BS Renewable Energy Engineering

2016-17 Assessment Report

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Contents

1 Introduction

1.1 Program Design and Goals

The Bachelor of Science in Renewable Energy Engineering (BSREE) program at Oregon Institute of Technology (Oregon Tech) has been designed to provide interdisciplinary education in mechanical, electrical, and chemical engineering topics as they apply to renewable energy. Students take coursework in communications, natural sciences, mathematics, and the humanities and social sciences to support their engineering coursework.

The BSREE program goal is to provide graduates for careers in areas of renewable energy engineering such as but not limited to: solar, solar thermal, wind power, wave power, geothermal energy, transportation, energy storage, hydroelectric and traditional energy fields such as power systems, smart grid, energy management, energy auditing, energy systems planning, energy economics, energy policy and development, carbon accounting and reduction, and controls and instrumentation. BSREE graduates will enter renewable energy engineering careers as design, site analysis, product, application, test, quality control, and sales engineers.

1.2 Program History

In 2005, the Oregon Institute of Technology (Oregon Tech) began offering its new Bachelor of Science degree in Renewable Energy Systems (BSRES) program at its satellite campus in Portland, Oregon. The BSRES degree was the first of its kind in North America, and it was created to prepare graduates for careers in various fields associated with renewable energy. These included, but were not limited to, energy management, energy auditing, energy systems planning, energy economics, energy policy and development, carbon accounting and reduction, and energy-related research, as stated in Oregon Tech's 2005-06 catalogue.

In 2008, however, the BSRES degree was discontinued and replaced by the Bachelor of Science degree in Renewable Energy Engineering (BSREE). Analysis of the market place and observed growth in career options across the renewable energy fields revealed significant opportunities for graduates with a solid energy engineering education. By design, the original BSRES program was built atop a firm engineering foundation, and the curriculum could generally be described as near engineering-level. But the title of the degree, Renewable Energy Systems, a dearth of 300-level mathematics coursework and the absence of several key engineering fundamentals courses prevented the degree from being considered a full engineering degree program, particularly one that could be accredited as by the Engineering Accreditation Commission of ABET, Inc. By stating engineering as a principle programmatic focus, the career potential for graduates expanded beyond those previously stated to also include engineering-related career paths such as electrochemical systems engineering, energy systems design engineering, building systems engineering and modeling, hydronics engineering, power electronics engineering, HVAC engineering, and power systems engineering.

BSREE graduates enter energy engineering careers as power engineers, PV/semiconductor processing engineers, facilities and energy managers, energy system integration engineers, HVAC and hydronics engineers, design and modeling engineers for net-zero energy buildings, LEED accredited professionals (AP), biofuels plant and operations engineers, energy systems control engineers, power electronics engineers, utility program managers, as well as renewable energy planners and policy makers. Graduates of the program will be able to pursue a wide range of career opportunities, not only within the emerging fields of renewable energy, but within more traditional areas of energy engineering as well. Without a mechanism for obtaining professional licensure, these graduates would either not be able to advance in their careers or they would not find employment in these fields to begin with. Our survey of the renewable energy industry cluster in the Pacific Northwest convinced us that an engineering degree, the BSREE degree, was the only suitable option for our students.

1.3 Industry Relationships

The BSREE program has strong relationships with industry, particularly through its program-level Industry Advisory Council (IAC) and REE alumni. The IAC has been instrumental in the success of the BSREE program. Representatives from corporations, government institutions and non-profit organizations comprise the IAC, giving the BSREE a broad constituent audience. The IAC provides advice and counsel to the REE program with respect to the areas of curriculum content advisement, instructional resources review, career guidance and placement activities, program accreditation reviews, and professional development advisement and assistance. In addition, each advisory committee member serves as a vehicle for public relations information and potentially provides a point of contact for the development of specific opportunities with industries for students and faculty.

1.4 Program Locations

Among the advantages that make Oregon Tech an ideal institution for offering the BSREE program is the benefit of having campuses in two distinctive locations – one in the Portland-metro area in proximity to the Pacific Northwest's energy industry cluster, and the second in rural Southern Oregon with exceptional natural energy resources. The Portland-metro campus allows students to leverage their classroom experience within internships at the Northwest's world-class energy and power companies. The Klamath Falls campus has unique energy advantages and is already a leading geothermal research facility. In addition, the climate makes it ideally suited to applied research in the field of solar energy.

2 Program Mission, Educational Objectives and Outcomes

2.1 Program Mission

The mission of the Renewable Energy Engineering degree program is to prepare students for the challenges of designing, promoting and implementing renewable energy solutions within society's rapidly-changing energy-related industry cluster, particularly within Oregon and the Pacific Northwest. Graduates will have a fundamental understanding of energy engineering and a sense of social responsibility for the implementation of sustainable energy solutions. The department will be a leader in providing career ready engineering graduates for various renewable energy engineering fields. Faculty and students will engage in applied research in emerging technologies and provide professional services to their communities.

2.2 Program Educational Objectives

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The Program Educational Objectives (PEOs) of Oregon Tech's Bachelor of Science in Renewable Energy Engineering program are:

- BSREE graduates will excel as professionals in the various fields of energy engineering.
- BSREE graduates will be known for their commitment to lifelong learning, social responsibility, and professional and ethical responsibilities in implementing sustainable engineering solutions.
- BSREE graduates will excel in critical thinking, problem solving and effective communication.

2.3 Relationship between Program Objectives and Institutional Objectives

These program educational objectives map to the Oregon Tech's institutional mission statement and core themes by offering statewide educational opportunity in an innovative and rigorous applied degree program in engineering oriented toward graduate success and an appreciation for the role of the engineer in public service.

2.4 Program Outcomes

The BS REE program outcomes include ABET's EAC *a* - *k*. All of these are listed below:

(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 multi-disciplinary 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) an ability to engage in independent learning and recognize the need for continual professional development

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

3 Cycle of Assessment for Program Outcomes

3.1 Introduction and Methodology

Assessment of the program outcomes is conducted over a three year-cycle. The assessment cycle was changed during the 2014-15 assessment year. This change was implemented at an assessment coordination meeting on February 2, 2014. At this meeting, assessment coordinators representing each program within the Electrical Engineering and Renewable Energy (EERE) Department aligned their assessment cycles so that each program assesses similar outcomes on the same years. The intention for this change is to better organize the assessment process and produce more meaningful data for comparison between different programs in the EERE Department. Table 1 shows the minimum outcomes assessed in each cycle.

Effective the 2016-17 academic year, the assessment cycle begins in the Fall. In previous years, the assessment cycle started in the Spring. This change reflects a shift on an institutional level to begin data collection in the Fall term. In 2016-17 the Assessment Commission Executive Committee began recommending that programs begin data collection during Fall term, and generate the assessment report at the beginning of the next academic year.

3.2 Assessment Cycle

Table 1 - BSREE Outcome Assessment Cycle

Student Outcome	2014-15	2015-16	2016-17
a) Fundamentals	EE321[W], EE419		
b) Experimentation		EE223[W], EE419, REE331[K]	
c) Design	EE355[W], REE412		
d) Teamwork	REE307[K,] REE412[W], MECH318[W], ENGR465[K]		
e) Problem solving			REE337[K], EE355[W], EE419[K]
f) Ethics		EE355[W], REE412[W], REE463[K], REE469[K]	
g) Communication			EE355[K,W], REE348[K,W]
h) Impact		REE412, REE346	
i) Independent learning			REE454[,K,W]
j) Contemporary Issues	REE412[K], REE469[W]		
k) Engineering tools			EE355[K,] ENGR211[W], EE454[K]
[K] – assessed at Klamath Falls campus only, [W] – Assessed at Wilsonville campus only			

3.3 Summary of Assessment Activities & Evidence of Student Learning

3.3.1 Introduction

The BSREE faculty conducted formal assessment during the 2016-17 academic year using direct measures, such as designated assignments and evaluation of coursework normally assigned. Additionally, the student outcomes were assessed using indirect measures, primarily results from a graduate exit survey.

3.3.2 Methods for Assessment of Program Outcomes

At the beginning of the assessment cycle, an assessment plan is generated by the Assessment Coordinator in consultation with the faculty. This plan includes the outcomes to be assessed during that assessment cycle (according to Table 1), as well as the courses and terms where these outcomes will be assessed.

The BSREE mapping process links specific tasks within BSREE course projects and assignments to program outcomes and on to program educational objectives in a systematic way. The program outcomes are evaluated as part of the course curriculum primarily by means of assignments. These assignments typically involve a short project requiring the student to apply math, science, and engineering principles learned in the course to solve a particular problem requiring the use of modern engineering methodology and effectively communicating the results.

The mapping process aims to systemize the assessment of engineering coursework, and to provide a mechanism that facilitates the design of engineering assignments that meet the relevant outcomes, particularly those that are more distant from traditional engineering coursework. Rather than considering how the outcomes match the assignment, the assignment is designed to map to the program outcomes.

A systematic, rubric-based process is then used to quickly assess the level of attainment of a given program outcome, based on a set of performance criteria. The work produced by each student is evaluated according to the different performance criteria, and assigned a level of 1-developing, 2-accomplished, or 3-exemplary. The results for each outcome are then summarized in a table, and reviewed by the faculty at the annual Closing-the-Loop meeting.

The acceptable performance level is to have at least 80% of the students obtain a level of accomplished or exemplary in each of the performance criteria for any given program outcome.

If any of the direct assessment methods indicates performance below the established level, that triggers the continuous improvement process, where all the direct and indirect assessment measures associated with that outcome are evaluated by the faculty, and based on the evidence, the faculty decides the adequate course of action. The possible courses of action are these:

- Collect more data (if there is insufficient data to reach a conclusion as to whether the outcome is being attained or not); this may be the appropriate course of action when assessment was conducted on a class with low enrollment, and it is recommendable to re-assess the outcome on the following year, even if it is out-of-cycle, in order to obtain more data.
- Make changes to the assessment methodology (if the faculty believe that missing the performance target on a specific outcome may be a result of the way the assessment is being conducted, and a more

proper assessment methodology may lead to more accurate numbers); for example, this could be the suggested course of action if an outcome was assessed in a lower-level course, and the faculty decide that the outcome should be assessed in a higher-level course before determining whether curriculum changes are truly needed.

- Implement changes to the curriculum (if the faculty conclude that a curriculum change is needed to improve attainment of a particular outcome). A curriculum change will be the course of action taken when the performance on a given outcome is below the target level, and the evidence indicates that there is sufficient data and an adequate assessment methodology already in place, and therefore there is no reason to question the results obtained.

If the faculty decide to take this last course of action and implement curriculum changes, the data from the direct assessments is analyzed and the faculty come up with a plan for continuous improvement, which specifies what changes will be implemented to the curriculum to improve outcome performance.

In addition to direct assessment measures, indirect assessment of the student outcomes is performed on an annual basis through a senior exit survey.

The results of the direct and indirect assessment, as well as the conclusions of the faculty discussion at the Closing-the-Loop meeting are included in the annual BSREE Assessment Report, which is reviewed by the Department Chair and the Director of Assessment for the university. The suggested changes to the curriculum are presented and discussed with all the department faculty at the annual Convocation meeting in Fall, as well as with the Industry Advisory Council (IAC) at the following IAC meeting. If approved, these changes are implemented in the curriculum and submitted to the Curriculum Planning Commission (if catalog changes are required) for the following academic year.

3.3.3 2016-17 Targeted Direct Assessment Activities

The sections below describe the 2016-17 targeted assessment activities and detail the performance of students for each of the assessed outcomes. Unless otherwise noted, the tables report the number of students performing at a developing level, accomplished level, and exemplary level for each performance criteria, as well as the percentage of students performing at an accomplished level or above.

3.3.4 Targeted Assessment for Outcome (e): an ability to identify, formulate and solve technical problems

This outcome was assessed in EE 419 – Power Electronics, REE337 – Materials for RE Applications, and EE355 – Control System Design.

Outcome (e): Klamath Falls, EE 419, Fall 2016, Dr. Hossain

This outcome was assessed in EE419 – Power Electronics in Fall 2016 by means of an engineering design problem. The project consisted of determining, assessing, and calculating control system parameters to determine a system performance. The students were given a Transfer Function and were asked to determine the conditions for critical damping and marginal stability.

Seventeen students were assessed in Fall 2016 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 2 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 2 - Outcome (e): Klamath Falls, EE 419, Fall 2016, Dr. Hossain

Outcome (e) an ability to identify, formulate and solve technical problems				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1- Identifies technical problems	0	2	15	100%
2- Defines problem statement and parameters	0	4	13	100%
3- Modeling the problem	0	2	15	100%
4- Develop solutions	0	1	16	100%
5- Interpreting results	0	1	16	100%
6- Implementing a solution	0	0	17	100%

Outcome (e): Klamath Falls, REE 337, Winter 2017, Dr. Shi

This outcome was assessed in REE 337 – Materials for RE Applications in Winter 2016 using the final examination of the course. Eight problems were prepared to test the seven criteria as well as the course contents. Each individual student was assessed based on their answers to the test questions.

Sixteen students were assessed in Winter 2017 using the performance criteria listed below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 3 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this student outcome.

Table 3 - Outcome (e): Klamath Falls, REE 337, Winter 2017, Dr. Shi

Outcome (e) an ability to identify, formulate and solve technical problems				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1- Identifies technical problems	1	4	11	94%
2- Defines problem statement and parameters	3	1	12	91%
3- Collect data resources and information for a problem	0	5	11	100%
4- Modeling the problem	0	5	11	100%
5- Develop solutions	1	2	13	93%
6- Interpreting results	1	2	13	94 %
7- Implementing a solution	3	12	1	81%

Outcome (e): Wilsonville, EE 355, Fall 2016, Dr. Hossain

This outcome was assessed in EE355 – Control System Design in Fall 2016 by means of an engineering design problem. The project consisted of determining, assessing, and calculating control system parameters to determine a system performance. The students were given a Transfer Function and were asked to determine the conditions for critical damping and marginal stability.

Eleven students were assessed in Fall 2016 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 4 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems. Hands-on laboratory skills are definitely a strength of the students in the REE program.

Table 4 - Outcome (e): Wilsonville, EE355, Fall 2016, Dr. Hossain

Outcome (e) an ability to identify, formulate and solve technical problems				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1- Identifies technical problems	1	0	10	91%
2- Defines problem statement and parameters	0	0	11	100%
3- Modeling the problem	0	2	9	100%
4- Develop solutions	0	1	10	100%
5- Interpreting results	0	0	11	100%
6- Implementing a solution	1	6	4	91%

3.3.5 Targeted Assessment of Outcome (g): an ability to communicate effectively

This outcome was assessed in EE 355 – Control System Design, and REE 348 – Solar Thermal Energy Systems.

Outcome (g): Klamath Falls, EE 355, Winter 2017, Dr. Hossain

This outcome was assessed in EE355 – Control System Design in Winter 2017 by means of a project. The project consisted of reproducing the results obtained in several papers related to the scope of this course. The students were assigned to create the MATLAB simulations, produce outputs, and write a report on their findings.

Eight students were assessed in Winter 2017 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 5 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 5 - Outcome (g): Klamath Falls, EE 355, Winter 2017, Dr. Hossain

Outcome (g) an ability to communicate effectively				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1- Organization (Oral)	0	0	8	100%
2- Question (Oral)	0	0	8	100%
3- Oral presentation techniques	0	0	8	100%
4- Acquiring information from various sources	0	2	6	100%
5- Context and organization	0	0	8	100%
6- Techniques	0	0	8	100%
7- Conclusion	0	0	8	100%

Outcome (g): Klamath Falls, REE 348, Fall 2016, Dr. Shi

The outcome was assessed in REE 348- Solar Thermal Energy Systems in Fall 2016 using team projects. The student teams were formed through two different ways: (1) Course project topics were offered by course instructor. The instructor gave presentations to introduce the background of the offered projects. Then students registered for their selected projects. During this process, students randomly registered for some projects and the students who registered for the same project form a team or students team up to register for a project. (2) Students team up and proposed their own projects. Two-student teams were formed and worked on two different projects, namely, "Solar Powered Shipping Container" and "Steam Injection Oil Recovery". The student groups were asked to give three presentations to demonstrate their project progresses and submit written report. The student oral communication is assessed based on presentation and written communication is assessed based on their written report.

Five students were assessed in Fall 2016 using the performance criteria listed below. The minimum acceptable performance level was to have 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 6 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome. Students met or exceeded expectations. It is observed that student team work was improved significantly through course project.

Table 6 - Outcome (g): Klamath Falls, REE 348, Fall 2016, Dr. Shi

Outcome (g) an ability to communicate effectively				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1- Organization (Oral)	0	0	5	100%
2- Question (Oral)	0	0	5	100%
3- Oral presentation techniques	0	0	5	100%
4- Acquiring information from various sources	0	0	5	100%
5- Context and organization	0	0	5	100%
6- Techniques	0	0	5	100%
7- Conclusion	0	0	5	100%

Outcome (g): Wilsonville, EE 355, Fall 2016, Dr. Hossain

This outcome was assessed in EE355 – Control System Design in Fall 2016 by means of a project. The project consisted of designing, simulating, implementing, and experimentally testing a system concerned with control of renewable energy systems. The students were assigned to design a system, simulate it to verify the outcomes, write a paper on the project following proper format, and give a presentation on their work.

Ten students were assessed in Fall 2016 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 7 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 7 - Outcome (g): Wilsonville, EE 355, Fall 2016, Dr. Hossain

Outcome (g) an ability to communicate effectively				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1- Organization (Oral)	0	0	10	100%
2- Question (Oral)	0	0	10	100%
3- Oral presentation techniques	0	0	10	100%
4- Acquiring information from various sources	0	0	10	100%
5- Context and organization	0	0	10	100%
6- Techniques	0	0	10	100%
7- Conclusion	0	0	10	100%

Outcome (g): Wilsonville, REE348, Fall 2016, Dr. Jiru

This outcome was assessed in REE 348- Solar Thermal Energy Systems in Fall 2016 using project reports and oral presentations. To assess the written communication outcome, students were assigned to design, select, and analyze a solar domestic hot water system and write a report using ASME conference article format. Students were allowed to work individually or as a team of two students. To assess the oral communication outcome, oral presentation topic was assigned for each student and each student was required to give a 20-minute oral presentation.

Seven students were assessed in Fall 2016 using the performance criteria listed below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 8 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this student outcome. 80% of the students met or exceeded expectations; they demonstrated their effective oral and written communication abilities.

Table 8 - Outcome (g): Wilsonville, REE 348, Fall 2016, Dr. Jiru

Outcome (g) an ability to communicate effectively				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1- Organization (Oral)	0	6	1	100%
2- Question (Oral)	0	6	1	100%
3- Oral presentation techniques	0	6	1	100%
4- Acquiring information from various sources	0	6	1	100%
5- Context and organization	1	5	1	86%
6- Techniques	1	5	1	86%
7- Conclusion	1	5	1	86%

3.3.6 Targeted Assessment of Outcome (i): a recognition of the need for, and an ability to engage in lifelong learning

This outcome was assessed in REE454 – Power System Control & Protection.

Outcome (i): Klamath Falls, REE 454, Winter 2017, Dr. Hossain

This outcome was assessed in REE454 – Power System Control & Protection in Winter 2017 by means of a study on an Engineering topic. The study consisted of study on a topic and presenting the knowledge acquired in a coherent way. The students were tasked to gather knowledge on a certain topic related to renewable energy, and were asked to produce a report following proper format on the things they had learnt.

Three students were assessed in Winter 2017 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 9 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 9 - Outcome (i): Klamath Falls, REE 454, Winter 2017, Dr. Hossain

Outcome (i) a recognition of the need for, and an ability to engage in lifelong learning				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1- Demonstrates an awareness of what needs to be learned	0	0	3	100%
2- Identifying, gathering and analyzing information	0	0	3	100%

Outcome (i): Wilsonville, REE 454, Winter 2017, Dr. Hossain

This outcome was assessed in REE454 – Power System Protection & Control in Winter 2017 by means of a project. The project consisted of designing, simulating, implementing, and experimentally testing a control system. All the assigned systems were related to renewable energy systems, and the students were assigned to submit a report following proper structure after completing the project.

Nine students were assessed in Winter 2017 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 10 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 10 - Outcome (i): Wilsonville, REE 454, Winter 2017, Dr. Hossain

Outcome (i) a recognition of the need for, and an ability to engage in lifelong learning				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1- Demonstrates an awareness of what needs to be learned	0	0	9	100%
2- Identifying, gathering and analyzing information	0	0	9	100%

3.3.7 Targeted Assessment of Outcome (k): an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

This outcome was assessed in EE355 – Control System Design, in REE454 – Power System Control & Protection, and ENGR 211 – Engineering Mechanics: Statics.

Outcome (k): Klamath Falls, EE 355, Winter 2017, Dr. Hossain

This outcome was assessed in EE355 – Control System Design in Winter 2017 by means of a project. The project consisted of reproducing the results obtained in several papers related to the scope of this course. The students were assigned to create the MATLAB simulations, produce outputs, and write a report on their findings.

Eight students were assessed in Winter 2017 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 11 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 11 - Outcome (k): Klamath Falls, EE 355, Winter 2017, Dr. Hossain

Outcome (k): an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 – Demonstrate proficiency with engineering software	0	0	8	100%
2 – Demonstrate proficiency with engineering hardware	0	0	8	100%

Outcome (k): Klamath Falls, REE 454, Winter 2017, Dr. Hossain

This outcome was assessed in REE454 – Power System Control & Protection in Winter 2017 by means of a study on an Engineering topic. The study consisted of study on a topic and presenting the knowledge acquired in a coherent way. The students were tasked to gather knowledge on a certain topic related to renewable energy, and were asked to produce a report following proper format on the things they had learnt.

Three students were assessed in Winter 2017 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 12 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to identify, analyze, and solve technical problems.

Table 12 - Outcome (k): Wilsonville, REE 454, Winter 2017, Dr. Hossain

Outcome (k): an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 – Demonstrate proficiency with engineering software	0	0	3	100%
2 – Demonstrate proficiency with engineering hardware	0	0	3	100%

Outcome (k): Wilsonville, ENGR 211, Fall 2016, Dr. Corsair

This outcome was assessed in ENGR 211 – Engineering Mechanics: Statics in Fall 2016 by means of a term-long design project. Students were required to design, build, and test a model truss bridge based on principles of structural analysis learned in the course. Individual student contributions to the project group were tracked.

Nineteen students were assessed in Fall 2016 using the performance criteria listed in the table below. The minimum acceptable performance level was to have 80% or more of the students performing at the accomplished or exemplary level in all performance criteria.

Table 13 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on the second of the performance criteria, but not the first.

Table 13 - Outcome (k): Wilsonville, ENGR 211, Fall 2016, Dr. Corsair

Outcome (k): an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 – Demonstrate proficiency with engineering software	7	9	3	63%
2 – Demonstrate proficiency with engineering hardware	2	10	7	89%

3.3.7 2016-17 Indirect Assessments

In addition to direct assessment measures, the student outcomes (a) through (k) were indirectly assessed through a senior exit survey conducted every year in the spring term. Question 44 in the survey asked students "Below are the ABET student outcomes for the BS REE program. Please indicate how well the BS REE program prepared you in each of the following areas".

Figure 1 and Table 14 show the results of the indirect assessment of the BSREE student outcomes for the 2016-17 graduating class. Twenty BS REE graduating seniors completed the survey, with over 90% of the respondents indicating that as a result of completing the BS REE program they feel proficient or highly proficient in each of the student outcomes. These results suggest that the BSREE graduating students feel they have attained the BSREE student outcomes, and agree with the direct assessment results (namely, that at least 80% of the students perform at the level of accomplished or exemplary in all performance criteria of the assessed outcomes.)

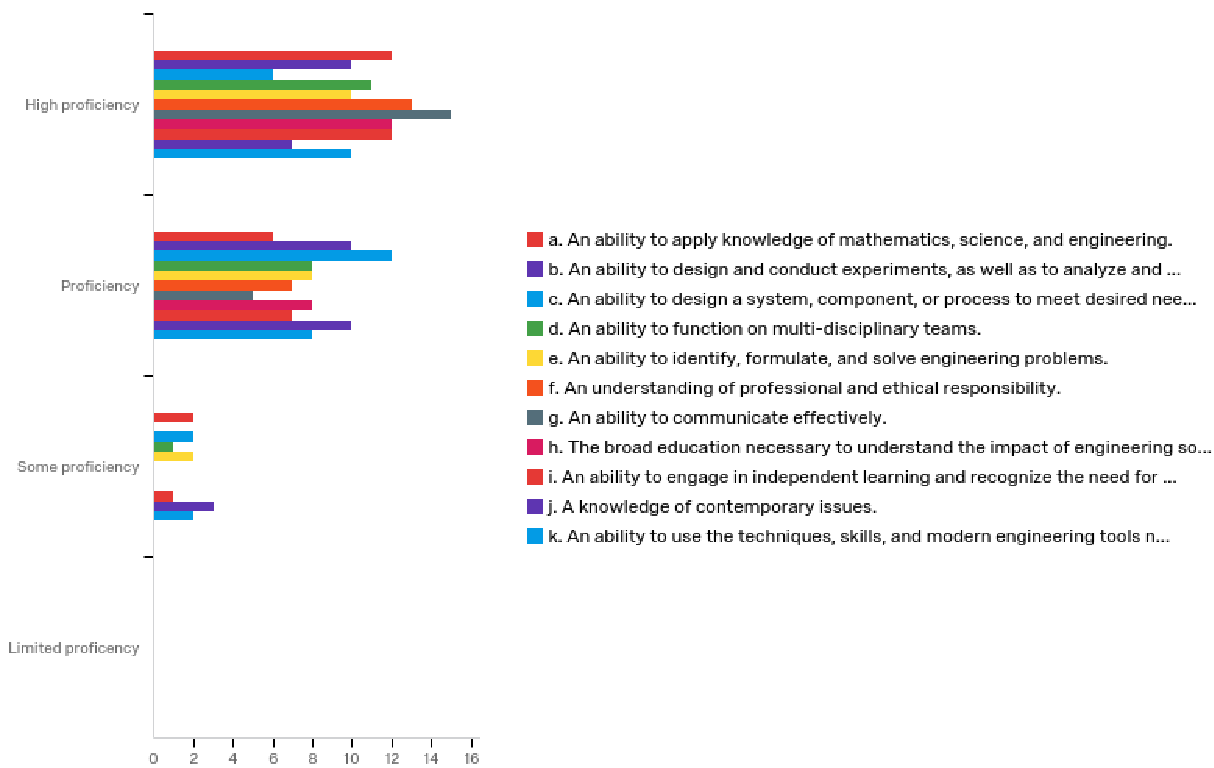

Figure 1 - Graph of results of the indirect assessment for the BSREE Student Outcomes as reported in the Senior Exit Survey (2016-17)

Table 14 - Results of the indirect assessment for the BSREE Student Outcomes as reported in the Senior Exit Survey (2016-17)

Outcome	1-Limited proficiency	2-Some proficiency	3- proficiency	3- High proficiency	% Student >= 3
a. an ability to apply knowledge of mathematics, science, and engineering	0	2	6	12	90%
b. an ability to design and conduct experiments, as well as to analyze and interpret data	0	0	10	10	100%
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	0	2	12	6	90%
d. an ability to function on multi-disciplinary teams	0	1	8	11	95%
e. an ability to identify, formulate, and solve engineering problems	0	2	8	10	90%
f. an understanding of professional and ethical responsibility	0	0	7	13	100%
g. an ability to communicate effectively	0	0	5	15	100%
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	0	0	8	12	100%
i. an ability to engage in independent learning and recognize the need for continual professional development	0	1	7	12	95%
j. a knowledge of contemporary issues	0	3	10	7	85%
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	0	2	8	10	90%

4 Changes Resulting from Assessment

This section describes the changes resulting from the assessment activities carried out during the year 2016-17. It includes any changes that have been implemented based on assessment in previous assessment cycles, from this or last year, as well as considerations for the next assessment cycle.

The BSREE faculty met on October 19, 2017 to review the assessment results and determine whether any changes are needed to the BSREE curriculum or assessment methodology based on the results presented in this document. The objective set by the BSREE faculty was to have at least 80% of the students perform at the level of accomplished or exemplary in all performance criteria of the assessed outcomes. Table 15 provides a summary of the 2015-16 assessment results for the outcomes which were directly assessed.

Table 15 - Summary of BSREE direct assessment for 2016-17

	Total Students	Students >= 2	% Students >=2
(e): problem solving (Klamath Falls, EE 419, Fall 2016, Dr. Hossain)			
1- Identifies technical problems	17	17	100%
2- Defines problem statement and parameters	17	17	100%
3- Collect data resources and information for a problem	17	17	100%
4- Modeling the problem	17	17	100%
5- Develop solutions	17	17	100%
6- Interpreting results	17	17	100%
7- Implementing a solution	17	17	100%
(e): problem solving (Klamath Falls, REE 337, Winter 2017, Dr. Shi)			
1- Identifies technical problems	16	15	94%
2- Defines problem statement and parameters	16	13	81%
3- Collect data resources and information for a problem	16	16	100%
4- Modeling the problem	16	16	100%
5- Develop solutions	16	15	94%
6- Interpreting results	16	15	94%
7- Implementing a solution	16	13	81
(e): problem solving (Wilsonville, EE 355, Fall 2016, Dr. Hossain			
1- Identifies technical problems	11	10	91%
2- Defines problem statement and parameters	11	11	100%
3- Modeling the problem	11	11	100%

4- Develop solutions	11	11	100%
5- Interpreting results	11	11	100%
6- Implementing a solution	11	10	91%
(g): communication (Klamath Falls, EE 355, Winter 2017, Dr. Hossain)			
1- Organization (oral)	5	5	100%
2- Question (oral)	5	5	100%
3- Oral presentation techniques	5	5	100%
4- Acquiring information from various sources	5	5	100%
5- Context and organization (Writing)	5	5	100%
6- Techniques (writing)	5	5	100%
7- Conclusion (writing)	5	5	100%
(g): communication (Klamath Falls, REE 348, Fall 2016, Dr. Shi)			
1- Organization (oral)	5	5	100%
2- Question (oral)	5	5	100%
3- Oral presentation techniques	5	5	100%
4- Acquiring information from various sources	5	5	100%
5- Context and organization (Writing)	5	5	100%
6- Techniques (writing)	5	5	100%
7- Conclusion (writing)	5	5	100%
(g): communication (Wilsonville, EE 355, Fall 2016, Dr. Hossain)			
1- Organization (oral)	10	10	100%
2- Question (oral)	10	10	100%
3- Oral presentation techniques	10	10	100%
4- Acquiring information from various sources	10	10	100%
5- Context and organization (Writing)	10	10	100%
6- Techniques (writing)	10	10	100%
7- Conclusion (writing)	10	10	100%
(g): communication (Wilsonville, REE348, Fall 2016, Dr. Jiru)			
1- Organization (oral)	7	7	100%
2- Question (oral)	7	7	100%
3- Oral presentation techniques	7	7	100%
4- Acquiring information from various sources	7	7	100%
5- Context and organization (Writing)	7	6	86%
6- Techniques (writing)	7	6	86%
7- Conclusion (writing)	7	6	86%
(i): independent learning (Klamath Falls, REE 454, Winter 2017, Dr. Hossain)			
1- Demonstrates an awareness of what needs to be learned	3	3	100%
2- Identifying, gathering and analyzing information	3	3	100%

(i): independent learning (Wilsonville, REE 454, Winter 2017, Dr. Hossain)			
1- Demonstrates an awareness of what needs to be learned	9	9	100%
2- Identifying, gathering and analyzing information	9	9	100%
(k): engineering tools (EE 355, Winter 2017, Dr. Hossain)			
1- Demonstrate proficiency with engineering software	8	8	100%
2- Demonstrate proficiency with engineering hardware	8	8	100%
(k): modern engineering tools (Klamath Falls, REE 454, Winter 2017, Dr. Hossain)			
1- Demonstrate proficiency with engineering software	3	3	100%
2- Demonstrate proficiency with engineering hardware	3	3	100%
(k): modern engineering tools (Wilsonville, ENGR 211, Fall 2016, Dr. Corsair)			
1- Demonstrate proficiency with engineering software	19	12	63%
2- Demonstrate proficiency with engineering hardware	19	17	89%

4.1 Changes Resulting from the 2015-16 Assessment

The results of the 2015-16 Assessment indicate that the minimum acceptable performance level of 80% was met on all performance criteria for all assessed outcomes. Areas of improvement to the curriculum were discussed during the Closing the Loop Meeting in June 2016 with respect to these results. These areas include:

- **Outcome (e): problem solving**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.
- **Outcome (g): communication**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria.
  - **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.
- **Outcome (i): independent learning**
  - **Results:** The results show that the threshold of attainment of this outcome was exceeded in all performance criteria.

- **Recommendation:** The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

- **Outcome (k): engineering tools**
  - **Results:** The threshold of attainment of this outcome was not met on one performance criteria when it was assessed in ENGR 211 in Wilsonville. The assessment results for this course indicate that for the first performance criterion - demonstrate proficiency with engineering software, only 63% of students were accomplished or exemplary. This is not consistent with the indirect assessment result where 90% of the graduating students felt proficient or highly proficient in this outcome as a result of completing the program.

  - **Recommendation:** A failure to demonstrate proficiency is not necessarily evidence of a lack of proficiency. The failure to meet the target of 80% proficiency is a failure of the assessment tool. The performance criteria and rubric for this outcome are considered vague and are being revised to give a better assessment of student mastery of this outcome. The assignment was not structured in a way that was adequate to assess students' skill with software: because it was a group project, some groups opted to have some members focus on modeling and software while other group members did not.