How to Qualify for ABET

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ABET OVERVIEW

- The Accreditation Board for Engineering and Technology (ABET) is a federation of over 30 professional engineering societies. It has been in the business of quality assurance for over 70 years

- It now consists of four commissions dealing with, Engineering (EAC), Computing(CAC), Engineering Technology (ETAC), and Applied Science (ASAC)

- Traditionally, it started and continued to accredit programs mainly in the US

INTERNATIONAL ACTIVITIES

- In recent years, the **global economy** has expanded and the demand for human **mobility** has increased. Quality education at schools located outside the United States has become increasingly important to universities, employers and professional societies

THE PROCESS OF EVALUATION FOR SUBSTANTIAL EQUIVALENCY

- Beginning with evaluations in 1995, "***substantial equivalency***" is granted to an engineering program for a specific term, usually ***three to six years***, if existing conditions satisfy the engineering criteria and are judged to potentially satisfy the criteria throughout the term of recognition

5   FULL FLEDGED ACCREDITATION

- Since 2006, substantial equivalency replaced by a full fledged ABET accreditation were all national and international programs are treated similarly

REMINDER!

- All ABET Accreditation Activities are voluntary and not mandatory

- ABET accredits programs and not colleges

- ABET does not rank programs

- ABET supports its activities from collected fees

EVALUATION PROCESS

- The evaluation process includes
    - Self study report (SSR)
    - An on-site visit of ABET team
    - An exit interview with the Dean
    - A written report to the institution

ABET GENERAL CRITERIA

- Students

- Program Educational Objectives

- Student Outcomes

- Continuous Improvement

- Curriculum

- Faculty

- Facilities

- Institutional Support & Financial Resources

PHILOSOPHY OF ABET

- Practice **continuous improvement** using:
  - Institutions and Programs define missions and objectives to meet the needs of their constituents
    - Input of constituencies
    - Process focus
    - Outcomes and Assessment linked to objectives
  - Programs demonstrate how criteria and program outcomes and objectives are being achieved

AN OVERVIEW:

A successful outcome of the ABET accreditation process of any engineering, computer sciences and technology programs, extensive preparations are needed. These include step by step type of approach in preparation that takes into consideration the strict and specific requirements of ABET 8 criteria

RECOMMENDATIONS

- For any program seeking accreditation we then recommend the following steps:
  - Building general awareness and appreciation by faculty, students and administrators of the importance of accreditation as the minimum requirement to quality. This means creating an atmosphere of knowledge, culture, appreciation and commitment to the accreditation process by all *stakeholders*

- Constructing appropriate departmental, college and industrial ***advisory board committees*** needed for pursuing ABET accreditation
- Defining ***missions*** for the programs seeking accreditation that are consistent with those of their colleges and the university a whole

- Constructing program **objectives** with the help of the various **constituents** of the program. This is a very important and fundamental requirement by ABET. Objectives are defined as <u>attributes that the graduates of the program acquire few years after graduation</u>. Constituents include alumni, employers, faculty, students and their parents, etc.

- Constructing program educational **outcomes**. These are the well known a-k outcome requirement by ABET. These mean the attribute gained by the students at the time of graduation. This item is also very important requirement by ABET

- Making sure that the ***curriculum*** meets the requirements of ABET and then mapping the program curriculum against the outcomes to show how the curriculum meets the specific requirement ***for satisfying the outcomes and hence the objectives***

- Identifying and adopting **assessment and evaluation** methods to check whether or not the outcomes and objectives are met. This is perhaps the most critical item required by ABET

- Showing how the assessment methods are used for **continuous improvement** of the program

- Making sure that the number of faculty members is enough and that they are well qualified to teach and advise students

- Making sure that the administrative and financial support is appropriate, etc

- And finally writing the required SSR template. This is the most important document that needs to be submitted well in advance for ABET that includes description and information from all items presented above

ABET TIME TABLE

Any program seeking ABET accreditation is required to:

- Submit to ABET headquarters a request for the evaluation visit no later than the end of January of the year it intends to be visited

- The visit will then be scheduled during the following fall

- The SSR needs to be submitted by the first of July after the application is requested

- The official visit will then be scheduled any time during October-December period of the year

- The final accreditation result will be announced by the end of July the following year

- There, however the continuous communication between the program and ABET agency until the final results are announced. This period can be used for submitting extra material that can support the program case

REMARKS

- It is obvious from the above that the process involved is lengthy and requires appropriate time, especially the assessment of objective and outcomes

- Under no circumstance the process will take less than two years of completion

CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS

CRITERION 1. STUDENTS

- The institution must evaluate, advise and monitor students to determine its success in meeting program objectives

- The institution must have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere

- The institution must also have and enforce procedures to assure that all students meet all program requirements

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

- Educational **objectives** are statements that describe the expected accomplishments of graduates during the **first several years** following graduation from the program

- Each engineering program for which an institution seeks accreditation must have in place:
  - Published educational objectives that are consistent with the mission of the institution and these criteria
  - A process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated
  - A curriculum and processes that prepare students for the achievement of these objectives
  - A system of ongoing evaluation that demonstrates achievements of these objectives and uses the results to improve the effectiveness of the program

CRITERION 3. PROGRAM OUTCOMES AND ASSESSMENT

- Program outcomes are statements that describe what students are expected to ***know or be able to do by the time of graduation from the program***. Engineering programs must demonstrate that their graduates have:

CRITERION 3. CONT.

(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, 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.

CRITERION 4. CONTINUOUS IMPROVEMENTS

- Each program must have an **assessment** process with documented results

- Evidence must be given that the results are applied to the **further development and improvement** of the program

- The assessment process must demonstrate that the objectives and outcomes of the program, including those listed above, are being measured

PROGRAM OBJECTIVES AND OUTCOMES
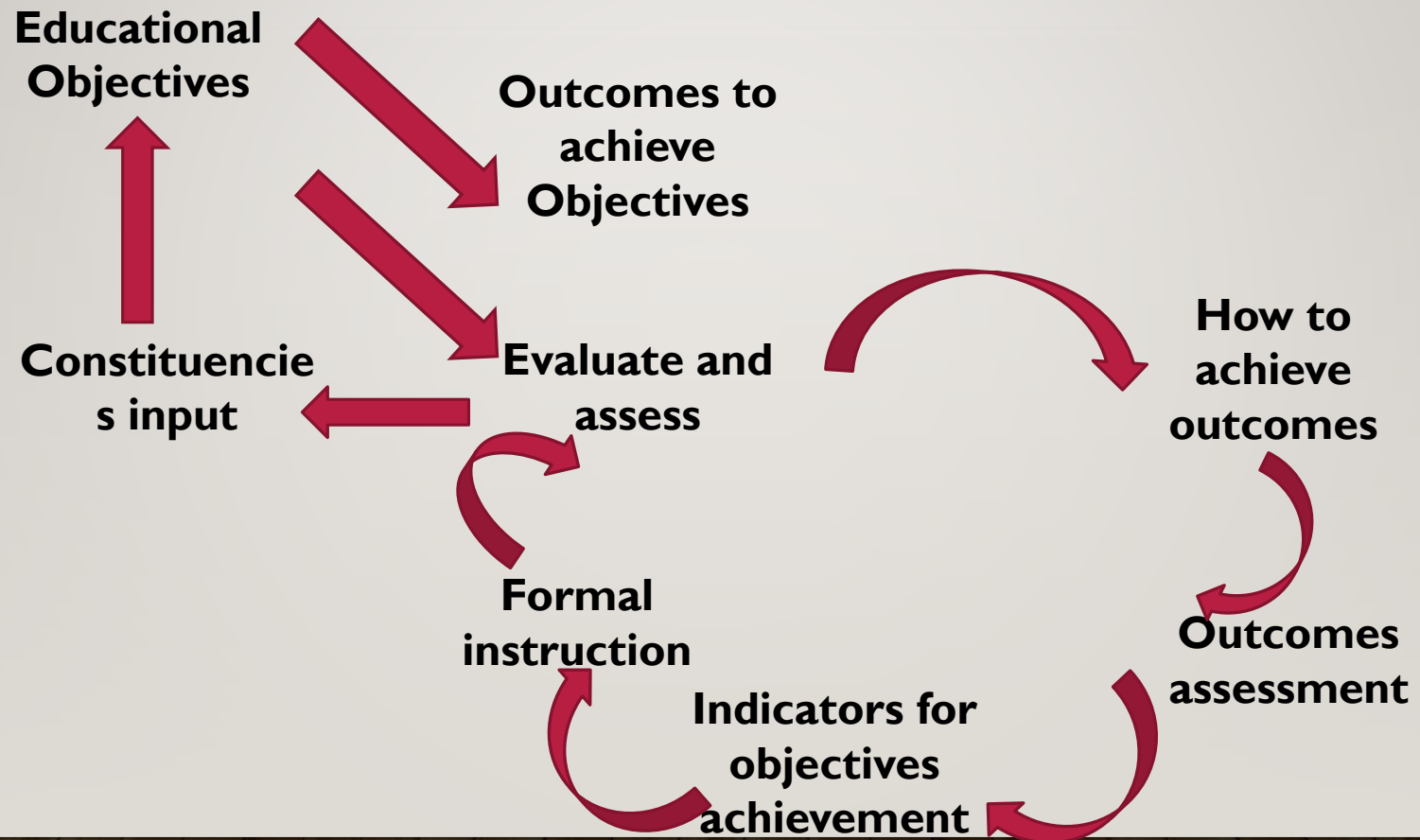
- **Program Educational Objectives**

Are statements that describe the expected accomplishments of graduates during the first several years following graduation from the program

  - Demonstrate leadership qualities and participate in professional development to ensure professional competent

  - Maintain and practice with the highest standards of ethics and integrity

- **Program Outcomes**

Are statements that describe what students are expected to know or be able to do by the time of graduation from the program

  - Graduates have the ability to communicate effectively

  - Have an ability to design a system, components, or process to meet desired needs

  - Ability to design and conduct experiments as well to analyses and interprets data

Educational Objectives

Outcomes to achieve Objectives

How to achieve outcomes

Constituencies input

Evaluate and assess

Outcomes assessment

Formal instruction

Indicators for objectives achievement

CRITERION 5. CURRICULUM

- The professional component requirements specify subject areas appropriate to engineering but do not prescribe specific courses

- The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program institution

- Students must be prepared for engineering practice through the curriculum culminating in a major design experience and incorporating engineering standards and realistic constraints that include ***economics, environmental, sustainability, manufacturability, ethical, health and safety, social, and political issues***

CRITERION 5. CONT.

The professional component must include:

A. ***One year*** of college-level mathematics and basic courses

B. ***One and one-half years*** of engineering topics, consisting of engineering sciences and engineering design. Engineering design is the process of devising a system, component, or process to meet desired needs

C. A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives

CRITERION 6. FACULTY

- The faculty must be of *sufficient number* to accommodate adequate levels of student-faculty interaction, student advising and counseling, professional and industrial service

- The program faculty must have appropriate qualifications to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes

- The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as professional engineers

CRITERION 7. FACILITIES

- *Classrooms, laboratories, and associated equipment* must be adequate to accomplish the program objectives and provide an atmosphere conductive to learning

- Appropriate *facilities* must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities

- Programs must provide opportunities for students to learn the use of *modern engineering tools*

- *Computing and information infrastructures* must be in place to support the scholarly activities of students and faculty and the educational objectives of the program and institution

CRITERION 8. INSTITUTIONAL SUPPORT AND FINANCIAL RESOURCES

- Institutional support, financial resources, and constructive leadership must be adequate to assure the *quality and continuity* of the engineering program

- Resources must be sufficient to attract, retain, and provide for the continued professional development of a *well-qualified faculty*

- Resources also must be sufficient to acquire, maintain, and operate *facilities and equipment* appropriate for the engineering program

- In addition, *support personnel* and institutional services must be adequate to meet program needs

PROGRAM CRITERIA

- Each program must satisfy applicable Program Criteria (if any). Program Criteria provide the specificity needed for interpretation of the basic level criteria as applicable to a given discipline

- Requirements stipulated in the Program Criteria are limited to the areas of curricular topics and faculty qualifications

- If a program, by virtue of its title, becomes subject to two or more sets of Program Criteria, then that program must satisfy each set of Program Criteria; however, overlapping requirements need to be satisfied only once

ASSESSMENT AND EVALUATION

Overview

- Program uses different tools and processes to regularly assess and evaluate the extent to which its PEOs and SOs are being attained. These processes are used to gather the data necessary for assessment. Evaluation, in the form of interpreting the data, is then carried out in order to determine how well the objectives and outcomes are being attained. The results of both the assessment and evaluation processes are finally utilized to affect continuous improvement of the program. The steps used for the assessment. Evaluation and feedback to the continuous improvement of the program follow the following three steps:

- Processes for assessment (i.e., collecting appropriate data) can be direct or indirect. Indirect assessment of PLOs and of SOs are usually obtained by using surveys, whereas direct assessment of SOs usually relies on the course work. This step includes designing forms of surveys and appropriate questions for the specific and applicable data

- This will be followed by analyzing and comparing it to a present performance indicator, which constitutes the evaluation (interpreting) processes

- Checking the degree to which the data evaluation results meet the pre-specified targets will be the driving force for the continuous improvement processes
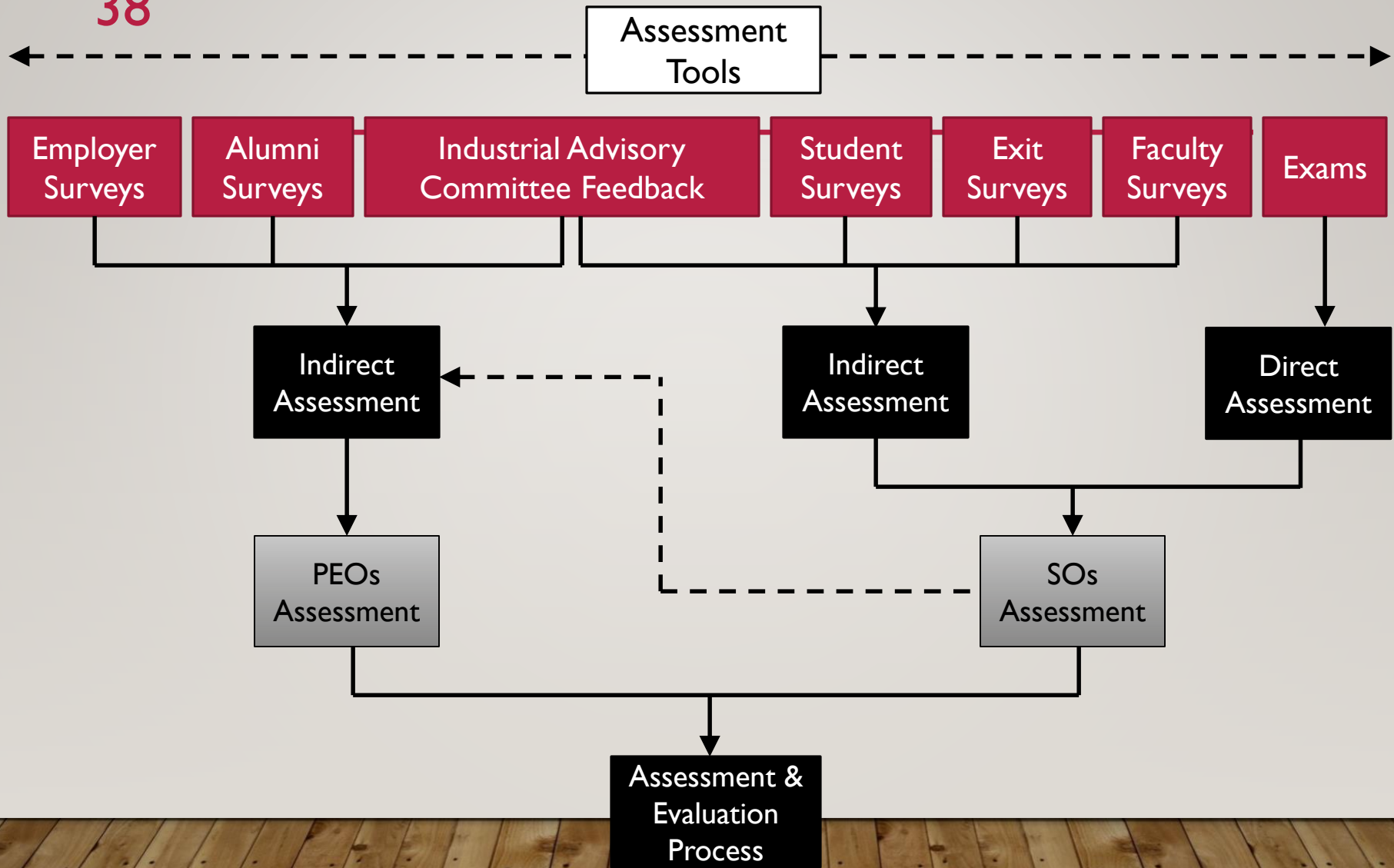
DIRECT ASSESSMENT

DESCRIPTION

- For our program, we have adopted the ABET A-I and the specific program criteria outcome J and K. We choose not to map university requirements or the basic science courses (math, physics, chemistry, biology, and computer) to the outcomes. These do automatically satisfy the outcomes A-I. In fact, being common courses with nationally and internationally similar basic instructional materials, they are actually the basis for defining ABET's general A-I outcomes

- As far as mapping a program courses (the mandatory and elective ones), we follow the recommendation of most experts who suggest mapping a given course to no more than 3 outcomes. The projects as well as capstone courses are exceptions and can have many SOs as needed. To maintain flexibility and allow the individual faculty member teaching a particular course to reflect his/her style of teaching, he or she can divide the course outcomes into several sub-outcomes, CLOs, as an intermediate step provided that these can be directly mapped back into the outcomes for ABET reporting

- To illustrate the whole process, we consider a hypothetical program that has identified its outcomes as A-K. Let us pick a typical course falls within the specialty of these faculty members, say P1, P2, and P3. These members, together with the course coordinator who is assigned by the departmental council, are responsible for identifying the course's key outcomes. This committee is also supplied with a set of student outcomes as well, with CLOs, which were adopted and tried for the course at an earlier semester. Let us assume that, after examining the situation, they agree that this particular course serves mainly the three key outcomes b, f and j up to a total level of 75%.

- Using this approach, the program faculty members determine the key SOs for each of the courses they are teaching. The SOs targeted by the program courses are then discussed and approved by the departmental council and tabulated in a matrix form in Table (**in the next slide 44**). This matrix shows that each of the A-K SOs is targeted by at least three courses of the program. All faculty members are obligated to follow this finalized matrix by using the targeted SOs for a course they will teach

Course Code	Course Title	Student Outcomes										
		A	B	C	D	E	F	G	H	I	J	K
202		✓	✓									
203		✓	✗									
204		✓	✓									
211		✓	✗									
212		✓										
214			✓				✓				✓	
222		✓										
223		✓	✓									
241												
301			✓									
302		✓	✓									
331		✓	✓									
351		✗	✓									
353												
361		✓	✓									
371			✓									
381			✓									
391			✓	✓	✓							
498		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
499		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ : Key Student Outcome

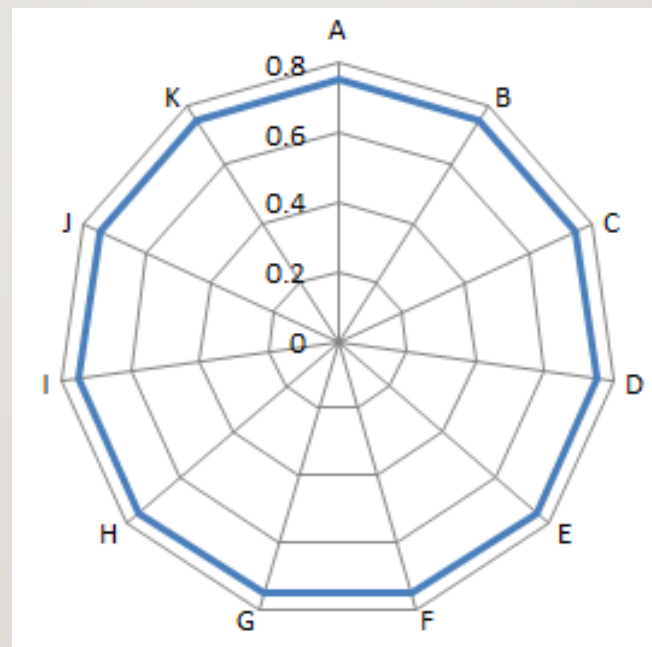✗ : Other less Important Student Outcome

DIRECT ASSESSMENT

- Next, we need to introduce the direct assessment of the SOs. We choose, for illustration, the hypothetical course described above, namely 214. Let us assume that faculty member P2 is teaching this course. During the semester, we suggest that three quizzes be given; one for each of the three outcomes. Following this, we identify the percentage of the students who score on or above a given pre-set grade level and tabulate this number in red, as shown in below Table (*slide 46*). For the midterm and final, the number and type of questions asked should involve the three outcomes. Here we indicate that faculty members can also choose other measures of their choice such as homework, laboratory works, in-class participation, etc., as they see fit.

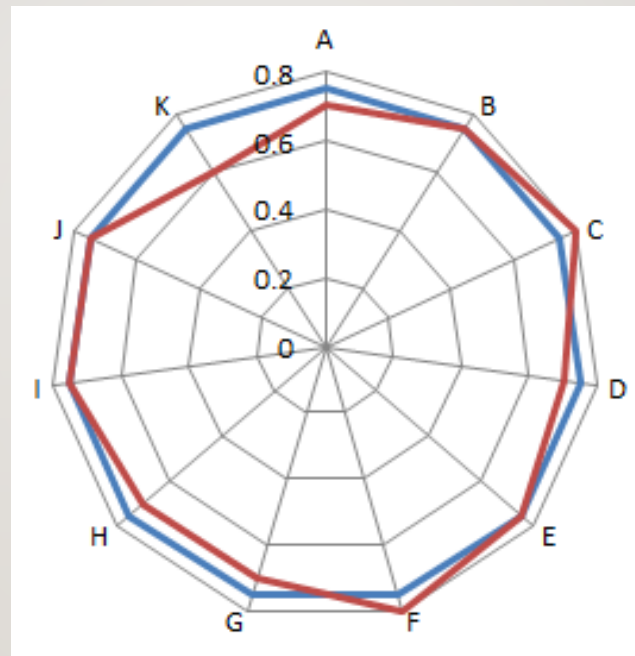|	A	B	C	D	E	F	G	H	I	J	K
Quiz 1	0	0.96	0	0	0	---	0	0	0	---	0
Quiz 2	0	---	0	0	0	0.52	0	0	0	---	0
Quiz 3	0	---	0	0	0	---	0	0	0	0.69	0
Midterm	0	0.76	0	0	0	0.46	0	0	0	0.80	0
Final	0	0.83	0	0	0	0.68	0	0	0	0.72	0
Avg. of averages for Outcomes B, F, and J	0	0.85	0	0	0	0.55	0	0	0	0.74	0

- The three (red) averages (of the quiz, midterm, and final) for each of the three outcomes are compared with a pre-set target value choses, say 75%. This whole exercise can be adopted and repeated for a few of the courses (as many as any program wishes) and the results of their assessments can be averaged for each outcome leading to its final value. An illustrative sample of this process for several representative courses is shown in the below Table (*slide 48*). This will then be followed by analysis and evaluation to see whether or not the individual outcome met the targeted value. These results will then be used for continuous improvement purposes.

Course Code	Course Title	Student Outcomes										
		A	B	C	D	E	F	G	H	I	J	K
202		0.80	0.68							0.70	X	
203		0.57	X							0.75	0.9	
204		0.76	0.80							X	0.58	
211		0.73	X	0.80						0.68		
214			0.85				0.49		X		0.76	
498		0.90	0.80	0.85	0.65	0.76	0.90	0.69	0.86	0.65	0.88	0.55
499		0.78	0.77	0.83	0.65	0.76	0.90	0.69	0.70	0.70	079	0.55

- In order to analyze the results in the above table, the data in the table are illustrated in the below Figure (*slide 50*) in the form of a polar graph of the degree of attainment of the course's outcomes B, F, and J as shown in the blue color and compared with the preset attainment level of 75%. As seen outcome B exceeds the target and outcome J meets the target. The next Figure (*slide 51*) illustrated the hypothetical case for the averages of few assessed courses as collected below for the whole program

52 REFERENCES

- http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2016-2017/

THANK YOU!!!

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