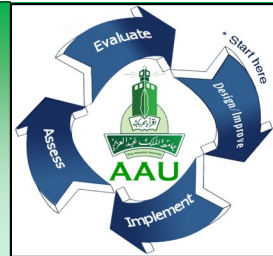


# Academic Accreditation Unit

## Assessment of Engineering Professional Skills



# AAU

Newsletter

## Introduction

ABET Engineering Accreditation Criteria define 11 student outcomes (enumerated from “a” to “k”) that describe what the students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program to prepare graduates to attain the program educational objectives<sup>1</sup>. Among these 11 outcomes, 6 are being designated as professional skills, namely:

- d) an ability to function on multidisciplinary teams
- 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, and
- j) a knowledge of contemporary issues.

In contrast with the 5 technical outcomes, these 6 professional skills are somewhat open to interpretation by individual programs<sup>2</sup> taking into consideration the role of the student outcomes to foster the attainment of program educational objectives. Over the last decade, since the appearance of the outcome-based ABET criteria by the beginning of the new millennium, engineering programs struggled to define, teach, and assess these professional skills<sup>3</sup>.

## Key Performance Indicators for Student Outcomes (SOs)

Infusion of student outcomes into curriculum is the way by which the program is giving to the students an efficient learning experience to master the skills, knowledge, and behaviours defined in student outcomes before graduation. Since Student Outcomes are common to all KAU engineering programs, the academic accreditation unit (AAU) defined a set of key performance indicators for each SO. These are statements of observable student actions that serve as evidence of achieving the set of knowledge, skills, and attitudes defined by the student learning outcome. Over the past decade outcome indicators were efficiently used by several KAU engineering programs to:

- 1) Map course learning outcomes into SOs to define the learning depth and breadth of each SO.
- 2) Prepare Outcomes Assessment Rubrics to assess direct achievement of SOs.
- 3) Prepare Outcomes Assessment Surveys as indirect assessment tools of student achievement of SOs .

## Key Courses Approach

In order to insure infusion of Student Outcomes into courses and facilitate assessment and evaluation of these outcomes, AAU adopted the “key courses approach”, an approach implemented in other universities such as West Virginia and Southern Illinois. In this approach key courses for a given outcome are defined as those courses that the program identifies as the most likely to display evidence of student’s work that can be used to assess that outcome. In order to ensure assessment triangulation, or redundancy, each engineering program, through consensus, assigns, at least 2 key courses for each of the 11 ABET outcomes a-k and nominated each core course as a key course for at least 2 outcomes; one of them is non technical. The course is considered as a related course for the remaining outcomes it addresses.

Key courses identified for a particular outcome are not by any means the only courses that contribute to developing the skills students need to master the outcome. Program enhancement requires that all opportunities for improvement be considered in both key courses and related courses. The idea of key courses is intended to minimize the faculty workload associated with the compilation and assessment of outcomes. It establishes an efficient process for collecting the convincing evidences required by ABET. It also solves the problem of courses taught outside the Faculty of Engineering (math, physics & humanities) and those taught outside the program. These courses are considered as related courses and are not required to present convincing evidence of achievement outcomes.

<sup>1</sup> ABET, Criteria for Accrediting Engineering Programs, Engineering Accreditation Commission, Baltimore, Md., October 29, 2011. See: <http://abet.org/accreditation-criteria-policies-documents/>

<sup>2</sup> M. Detamore and P. Willhite, “Planning for the ABET Program Outcomes in Life-Long Learning and Contemporary Issues,” Proceedings of the 2010 Midwest Section Conference of the American Society for Engineering Education, 2012. See: [http://www.asee.org/documents/sections/midwest/2010/34\\_Detamore-Willhite.pdf](http://www.asee.org/documents/sections/midwest/2010/34_Detamore-Willhite.pdf).

<sup>3</sup> E. Schmeckpeper, A. Ater Kranov, S Beyerlein, J. McCormack, and P. Pedrow, “A Direct Method for Simultaneously Teaching and Measuring Engineering Professional Skills,” 2012 ASEE Northeast Section Conference University of Massachusetts Lowell Reviewed Paper April 27-28, 2012. See: [http://acamedics.com/proceedings/aseene/2012/PM\\_3152.pdf](http://acamedics.com/proceedings/aseene/2012/PM_3152.pdf).

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## Summative Assessment of Professional Skills

Capstone BS Project is used as the key course for the summative assessment of teamwork (outcome d), communication skills (outcome g) and impact of engineering solutions (outcome h) using AAU assessment rubrics and surveys for these outcomes. Programs are required to identify at least two key courses for the summative assessment of the 3 remaining professional outcomes. These courses use two standard assignments in the form of two term papers, explained hereafter to assess professional and ethical responsibility (outcome f), life-long learning (outcome i), and knowledge of contemporary issues (outcome j). In addition to the key course for outcome f, companies' evaluation of the students' performance during summer and coop training is used as an additional assessment tool for that outcome.

## An Engineering Ethics Assignment

This assignment assesses the understanding of engineering students to their ethical responsibilities through analysing an ethical situation using codes of ethics. The assignment consists of four steps:

- 1) Each student has to select three Engineering Ethics cases relevant to his engineering discipline (civil, electrical, industrial for example) and submit them to the course instructor. The duration of this step is one week.
- 2) Each student has to discuss the selected cases with the course instructor & get his approval for one of them. The duration of this step is one week.
- 3) Each student has to study the Saudi Council of Engineers (SCE), the National Society of Professional Engineers (NSPE) Codes of Ethics and a code of ethics relevant to his discipline (e.g. ASCE for civil engineering). The duration of this step is one week.
- 4) Each student has to read the selected case and answer the question(s) provided with it and prepare a final report in the form of a term paper that follows the standards of KAU Engineering Journal paper. The duration of this step is one week.

The assignment will be graded as follows:

- 1) Students who did not submit the selected cases within (3) working days or the final report within (5) working days after the due date will get a ZERO Grade for the entire assignment.
- 2) Checklist entitled "Presentation of Engineering Ethics Case" will be applied:
  - i. Students who received "Needs Improvement (NI)" grade can improve their work and re-submit it within one week of receiving their reports. No late reports for resubmission will be accepted.
  - ii. Students' work that got "Meet (M)", will be graded using the Rubric for Understanding of Professional and Ethical Responsibility given on page 4.

- 3) Any evidence of plagiarism will result in a ZERO grade for the entire assignment.

KING ABDULAZIZ UNIVERSITY - FACULTY OF ENGINEERING  
(DEPARTMENT) – (COURSE CODE & NAME) – CONTACT: (E-MAIL)

### Presentation of Engineering Ethics Case Checklist

Student Name: ..... ID Number: ..... Date: .....

Self-Assessed by Student Color: ..... Assessed by Instructor: ..... Color: RED

Student must self-assess by filling out this Checklist and attach it as a cover sheet to his assignment.

Negative Points	Self-regulation issues (this part is filled by instructor)
	A. Did the student submit the selected cases on time? (If No, enter 2 points for each day late (Max 3 working days ))
	B. Is the report submitted on time? (if No, enter 2 points for each day late (Max 5 working days ))
	C. Is this a resubmitted work, enter 10 points
	D. Other self regulation issues (e.g.: the student was unprepared during the discussion of the selected cases).
	Enter the total points (A+B+C+D)

YES	No	Expected Features
		1. The <b>Cover page</b> includes: Course Name, Section No, Semester and year, Report Name, Student name and SSN, Report due date, Report submission date.
		2. The introduction marks the <b>context</b> of the new work and <b>orients</b> the reader (i.e., gives the reader what is the report about and some sense of what follows)?
		3. In the write-up, there is a clear reference to SPECIFIC RELEVANT PORTIONS OF THE CODES OF ETHICS that supports the student's answers (for example, "per SCE code 1-2")
		4. In the write-up, the student included his own and societal values as they apply.
		5. <b>The conclusion</b> that is at the end of the work, <b>discusses</b> and <b>reflects</b> upon the work done (i.e. what was learned, justifications about subject and what will happen next)
		6. The work is professional and ethical (i.e., all claims are proved or referenced and references are given in detail at the end of the work, and no plagiarism)
		7. The work followed <b>KAU Engineering Journal Format Template posted at <a href="http://www.aaueng.com">www.aaueng.com</a></b>

### Results of Assessment

M	NI*	
		1. M, meets expectations, requires all <u>Yes</u> 's for items 1 to 7 2. NI, needs improvement, is given if there are any <u>No</u> 's for items 1 to 7

\* If the report was assessed as NI, the student is required to submit a corrective version within (5) working days after the report was returned to him.

## A Contemporary Issues and Life– Long Assignment

It is required for the students in an engineering discipline to know about contemporary issues that are recent/modern events or problems that may affect the engineering discipline or are affected by the engineering discipline. Contemporary issues can be environmental, societal, economical, technical, non-technical or political. In this assignment, students will prepare a term paper about one of the contemporary issues. The assignment consists of two steps:

- 1) Students will search contemporary issues and report out (oral and in writing) at least five of them using "Presentation of Contemporary Issues Checklist" attached to this assignment. Duration of this step is two weeks.
- 2) Students will select one of the contemporary issues with approval of their instructor and search in details about it. Then, they will prepare a final report that includes Step 1 and Step 2 in the form of a term paper that follows the standards of KAU Engineering Journal paper. Duration of this step is four weeks.

The assignment will be graded as follows:

- 1) Students who did not submit the report within (5) working days after the due date will get a ZERO Grade for the entire assignment.
- 2) Checklist entitled "Presentation of Contemporary Issues Checklist" will be applied. Students who received "Needs Improvement (NI)" grade can improve their work and resubmit it within one week of receiving their reports. No late reports for resubmission will be accepted.
- 3) Students' work that got "M", will be graded using two rubrics: Rubric for Knowledge of Contemporary Issues and Rubric for Life-Long Learning which are given on page 3 and 4..

KING ABDULAZIZ UNIVERSITY - FACULTY OF ENGINEERING (DEPARTMENT) – (COURSE CODE & NAME) – CONTACT: (E-MAIL)	
<b>Presentation of Contemporary Issues Checklist</b>	
Student Name: ..... ID Number: ..... Date: .....	
Self-Assessed by Student Color: ..... Assessed by Instructor: ..... Color: RED	
Student must self-assess by filling out "Written Report" part of this Checklist and attach it as a cover sheet to his assignment.	
<b>Negative Points</b>	<b>Self-regulation issues (this part is filled by instructor)</b>
	A. Is the report submitted on time? (if No, enter <b>2</b> points for each day late (Max 5 working days))
	B. Is this a resubmitted work, enter 10 points.
	C. Other self regulation issues. Specify:
	Enter the total points (A+B+C)
<b>Yes</b>	<b>No</b>
<b>Written Report (this part is filled by student and instructor)</b>	
	1. Does <b>the cover page</b> includes: Course Name, Section No, Semester and year, Report Name, Student name and SSN, Report due date, Report submission date?
	2. Are there a <b>title for the paper, name of author and his affiliation, and an abstract</b> ?
	3. Is there an <b>Introduction</b> which marks the context of the new work and orients the reader (i.e., gives the reader what is the report about and some sense of what follows)?
	4. Are there <b>acceptable five contemporary issues</b> and brief <b>explanations</b> for them?
	5. Is there any explanation of " <b>how the contemporary issues are related to the engineering discipline</b> "?
	6. Is there a <b>conclusion</b> that is at the end of the work, which discusses and reflects upon the work done (i.e. what was learned, justifications about subject and what will happen next)?
	7. Is the report <b>professional</b> and <b>ethical</b> (i.e., all claims are proved or referenced and references are given in detail at the end of the work, and no plagiarism)
	8. Is the report written according to <b>KAU Engineering Journal Format Template posted at www.aaueng.com</b>
<b>Oral Presentation (this part is filled by instructor)</b>	
	9. Does <b>the oral presentation</b> given by the student meet expectations?
<b>Results of Assessment</b>	
<b>M</b>	<b>NI*</b>
	1. M, meets expectations, requires <b>all Yes</b> 's for items 1 to 9. 2. NI, needs improvement, is given if there are any <b>No</b> 's for items 1 to 9.
* If the report was assessed as NI, the student is required to submit a corrective version within (5) working days after the report was returned to him.	

## Rubric for Knowledge of Contemporary Issues

#	KPI	Excellent (3)	Good (2)	Needs Improvement (1)	Unsatisfactory (0)
j.1	Identification	Analyze some contemporary issues and discuss their impact and what makes them particularly problematic or controversial in the present time.	Analyze some contemporary issues and discuss some of their short term and long term impacts on direct and indirect users.	Analyze some contemporary issues but only short term impacts are discussed.	Identified issues are not of real interest, not really contemporary, or not problematic.
j.2	Root causes	Suggest reasonably justified and well referenced theories regarding the root causes of contemporary problems.	Present only some reasonably justified and well referenced causes of contemporary issues	Use credible references to suggest or postulate causes without reasonable justification.	Fail to present any correct causes.
j.3	Possible solutions	Evaluate/propose possible solution strategies to contemporary problems, as well as any limitations of such strategies.	Discuss possible solutions are discussed but they are taken as granted without discussing their limitations.	Present solutions that have a limited likelihood to solve the problems.	Fail to present any possible solutions.

## Rubric for Understanding of Professional and Ethical Responsibility

#	KPI	Excellent (3)	Good (2)	Needs Improvement (1)	Unsatisfactory (0)
f.1	Professional Appearance	Usually demonstrate trustful appearance, self confidence, convincing personality, and respect of his/her personal skills without being personally prideful in words or actions.	Have acceptable level of personal appearance and respect of his/her skills and abilities without being arrogant.	Have acceptable level of personal appearance, but may underestimate or overestimate his/her skills and abilities or demonstrate arrogant attitudes.	Have unacceptable personal appearance
f.2	Professional Interactions	Be punctual, enthusiastic, initiative taker, show respect for others, take personal responsibility for his/her actions, and establish successful relationships with peers, superiors, and clients while remaining business focused and quality oriented.	Be punctual, enthusiastic, business focused, quality oriented, take personal responsibility for his/her actions, but usually concentrate on establishing good relations with superiors or relations based on personal benefits.	Underestimate the importance of punctuality, tend to have things done with minimum level of quality and/or effort, if any, or do not recognize the need to take personal responsibility for his/her actions.	Fail to maintain successful business interactions, fail to have things done on time and within budget, or tend to blame others for own issues and problems.
f.3	Objectivity	Analyze a problem objectively using facts and a professional code of ethics while recognizing individual and cultural biases.	Listen to other viewpoints and try to maintain a fair and objective perspective.	Evaluate and judge a situation using personal understanding of the situation, possibly applying a personal value system	Have personally biased perspective of problems and issues and fails to assess things objectively.
f.4	Ethical Choices	Use engineering codes of ethics, input from constituencies and common sense to evaluate choices using formal ethical criteria and accept responsibility for decisions.	Use heuristics or personal experience to make choices that are consistent with codes of ethics and accept responsibility for decisions.	Make decisions based on personal feelings or avoid taking responsibility for actions.	Behave unethically, fail to recognize ethical dilemmas, or blame others for failures.

**N.B.:** f.1 and f.2 KPIs are assessed by the course instructor based on the in-class attitudes of the student over the semester, while f.3 and f.4 are assessed using the final term paper submitted by the student.

## Rubric for Life-Long Learning

#	KPI	Excellent (3)	Good (2)	Needs Improvement (1)	Unsatisfactory (0)
i.1	Recognition of the Need	Go beyond what is required in completing an assignment, by bringing credible value-adding information from outside sources.	Go beyond what is required in completing an assignment, but the collected information may lack credibility, authenticity, or added values.	Complete only what is required.	Have trouble completing even the minimum required tasks.
i.2	Accessing Information	Access information from a variety of sources and critically assess their quality, validity, and accuracy.	Access information from a variety of sources and assess their quality, validity and accuracy to some extent.	Access information from a variety of sources without any attempt to assess their quality, validity or accuracy.	Be unable to access information unless clearly guided to pending sources.
i.3	Self learning	Analyze new content by breaking it down, comparing, contrasting, recognizing patterns, and/or interpreting information.	Analyze new content with some difficulties.	Reach the expected outcome of task or projects only with some guidance.	Complete a task only with detailed or step-by-step instructions.
i.4	Reflection on learning	Regularly reflect on his/her learning process, evaluate personal performance and progress, and take required actions and improvements.	Reflect on his/her learning process, evaluate personal performance and progress, but fail to take required actions.	Occasionally reflect on his/her learning process if asked to do.	Fail to recognize his/her own shortcomings or deficiencies.

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