BAE Faculty regarding implementation of program and/or curriculum changes. The Faculty will consider each of the Course and Curriculum Committee's recommendations and decide on the appropriate action. The Department Head will implement the improvement decisions by the faculty, in accordance with University guidelines. The Department Head and the Faculty will also address any issues raised during the ABET review.

Appendix 1 – Course Descriptions

BAE 020. Engineering Assembly. (0) I, II. Presentation of professional problems and practices by students, faculty, and professionals associated with the career of biological and agricultural engineering. One hour lec. a month.

BAE 200. Introduction to Biological and Agricultural Engineering and Technology. (2) I. Introduction to discipline, department, profession. Gain skills through application-oriented problem solving, computer use, and written communication. Introduction to land surveying. One hour rec. and three hours lab a week. Open to ATM and BAE majors only.

BAE 350. Agricultural Machinery Systems. (2) I. Basic power and energy concepts. Machinery systems for tillage, planting, and harvesting crops. Impact of these systems on the environment and natural resources. Two hours rec. a week. Pr.: ATM 160 or PHYS 113 or one year of high school physics.

BAE 500. Properties of Biological Materials. (2) II. Characterization of biological material properties that affect the design and analysis of material handling equipment and processes. Physical, electrical, thermal, mechanical, aero-dynamic, hygroscopic, and rheological properties of grain and other agricultural products will be examined. One hour rec. and three hours lab a week. Pr.: PHYS 213.

BAE 530. Natural Resource Engineering. (3) II. Principles and measures for controlling storm water runoff and soil erosion including hydrology and surface water flow; design of water handling structures for land drainage, flood protection, and irrigation; pipeline flow and pump selection. Two hours rec. and three hours lab a week. Pr.: STAT 490. Pr. or conc.: ME 571. Not available for students with credit for CE 550.

BAE 535. Fundamentals of Structures and Environment Engineering. (3) I. Principles of environmental control for agricultural buildings and structures; analysis and design of structural systems and members for agricultural structures. Two hours rec. and three hours lab a week. Pr.: ME 513 and CE 333.

BAE 536. Agricultural Engineering Design I. (2) I. Team-oriented design laboratory, with projects selected to address design of equipment or systems to produce or process food, fiber, and energy, or to preserve environmental quality, remediate damage, and conserve natural resources. Two 3-hour labs a week. Pr.: ME 533 or BAE 530 or BAE 575.

BAE 636. Agricultural Engineering Design II. (2) II. Continuation of BAE 536. Completion of a team-oriented design project, with emphasis on construction, evaluation, documentation, and presentation of the design. Two 3-hour labs a week. Pr.: BAE 536.

BAE 640. Instrumentation and Control for Biological Systems. (3) II. Fundamentals of instrumentation and control engineering applied in biological and agricultural systems and processes. Time-domain analysis and frequency response methods. Sensors and actuators in feedback control systems. Control system design. Case studies. Two hours rec. and three hours lab a week. Pr.: EECE 510 (or EECE 519) and MATH 240.