Student Learning Outcomes Check Sheet

Degree Program Title: Industrial Engineering  Degree Type: Bachelor of Science
Banner/CIP Code: 14.3501.00

Responsible Program Coordinator/Chair completing this form: Dr. Brent Donham

A. Program MISSION Statement: What body of knowledge and/or what skills and qualities will graduates from this program possess upon completion of the degree?

The Industrial Engineering program provides a life-long learning environment to advance professional engineering careers globally.

(Program Educational Outcomes and Student Learning Outcomes are based upon the ABET Criteria for Accrediting Engineering Programs.)

Graduates of the Bachelor of Science in Industrial Engineering program at Texas A&M University-Commerce will...

Function effectively within an engineering profession or graduate program by drawing upon IE skills and knowledge, as evidenced by, but not limited to, continuous employment or successful progress towards a graduate degree.

Progress within the engineering profession as evidenced by, but not limited to, leadership roles, value added within a team, increased responsibility with decision making, or creation of better or more effective products, processes, technologies, or ideas.

Engage in life-long growth within the industrial engineering profession as evidenced by, but not limited to, company training, industry certifications, professional conferences, and graduate work.

By graduation, Industrial Engineering students will demonstrate:

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,
i) economic, environmental, and societal context 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.
B. Does this program have any culminating experience or capstone course that would capture the cumulative knowledge and accomplishments of graduates of your program? If so, please describe the process by which faculty participate in the design and evaluation of the course and its products/experiences.

The Industrial Engineering program has a sequenced two-course senior capstone, IE 471 and IE 495.

IE 471 - Planning for Industrial Systems Design (3 SCH)
Student teams prepare a proposal (technical and management sections) to outline the approach and methodology the team plans to follow in working with industry sponsors on real-world industrial engineering process improvement activities. The proposed improvement activity will be the systems design project planned for the following spring semester in IE 495 - Industrial Systems Design.

IE 495 - Industrial Systems Design (4 SCH)
This course is the Industrial Engineering Capstone Design course, covering: flexible manufacturing systems and manufacturing integration; integrated knowledge to be gained from using all required industrial engineering courses in a system design project. Laboratory component will be used to reinforce team activities by working with industry sponsors on real-world industrial engineering process improvement activities.

Student Learning Outcomes (a-k) are not demonstrated or measured in a single course by a specific project or activity. Rather, they are integrated throughout the curriculum and assessed a variety of techniques. It is a process that involves the entire program faculty. Course competencies/outcomes were developed by the faculty for each course in the major, including the capstone sequence. The course competencies are mapped to the associated student learning outcome(s). For example, the design, fabrication, and testing of a electromechanical system would be associated with student outcome 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. Performance on assignments, projects, and activities associated with course competencies are measured and evaluated through an embedded assessment process in each course. The intent of the embedded assessment process is to provide a structured evaluation and assessment method, which will provide a constructive review of the student performance beyond the course grade. The process requires each faculty member to measure the degree of student attainment of the competencies by course. Collectively, all of the performance scores for course competencies are used to determine the attainment of the student learning outcomes.

In the attached pages, please provide the learning outcomes the faculty as a whole expects from graduates from the program. While you may choose as many outcomes as you wish, it is often a good strategy to focus on the most important goals for students in the first few years of your Student Assessment Program. For example, two or three of the most critical goals would be a good starting point. Please complete questions 1-6 for each Student Learning Outcome you are assessing or plan to evaluate in the next review period on the attached sheet.
Industrial Engineering Program / Student Learning Outcome Assessment 2011 - 2012

The 2011-2012 program assessment for Industrial Engineering was based upon the ABET Program Educational Objectives (PEOs), which defined skills and/or knowledge that an individual should demonstrate a few years after graduation. The PEOs are aligned with the Student Learning Outcomes (SLOs), which define a set of skills and knowledge that a student will demonstrate by graduation. SLOs are aligned with program courses. Assessment of the PEOs will ultimately result in corrective action, as needed, in the IE curriculum. This process is shown graphically in the following figures.

PEO Evaluation and Revision Process

PEO / Curriculum Alignment Model
Four different assessment instruments are utilized to assess the attainment of the PEOs: 1) Graduating Senior Exit Survey, 2) 1st-Year Alumni Survey, 3) 2-4 Year Alumni Survey, and 4) Employer Survey.

Graduating Senior Exit Survey

By definition, students are not expected to attain the PEOs by the time of graduation. The Exit Survey asks graduating seniors to rate the level they feel prepared to achieve the PEOs, not whether they have attained them. Given this fact, corrective action will not be taken for PEOs based solely upon the results of the Exit Survey. However, the results provide a baseline on how graduating seniors perceive their ability to attain the PEOs. The survey is administered annually prior to graduation.

1st-year Alumni Survey

The influence of an undergraduate education on the attainment of the PEOs is assumed to be at the highest level during the first year of work. After an individual has been employed or out of the program for longer period of times, the impact of industry training and other life experiences begin to take on a more significant role and it becomes difficult to attribute success in PEO attainment directly to the undergraduate program. The survey is administered annually in the Spring, one year following graduation. The results from the 1st-year Alumni Survey and Graduating Senior Exit Survey are compared, which indicates the differences in perception versus actually attaining PEOs for the same study group. This provides an opportunity to identify potential areas for program improvement and/or enhancement, even if the 1st-year alumni report they have attained a PEO.

2-4 year Alumni Survey

The survey is administered on a three year cycle in the Spring. The study population includes alumni who graduated 2-4 years prior to the time the survey is conducted. The results from the 2-4 year Alumni Survey and 1st-year Alumni Survey are compared. This provides an opportunity to identify potential areas for program improvement and/or enhancement, even if both study groups report they have attained a PEO.

Employer Survey

Legal and privacy issues often limit or prohibit employers from providing information on specific employees. The Industry Advisory Board recommended employers assess cohorts of industrial engineering graduates from A&M-Commerce. Recognized limitations of this approach include fewer employer responses, due to the fact companies only submit one survey rather than obtaining data from each hiring manager, and the study population cannot be broken down into graduation cohorts for direct comparison. The study population can include alumni who graduated in any year since the program was implemented.

The results from the Employer Survey and 2-4 year Alumni Survey are compared. This provides an opportunity to identify potential areas for program improvement and/or enhancement, even if both groups report graduates have attained a PEO.

The assessment process is shown graphically in the following figure.
Graduating Senior Exit Survey

Exit: Not prepared for PEO
1st year: PEO not achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

Exit: Prepared for PEO
1st year: PEO achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

Exit: Prepared for PEO
1st year: PEO achieved
* 1st-year achievement level is lower than the Exit survey
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

Exit: Not prepared for PEO
1st year: PEO achieved
No corrective action required
If trend persists, measures may be taken to address the perception of being adequately prepared

1st Year Alumni Survey

1st year: PEO not achieved
2-4 year: PEO not achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

1st year: PEO achieved
2-4 year: PEO not achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

1st year: PEO not achieved
2-4 year: PEO achieved
No corrective action required
Action taken as a result of the Exit Survey / 1st-year Alumni Survey assessment stage

1st year: PEO achieved
2-4 year: PEO achieved
* 2-4 year achievement level is lower than the 1st-year survey
No corrective action required
* If trend persists, this may indicate an area in the program that could be strengthened or enhanced

2-4 Year Alumni Survey

2-4 year: PEO not achieved
Employer: PEO not achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

2-4 year: PEO achieved
Employer: PEO not achieved
Corrective action will be taken in an attempt to resolve the deficiency in attainment of PEOs

2-4 year: PEO not achieved
Employer: PEO achieved
No corrective action required
Action taken as a result of the 1st-year/2-4 year Alumni Survey assessment stage

2-4 year: PEO achieved
Employer: PEO achieved
* Employer achievement level is lower than the 2-4 year survey
No corrective action required
* If trend persists, this may indicate an area in the program that could be strengthened or enhanced

Employer Survey

Program Educational Objectives Assessment Process
STUDENT LEARNING OUTCOME # 1
(For 2011-2012, assessment was developed around the ABET Program Educational Objectives)

1. STUDENT LEARNING OUTCOME (SLO): What will a student be able to do, what knowledge, skills, values will they have, etc., upon graduation from the program that will be assessed? A Student Learning Outcome is a clear concise statement that describes how students can demonstrate their mastery of some element of the academic program goals.

Graduating Industrial Engineering students will indicate their perceived level of attainment of the program goals/objectives. This assessment is part of an ABET Continuous Improvement process.

2. LINKS TO CURRICULUM & PROGRAM FACULTY. What courses support this SLO? How do all program faculty participate in setting the goals, content and learning outcomes of these courses? How do all program faculty participate in analyzing and making recommendations based on the results of student assessments?

The faculty established the 2011-2012 program assessment to be based upon the Program Educational Outcomes rather than the SLOs (a-k). The PEOs are aligned with the Student Learning Outcomes (SLOs), which define a set of skills and knowledge that a student will demonstrate by graduation. SLOs are aligned with program courses. Student Learning Outcomes (a-k) are not demonstrated or measured in a single course by a specific project or activity. Rather, they are integrated throughout the curriculum and assessed a variety of techniques. It is a process that involves the entire program faculty. Course competencies/outcomes were developed by the faculty for each course in the major, including the capstone sequence. The course competencies are mapped to the associated student learning outcome(s).

Program faculty review and interpret the PEO assessment data, both quantitative and qualitative, to determine if any action related to program improvement is required.

3. ACTION PLAN: STRATEGIES/METHODS FOR OBSERVING STUDENT LEARNING. How will data be collected, analyzed, shared? How will faculty observe the accomplishment of this outcome? Please provide specific descriptions for how, when, how often, what course(s), what student performances will be observed, collected and analyzed. Please provide or attach any descriptions of your ACTION PLAN OR PROCESS addressing the who, what, when, where questions for the assessment program.

Graduating Senior Exit Survey

A survey will be conducted for graduating Industrial Engineering seniors to assess the student's feeling of preparedness for each program goals/objectives. A 5-point Likert scale (Fully Prepared = 5, Not Prepared=1) will be utilized.
4. **CRITERIA FOR SUCCESS: MEASURES & TARGETS.** What are the standards of progress or criteria used for judging success for the student learning assessment observations? Please attach any assessment tools, standards (rubrics) or other documents used to judge success or achievement of the outcome.

The faculty established the expectation that no graduating IE student will indicate a rating of "Not Prepared" for any PEO and the mean and median scores will be greater than or equal to 3. Results will also be compared to 1st year alumni surveys conducted in prior years to determine if the perception of achievement is consistent across alumni at different stages in their career.

<table>
<thead>
<tr>
<th>Graduating Exit Survey</th>
<th>1st-year Alumni Survey</th>
<th>Action / Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Prepared ((\bar{x} \leq 3), ((\text{Median}&lt;3))</td>
<td>Not Achieved ((\bar{x} \leq 3), ((\text{Median}&lt;3))</td>
<td>Corrective action will be taken to develop and/or improve program/student outcomes in an attempt to resolve the deficiency in attainment of PEOs.</td>
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<td>No corrective action required. If the trend persists, measures may be taken to address the perception of graduating seniors of being adequately prepared.</td>
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<tr>
<td>Prepared ((\bar{x} \geq 3), ((\text{Median}&gt;3))</td>
<td>Achieved ((\bar{x} \geq 3), ((\text{Median}&gt;3))</td>
<td>No corrective action required. If a trend persists in which the 1st-year achievement level is lower than the expectation level from the Exit survey, this may indicate an area in the program that could be strengthened or enhanced. If deemed necessary, action will be taken to improve the program/student outcomes.</td>
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</table>

These two additional reports for questions 5&6 below will be due in **May 11, 2012**

5. **ACHIEVEMENT SUMMARY: FINDINGS & RESULTS.** What are the results of the assessment of this learning objective thus far? Be sure to include the year of the assessment, attach any relevant reports, data tables, etc. Please be specific in your descriptions. Indicating that \(n\)% students took a test or passed an oral exam is not an example of assessment findings.

6. **PROGRAM ENHANCEMENT.** How has assessment data been used? Please give examples over the last 3 years. What are the specific mechanisms for communicating results and changing courses, curriculum, learning activities within a course, etc.

Review and Approval Signatures & Date:
Program Coordinator if applicable ____________________________
Department Chair: __________________________________________
Dean ______________________________________________________
STUDENT LEARNING OUTCOME # 2
(For 2011-2012, assessment was developed around the ABET Program Educational Objectives)

1. STUDENT LEARNING OUTCOME (SLO): What will a student be able to do, what knowledge, skills, values will they have, etc., upon graduation from the program that will be assessed? A Student Learning Outcome is a clear concise statement that describes how students can demonstrate their mastery of some element of the academic program goals.

Industrial engineering alumni will demonstrate the achievement of the Industrial Engineering program goals/objectives. This assessment is part of an ABET Continuous Improvement process.

2. LINKS TO CURRICULUM & PROGRAM FACULTY. What courses support this SLO? How do all program faculty participate in setting the goals, content and learning outcomes of these courses? How do all program faculty participate in analyzing and making recommendations based on the results of student assessments?

The faculty established the 2011-2012 program assessment to be based upon the Program Educational Outcomes rather than the SLOs (a-k). The PEOs are aligned with the Student Learning Outcomes (SLOs), which define a set of skills and knowledge that a student will demonstrate by graduation. SLOs are aligned with program courses. Student Learning Outcomes (a-k) are not demonstrated or measured in a single course by a specific project or activity. Rather, they are integrated throughout the curriculum and assessed a variety of techniques. It is a process that involves the entire program faculty. Course competencies/outcomes were developed by the faculty for each course in the major, including the capstone sequence. The course competencies are mapped to the associated student learning outcome(s).

Program faculty review and interpret the PEO assessment data, both quantitative and qualitative, to determine if any action related to program improvement is required.

3. ACTION PLAN: STRATEGIES/METHODS FOR OBSERVING STUDENT LEARNING. How will data be collected, analyzed, shared? How will faculty observe the accomplishment of this outcome? Please provide specific descriptions for how, when, how often, what course(s), what student performances will be observed, collected and analyzed. Please provide or attach any descriptions of your ACTION PLAN OR PROCESS addressing the who, what, when, where questions for the assessment program.

1st-year Alumni Survey

A survey will be conducted for 1-year industrial engineering alumni to assess the achievement level of the program goals/objectives. A 5-point Likert scale (Fully Achieved = 5, Not Achieved =1) will be utilized.
4. CRITERIA FOR SUCCESS: MEASURES & TARGETS. What are the standards of progress or criteria used for judging success for the student learning assessment observations? Please attach any assessment tools, standards (rubrics) or other documents used to judge success or achievement of the outcome.

The faculty established the expectation that no alumni will indicate a rating of "Not Achieved" for any program goal/objective and the mean and median scores will be greater than or equal to 3. Results will also be compared to 2-4 year alumni surveys and Graduating Senior Exit survey results conducted in prior years to determine perception of achievement is consistent across alumni at different stages in their career.

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<th>2-4 year Alumni Survey</th>
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<td>No additional corrective action required. Action taken as a result of the Exit Survey / 1st-year Alumni Survey assessment stage.</td>
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<td>Achieved ((\bar{x} \geq 3), (Median&gt;3)</td>
<td>Achieved ((x \geq 3), (Median&gt;3)</td>
<td>No corrective action required. If a trend persists in which the 2-4 year achievement level is lower than the 1st year survey, this may indicate an area in the program that could be strengthened or enhanced. If deemed necessary, action will be taken to improve the program/student outcomes.</td>
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These two additional reports for questions 5&6 below will be due in May 11, 2012

5. ACHIEVEMENT SUMMARY: FINDINGS & RESULTS. What are the results of the assessment of this learning objective thus far? Be sure to include the year of the assessment, attach any relevant reports, data tables, etc. Please be specific in your descriptions. Indicating that n% students took a test or passed an oral exam is not an example of assessment findings.

6. PROGRAM ENHANCEMENT. How has assessment data been used? Please give examples over the last 3 years. What are the specific mechanisms for communicating results and changing courses, curriculum, learning activities within a course, etc

Review and Approval Signatures & Date:
Program Coordinator if applicable ____________________________________________
Department Chair: _________________________________________________________
Dean _________________________________________________________________
STUDENT LEARNING OUTCOME # 3
(For 2011-2012, assessment was developed around the ABET Program Educational Objectives)

1. STUDENT LEARNING OUTCOME (SLO): What will a student be able to do, what knowledge, skills, values will they have, etc., upon graduation from the program that will be assessed? A Student Learning Outcome is a clear concise statement that describes how students can demonstrate their mastery of some element of the academic program goals.

Employers of Industrial Engineering graduates will validate the achievement of the Industrial Engineering program goals/objectives. This assessment if part of an ABET Continuous Improvement process.

2. LINKS TO CURRICULUM & PROGRAM FACULTY. What courses support this SLO? How do all program faculty participate in setting the goals, content and learning outcomes of these courses? How do all program faculty participate in analyzing and making recommendations based on the results of student assessments?

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Program faculty review and interpret the PEO assessment data, both quantitative and qualitative, to determine if any action related to program improvement is required.

3. ACTION PLAN: STRATEGIES/METHODS FOR OBSERVING STUDENT LEARNING. How will data be collected, analyzed, shared? How will faculty observe the accomplishment of this outcome? Please provide specific descriptions for how, when, how often, what course(s), what student performances will be observed, collected and analyzed. Please provide or attach any descriptions of your ACTION PLAN OR PROCESS addressing the who, what, when, where questions for the assessment program.

Employer Survey

A survey will be conducted employers of industrial engineering graduates to assess the achievement level of the program goals/objectives. A 5-point Likert scale (Fully Achieved = 5, Not Achieved = 1) will be utilized.
4. CRITERIA FOR SUCCESS: MEASURES & TARGETS. What are the standards of progress or criteria used for judging success for the student learning assessment observations? Please attach any assessment tools, standards (rubrics) or other documents used to judge success or achievement of the outcome.

The faculty established the expectation that no employer will indicate a rating of "Not Achieved" for an program goal/objective and the mean and median scores will be greater than or equal to 3. Results will also be compared to 2-4 year alumni surveys conducted in prior years to determine if the employers and alumni perception of achievement is consistent.

<table>
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<tr>
<th>2-4 year Alumni Survey</th>
<th>Employer Survey</th>
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<td>No corrective action required. If a trend persists in which the employer survey achievement level is lower than the 2-4 year survey, this may indicate an area in the program that could be strengthened or enhanced. If deemed necessary, action will be taken to improve the program/student outcomes.</td>
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These two additional reports for questions 5&6 below will be due in **May 11, 2012**

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