Department of Electrical Engineering
EE Program Assessment Plan
I. Electrical Engineering Program's Mission, Vision, and Objectives

Electrical Engineering Program Mission Statement

The mission of the Electrical Engineering Program is consistent with the University and the College missions.

The mission of the Electrical Engineering Program is:
- To provide a quality and broad engineering education.

- To conduct strong basic and applied research, to disseminate knowledge, and to contribute to the advancement of science and technology.

- To serve the industry, the profession, and the community at large through innovative solutions.

A. Program Educational Objectives (PEOs)

The Electrical Engineering Program (PEOs) at Kuwait University has adopted and implemented the use of the term "objectives" as defined by ABET Engineering Criteria for 2019-2020 review cycle: *"Program educational objectives are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program's constituencies".* The EE Program has adopted the following Program Educational Objectives.

1. *Graduates will successfully engage in careers in the broad range of electrical engineering areas to serve the needs of both private and public sectors.*
2. *Graduates will engage in continuous professional development activities, seek learning opportunities including graduate studies, and adapt to the rapid changes in work environment.*
3. *Graduates will contribute to the well-being of the society and environment through responsible practice of engineering profession.*

B. Consistency of the Program Educational Objectives with the Mission of Institution

The PEOs are consistent with the College mission statement and support the principles, the core values, and the University mission statement. Specifically, when the EE graduates can utilize their skills in a large range of private and government companies then this is due to the quality and broad engineering education that the EE program is providing. Similarly, the second PEO, dealing with professional development activities and adapting to rapid changes in work environment, directly addresses the College mission. This directly implies a desire for life-long learning. The

third objective of the contribution of practicing engineers to the well-being of the society is aligned with the College mission to serve the industry, the profession, and the community at large by providing solutions and taking advantage of diverse technical knowledge and skills.

    Table 1 cross-lists the relations between the EE Program Educational Objectives and the University, the College, and the EE Program missions.

Table 1: Relations of the EE Program Educational Objectives to the University and College missions.

Missions		EE Program Educational Objectives		
		Graduates will successfully engage in careers in the broad range of electrical engineering areas to serve the needs of both private and public sectors.	Graduates will engage in continuous professional development activities, seek learning opportunities including graduate studies, and adapt to the rapid changes in work environment.	Graduates will contribute to the well-being of the society and environment through responsible practice of engineering profession.
Kuwait University	To prepare a prominent human capital characterized by their exceptional knowledge	✓		
	To meet the development requirements		✓	✓
	To keep pace with the latest information and technology in higher education		✓	
	To lead in scientific research while upgrading in serving the community		✓	
College	To provide students with quality engineering education	✓	✓	
	To advance and disseminate knowledge	✓	✓	
	To lead the society in enhancing its welfare.			✓
Electrical Engineering	To provide a quality and broad engineering education.	✓	✓	✓
	To conduct strong basic and applied research, to disseminate knowledge, and to contribute to advancement of science and technology.	✓	✓	✓
	To serve the industry, the profession, and the community at large through innovative solutions.	✓		✓

C. Program Constituencies

The following principal constituencies provide the major means for accomplishing the Program Educational Objectives for the Electrical Engineering Program.

1. Current undergraduate students of the Electrical Engineering Program
2. Faculty members of the Electrical Engineering Department
3. Employers of graduates of the Electrical Engineering Program
4. Alumni of the Electrical Engineering Program

Current undergraduate students of the Electrical Engineering Program:

The constituency of the EE students is very valuable since they are the most beneficiary from the high quality of education that the EE program is providing. Students concerns, suggestions, and recommendations are used for program improvements. Students' inputs are formally obtained through exit surveys (*http://www.eng1.kuniv.edu/oaa/exit/*) of graduating seniors, which is conducted every semester. All graduates conduct the exit survey; completing the exit survey form is considered a requirement for graduation. For example, 144 graduates completed the exit survey in the academic year 2021-2022. In addition, further informal inputs are obtained through discussions (the department chair) with the officers of student groups (primarily the IEEE Student Chapter and the SEES organization) as well as the discussions (Questions & Answers session) with the students during the yearly Open Day activities.

Faculty members of the Electrical Engineering Department:

Accomplishing the PEOs of the EE program is the main responsibility of the EE faculty members who provide the educations to the students. The EE faculty members ensure that the teaching practices and the program curriculum meet the PEOs of the EE program. The EE faculty members directly review the overall program through an Online Faculty survey (*http://www.eng1.kuniv.edu/oaa/faculty/*), which is conducted every three years. In addition, the EE faculty members directly evaluate the Student Outcomes of the courses using Instructor Class Evaluation referred to as online course-assessment (*http://www.eng1.kuniv.edu/oaa/*) at the end of each semester.

Alumni of the Electrical Engineering Program:

The EE program seeks feedback from its employed graduates for further enhancements to its educational process. Alumni are encouraged to share their perspectives and advice on the EE program through Alumni surveys (*http://www.eng1.kuniv.edu/oaa/alumni/*), which are conducted every 3 years.

<u>Employers of graduates of the Electrical Engineering Program</u>:

In addition to some private companies, Kuwait Government ministries are the main employers of our graduates. Thus, the Program Educational Objectives when achieved will serve the needs of the State of Kuwait by providing well-educated graduates. The EE program surveys the employers (*http://www.eng1.kuniv.edu/oaa/employer/*) of our graduates every 4 years.

An additional source of employer input is obtained from the Department External Advisory Board. The board meets with EE chairman and some of the Department faculty members and the administration. The agenda of the meeting normally includes a review of proposed changes in the academic program, and discussions of new activities for the department. The recommendations are distributed to faculty members.

Finally, it is worth mentioning that the Electrical Engineering Program follows the recommendations and addresses all the observations by ABET team after every review visit.

D. Process for Review of the Program Educational Objectives

The Electrical Engineering Department formed two major committees (The Undergraduate Program Committee (UPC) and the Assessment Committee (AC)) with mandates to establish the Mission, the Program Educational Objectives, and the Student Outcomes of the Electrical Engineering Program according to ABET EC-2000. The members of these two committees were faculty who served for a long time in curriculum development activities since the curriculum is the major means for students to achieve the PEOs.

Figure 1 shows the process cycle to review the EE Program Educational Objectives. The various constituencies provide input to establish the PEOs of the EE program. Direct measurements are used to ensure that the PEOs are reviewed and revised. The PEOs are reviewed (evaluated if necessary) and further discussed with the constituencies (Students, Faculty, Alumni, Employers) for improvements as shown in the loop in the figure. The Student Outcomes are achieved through the EE curriculum and the teaching practices in the program. The Student Outcomes are assessed and evaluated using direct measures (Online course evaluation, Teaching Area Group, Faculty survey, exit surveys) and indirect measures (Employer surveys, Alumni surveys). The Student Outcomes are assessed and evaluated to ensure that the PEOs are achieved for the set target of performance; and accordingly, teaching practices are modified, enhanced, and/or changed to reach this target.

The Undergraduate Program Committee (UPC) is responsible for determining that the PEOs are consistent with the missions of the EE program and the College and ensuring that they are achieved.

Figure 2 shows the steps taken for the assessment and evaluation process and the decision-making process at the College and at the EE Department levels for curriculum changes. The timelines of the various constituents' inputs to the PEOs are shown in **Table 2**.
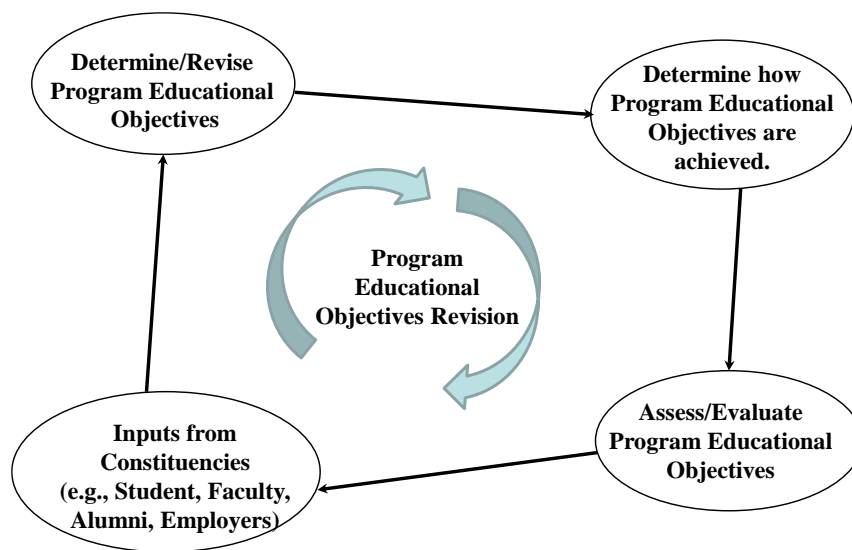

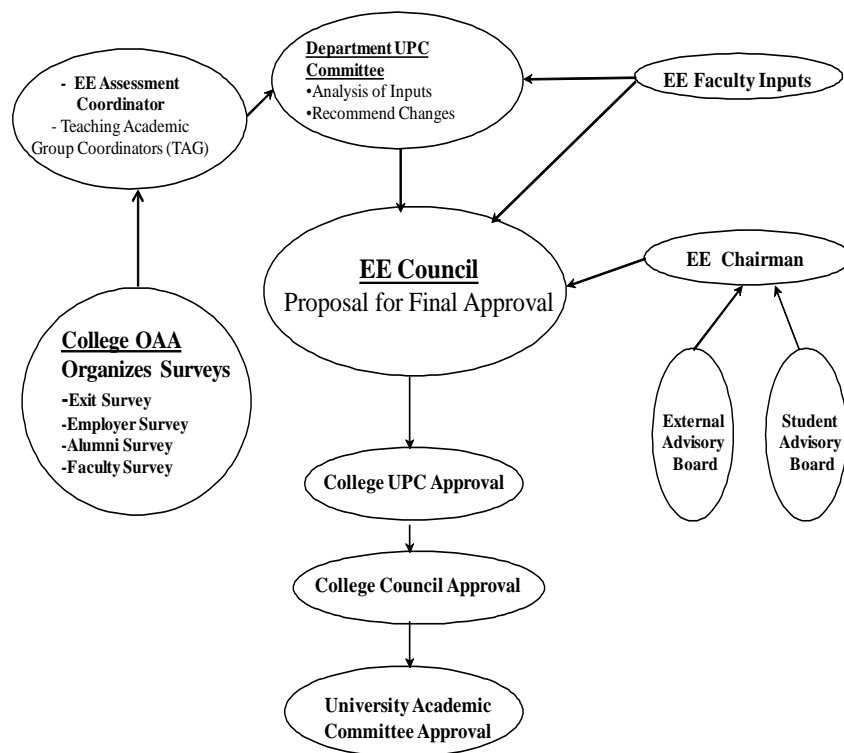**Figure 1:** Process for the revision of the Program Educational Objectives.

Figure 2: Steps of the assessment/evaluation and decision-making process.

Table 2: Summary of Constituents Inputs to PEOs

Input Method	Schedule	Constituent
Alumni survey	Every three years	Alumni 3-5 years out
Employer survey	Every four years	Employers (and recruiters); some are alumni
Faculty survey	Every two years	Faculty members
Senior exit survey	Every semester	Students must fill in the form for graduation
External Advisory board discussions	Yearly	Members of private and government sectors, employers, alumni
Students Advisory board discussions	Yearly	Members of IEEE, SEES, and others
UPC (Undergraduate Program Committee) meetings	Available as frequently as needed	Faculty members

II- STUDENT OUTCOMES

According to ABET Criterion 3 (2019-2020):

"Student outcomes describe what 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".

A. Student Outcomes

The revised EE Student Outcomes (For the 2019/2020 Review cycle)

1- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3- An ability to communicate effectively with a range of audiences.

4- An ability to recognize ethical and professional responsibilities in engineering. situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Table 3 shows the mapping of the Current Student Outcomes to the Revised ABET (2019-2020) Student Outcomes.

Table 3: Relationship between the Revised Student Outcomes and the PEOs.

Revised Student Outcomes		**PEOs**		
		1	**2**	**3**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	✓	✓	
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	✓		✓
3	An ability to communicate effectively with a range of audiences.	✓		✓
4	An ability to recognize ethical and professional responsibilities in engineering. Situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.			✓
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	✓		✓
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	✓		
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies..		✓	

B. Relationship of Student Outcomes to Program Educational Objectives

Achievement of all Student Outcomes indicates that the graduates are equipped to achieve the PEOs. The relationship between the EE Student Outcomes to the PEOs is shown in **Table 3**. As shown by the mapping, achievement of the Student Outcomes indicates that the EE graduates are equipped to achieve the PEOs. Further, to "determine how Student Outcomes will be achieved", the EE program linked every course in the curriculum to address some Students Outcome as it will be demonstrated in Section 4 Continuous Improvement.

III. Continuous Improvement

In this section, we describe *the processes* of regularly assessing and evaluating the Student Outcomes and the extent to which they are being attained

We have adopted ABET (2019-2020) definitions for assessment and evaluation as:

Assessment – Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of student outcomes. Effective assessment uses relevant direct, indirect, quantitative, and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

Evaluation – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.

To ensure the achievement of the Student Outcomes, the EE program has set processes to regularly gather data to evaluate the extent to which the Student Outcomes are being attained. Two direct measures and two indirect measures are used in these processes. The first direct measure is completed through the collection of samples of homework, examinations, projects reports, and laboratory projects every semester. The collected data are organized into course folders (portfolios). Teaching Area Groups (TAGs) are formed to yearly evaluate these portfolios; and consequently, evaluate the Student Outcomes. The second direct measure is done through the completion by faculty members of an online course-assessment form at the end of each semester. The Assessment Coordinator collects these data and makes recommendations to the UPC committee.

On the other hand, the first indirect measure that is used as a supporting assessment tool is the student exit survey (*http://www.eng1.kuniv.edu/oaa/exit/*). All graduates conduct this exit survey, which is considered a requirement for graduation. In addition, the second indirect measure is the employers' survey, which is carried out every four years.

Direct Measurement: The Teaching Area Groups (TAGs) Assessment

The first main direct measure for evaluating the level of attainment of the Student Outcomes is the evaluation of the courses by the Teaching Area Groups (TAGs). The TAGs were first formed starting the academic year 2008-2009. At the end of each semester, the faculty members are asked to prepare and submit assessment portfolios for the courses they are teaching. A portfolio contains

material such as syllabus, samples from students' midterm and final exams, samples from quizzes, samples from student homework, and samples from projects and/or reports. Each course in the EE curriculum has an assessment plan developed by at least one faculty member. The course description includes course learning objectives, practices and assessment methods, and the contribution of the course to the Student Outcomes. **Table 4** shows a mapping of the curriculum courses and their contributions to the student outcomes of the EE program.

Table 4: Mapping of the required courses in the EE Curriculum to the Student Outcomes

Course No	Course Title	Electrical Engineering Student Outcomes						
		1	2	3	4	5	6	7
Engr 205	Electrical Engineering Fundamentals	H						H
Engr 207	Electrical Engineering Fundamentals Lab	M		M		M	H	M
EE 212	Advanced Mathematics for EE	H						H
EE 213	Linear Circuits Analysis	M						H
EE 233	Electronics I	M						M
EE 234	Electronics Lab I			M		M	H	M
EE 297	Cornerstone Design	H	H	H	H	H	H	H
EE 312	Signals and Systems	H						H
EE 385/ 318	Introduction to DSP	H						H
EE 320	Electromagnetic Field	H						H
EE 333	Electronics II	H						H
EE 334	Electronics Lab II			M		M	H	M
EE 343	Energy Conversion I	H						M
EE 345	Energy Conversion Lab I			M		M	H	
EE 350	Power System Analysis I	H						H
EE 370	Control Theory I	H	H					M
EE 374	Control Lab I	M	H	H		M	H	M
EE 381	Communication Theory	H						M
EE 384	Communication Lab			M		M	H	H
EE 497	Engineering Design	H	H	H	H	H	H	H

Table 4 (Continued): Mapping of the EE elective courses to the Student Outcomes

Course	Course Title	Electrical Engineering Student Outcomes						
		1	2	3	4	5	6	7
EE 399	Engineering Training	M		H	M	M	M	M
EE 410	Active Filter Design	H						M
EE 413	Optoelectronics and Photonics Lab			M		M	H	M
EE 414	Industrial Control Lab	M	M	M	H	M	H	M
EE 415	Inst. & Measurements Lab			M		M	H	M
EE 416	Instrumentation and Measurements	M						M
EE 417	Network Synthesis	H						M
EE 420	Antenna & Propagation	H				M		H
EE 421	Microwave Engineering	H		M		M		H
EE 422	Fiber Optics	H				M		H
EE 423	Computational Electromagnetics	H		M		M		M
EE 424	Microwave Lab			M		H	H	M

EE 425	Electromagnetic Compatibility	H	H	M	H	M	H	
EE 426	Introduction to Remote Sensing	H						H
EE 428	Wireless Communication Networks	H		M		M	M	H
EE 429	Antenna and Propagation Lab			M		M	H	M
EE 430	Semiconductor Devices	H		H				H
EE 432	Analog Integrated Circuits	H						M
EE 433	Digital Integrated Electronics	H						H
EE 434	Digital Integrated Electronics Lab			M		M	H	M
EE 436	VLSI design Lab			M		M	H	M
EE 437	Introduction to VLSI Design	H		M		M		H
EE 438	CAD for VLSI Design	H		M		M		H
EE 439	Semiconductor & Solid State Optoelectronics	H						H
EE 440	Sustainable Energy Technologies	H		M				H
EE 443	Energy Conversion II	H		M				H
EE 444	Energy Conversion Laboratory II	M		M				
EE 446	Introduction to Power Electronics	H	M		M			M
EE 447	Power Electronics Lab	H	M	M	M	H	H	M
EE 452	Electrical Power Systems II	H		M				H
EE 454	Electrical Power Systems Lab II	H					H	M
EE 455	Computer Methods in Power Sys. Analysis	H	M					H
EE 456	Power Apparatus and Systems	H						H
EE 458	Electric Power Distribution Eng.	H		M				H
EE 460	Communication Networks	H		M		M		H
EE 462	Selected Topics Comm. Networking	H		M		M		H
EE 470	Digital Control Lab	M	H	H		M	H	M
EE 472	Control Theory II	H	H					M
EE 473	Digital Control	H	H					M
EE 475	Industrial Control	M		M			M	
EE 476	Nonlinear Control	H			M		M	M
EE 477	Optimization Techniques	H						M
EE 478	Intelligent Control	H	M				M	H
EE 479	Adaptive Control Techniques	H					M	H
EE 480	Introduction to Data Compression	H		M			M	H
EE 482	Digital Communications	H		M		M		H
EE 483	Digital Communications Lab			M			H	M
EE 485	Digital Signal Processing	H		M		M	M	H
EE 486	Digital Signal Processing Lab			M		M	H	M
EE 487	Radar Technology	H						H
EE 488	Digital Image Processing	H		M		M		H
EE 489	Artificial Neural Systems	H		M		M	H	H
EE 490	Special Topics in EE	H						H
EE 495	Senior Project	H						H

In **Table 4** the levels of emphasis **H**, **M**, or **L**, for a given Student outcome are used. These levels are defined as follows:

- The level of emphasis **H** (High) indicates that demonstrating this knowledge or skill in the course is critical for the overall aggregate performance of the student, i.e., it is one of the most important outcomes of the course.

- The level of emphasis **M** (Medium) indicates that demonstrating this knowledge or skill in the course has considerable impact on the overall aggregate performance of the student.

- The level of emphasis **L** (Low) indicates that demonstrating this knowledge or skill in the course has only minor impact on the overall aggregate performance of the student.

At the beginning of every academic year, the TAGs assess the materials of the course's portfolios collected during the previous academic year.

Table 5: The cycle for courses assessment

Semester	Required Courses	Elective Courses
Fall	EE 212, EE 213, EE 233, EE 234, EE 297, EE 312, EE 320, EE 343, EE 370, EE 374, EE 497.	EE 415, EE 416, EE 432, EE 433, EE 434, EE 443, EE 446, EE 472, and any other elective that is offered.
Spring	EE 233, EE 234, EE 297, EE 333, EE 334, EE 350, EE 381, EE 385, EE 384, EE 497.	EE 410, EE 439, EE 440, EE 452, EE 454, EE 473, EE 477, EE 485, and any other elective that is offered.

Table 6: The EE TAGs Structure

Control	Electronics	Power	Electromagnetics	Communications	Common	Design
EE 312	EE 230	EE 343	EE 320	EE 381	EE 205	EE 297
EE 370	EE 233	EE 345	EE 420	EE 384	EE 212	EE 497
EE 374	EE 234	EE 350	EE 421	EE 385	EE 213	
EE 414	EE 333	EE 440	EE 422	EE 460		
EE 470	EE 334	EE 443	EE 423	EE 462		
EE 472	EE 410	EE 444	EE 424	EE 480		
EE 473	EE 415	EE 446	EE 425	EE482		
EE 475	EE 416	EE 447	EE 426	EE 483		
EE 476	EE 432	EE 452	EE 428	EE 485		
EE 477	EE 433	EE 454	EE 429	EE 486		
EE 478	EE 434	EE 455		EE 487		
EE 479	EE 437	EE 456		EE 488		
	EE 439	EE 458		EE 489		

The Online Course-Assessment

The second direct measure of the attainment of the Student Outcomes is the online course assessment. At the end of each semester, faculty members are requested to complete an online course-assessment form (http://www.eng1.kuniv.edu/oaa/tools/icef/) for each course they taught. This form includes the grade distribution, the Student Outcomes served by the course, the performance indicators and the assessment of the Student Outcomes. The faculty members evaluate the performances of the students using a five-point scale (1=very weak; 2= weak; 3= satisfactory; 4=very good; 5=excellent). In addition, in the assessment form, the faculty members may provide feedback on the course contents and any general and/or specific observations, concerns, deficiencies regarding the course.

The Students Exit Survey

The student exit surveys represent the first *indirect* assessment measure of the Student Outcomes.

The Employers Survey

The second *indirect* assessment measure of the Student Outcomes is the employers' survey. In the survey, the following weights are assigned: not prepared=1, somewhat prepared=2, prepared=3, well prepared=4, very well prepared=5. Therefore, an average score above 3.00 represents an overall positive evaluation.