BS Renewable Energy Engineering

2020-21 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 including 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.

It is anticipated that BSREE graduates will 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 Klamath Falls, in the 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 Bachelor of Science in 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.

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.

Table 1: BSREE Program Enrollment Headcounts

	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
REE	160	158	162	159	138

Table 2: Number of BSREE Degrees Awarded

	2015-16	2016-17	2017-18	2018-19	2019-20
REE	39	39	46	17	29

2.4 Program Outcomes

Starting with the 2018-19 academic year, assessment will be done using the student outcomes as outlined below:

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

The rubric based on the outcomes are represented in the appendix.

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 Department of Electrical Engineering and Renewable Energy (EERE) 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.

Effective from the 2016-17 academic year, the assessment cycle begins in the Fall. In 2015-16 academic year, 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 Present and Proposed Assessment Cycle

Table 3 – 2018-21 BSREE Outcome Assessment Cycle

Student Outcome	**2018-19**	**2019-20**	**2020–21**
(1) Problem Solving		REE337pm (Fall; Dr. TorresGaribay), EE461k (Winter, Dr. Hossain)	
(2) Broader Factors			EE461k (Spring, Dr. Hossain), REE412pm (Winter; Dr. Petrovic)
(3) Communication	REE407k (Spring, Dr. Shi, Winter, Dr. Dobzhanskyi)	REE337pm (Fall, Dr. TorresGaribay)	
(4) Ethics	REE454k (Winter, Dr. Hossain)		REE463pm (Winter, Dr. Melendy)
(5) Teams	ENGR465k (Spring, Dr. Shi)		REE413pm (Spring, Dr. Venugopal)
(6) Experimentation	EE355k (Spring, Dr. Hossain)		EE419pm (Winter, Dr. Venugopal)
(7) Learning			REE337 pm (Fall, Dr. Corsair), REE453 k (Fall, Dr. Hossain)

k – Assessed at Klamath Falls campus only, pm – Assessed at Portland Metro campus only, if none is specified then it is applicable for both campuses.

- EE355 was later changed to EE461 from Academic Year 2019-20

Table 4 – 2021-2024 BSREE Outcome Assessment Cycle

Student Outcome	**2021-22**	**2022-23**	**2023-24**
(1) Problem Solving	REE412[pm] (Winter; Dr. Petrovic)	EE461[k] (Winter, Dr. Hossain)	
(2) Broader Factors			EE461[k] (Spring, Dr. Hossain), REE463[pm] (Winter, Dr. Melendy)
(3) Communication		REE412[pm] (Winter; Dr. Petrovic), REE407[k] (Spring, Dr. Shi)	
(4) Ethics	REE454[k] (Winter, Dr. Hossain)	REE463[pm] (Winter, Dr. Melendy)	
(5) Teams	ENGR465[k] (Spring, Dr. Shi), REE413[pm] (Spring, Dr. Venugopal)		
(6) Experimentation	EE461[k] (Spring, Dr. Hossain)		EE419[pm] (Winter, Dr. Venugopal)
(7) Learning		EE419[pm] (Winter, Dr. Venugopal)	REE453[k] (Fall, Dr. Hossain)
k – Assessed at Klamath Falls campus only, pm – Assessed at Portland Metro campus only, if none is specified then it is applicable for both campuses.			

3.3 Summary of Assessment Activities & Evidence of Student Learning

3.3.1 Introduction

The BSREE faculty conducted formal assessment during the 2020-21 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 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 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 2020-21 Targeted Direct Assessment Activities

The sections below describe the 2020-21 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 (2): EE 461, Spring 2021, Dr. Eklas Hossain

Outcome: 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.

This outcome was assessed in EE 461 – Control System Engineering – Spring 2021. The outcome explores students' capability to apply engineering design for producing solutions for meeting specific requirements including public health, safety, and welfare, along with global, cultural, social, environmental, and economic factors. EE 461 in Spring 2021 is chosen to assess the mentioned outcome. Students were given some control system related questions where they were asked to choose a control system for traffic light system and cruise control system. Moreover, a design of obstacle avoider robot was also asked to be designed with certain instructions. This helped to meet the first performance criteria of the outcome. Moreover, the students were also required to justify their choices by mentioning associated factors and effects, which reflects their ability to design solutions for broader considerations, which meets the second criteria of the outcome.

Nineteen (19) students were assessed in Spring 2021 term 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 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. Students met or exceeded expectations; they demonstrated their abilities to function on multi-disciplinary teams. It is observed that student team work was improved significantly through senior capstone project.

Table 5 - Outcome (2): EE 461, Spring 2021, Dr. Eklas Hossain

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	% STUDENT >1
ABILITY TO APPLY ENGINEERING DESIGN TO PRODUCE SOLUTIONS THAT MEET SPECIFIED NEEDS	2	4	13	89.47%

ABILITY TO DESIGN SOLUTIONS ACCOUNTING FOR BROADER CONSIDERATIONS, SUCH AS PUBLIC HEALTH, SAFETY, AND WELFARE, AS WELL AS GLOBAL, CULTURAL, SOCIAL, ENVIRONMENTAL, AND ECONOMIC FACTORS	1	4	14	94.74%

3.3.5 Targeted Assessment for Outcome (2): REE 412, Winter 2021, Dr. Slobodan Petrovic

The outcome was assessed using the REE 412 Photovoltaic Systems. The students are given a date to submit a written report on different case analysis of PV installation sites, and conduct a tentative feasibility study to meet specific needs under the consideration of various external factors. The case analysis of the PV installation sites and feasibility studies requires students to apply their knowledge of the engineering design and produce innovative solutions which may be environment-friendly, may contribute to public health and welfare through creative applications, and guide global policy-making and societal goals of sustainability. Thirteen (13) senior students were assessed in term Winter 2021 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.

The table below 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; they demonstrated their abilities to function on multi-disciplinary teams. It is observed that student team work was improved significantly through the assigned study.

Table 6 – Outcome (2): REE 412, Winter 2021, Dr. Slobodan Petrovic

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	% STUDENT >1
ABILITY TO APPLY ENGINEERING DESIGN TO PRODUCE SOLUTIONS THAT MEET SPECIFIED NEEDS	1	3	9	92.31%
ABILITY TO DESIGN				

SOLUTIONS ACCOUNTING FOR BROADER CONSIDERATIONS, SUCH AS PUBLIC HEALTH, SAFETY, AND WELFARE, AS WELL AS GLOBAL, CULTURAL, SOCIAL, ENVIRONMENTAL, AND ECONOMIC FACTORS	1	4	8	92.31%

3.3.6 Targeted Assessment for Outcome (4): REE 463, Winter 2021, Dr. Robert Melendy

Outcome: 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

This outcome was assessed in REE 463 Energy Systems Instrumentation, Winter 2021. REE 463 Energy Systems Instrumentation (Winter 2021) ABET Outcome EAC (4) was assessed by a four week-long series involving engineering ethics standards and case studies pertaining directly to engineering ethics. Three groups of students prepared three presentations on 'Ethics in Engineering' case studies, where they presented incidents such as the Silver Bridge incident, septic tank blast padding and wiring. In those presentations, the students described the incidents, associated ethical codes, their violations, and the suggested actions with respect to the codes of ethics to overcome such issues. These segments of the presentation helped to assess three performance criteria required for the outcomes. The ability to recognize ethical and professional responsibilities were assessed by the elaboration of the associated codes of ethics, the ability to identify different contexts in engineering situation was judged by their rigorous analyses of the incidents, and their ability to judge the impacts were analyzed by the mentioned violations and proposed suggestions to overcome their impacts.

Nine (9) REE majors were assessed using the performance criteria (Table 7). All the students exceeded expectations, as they clearly outlined the ethical contexts in the past incidents by mentioning specific codes of ethics, and by suggesting technical recommendations with respect to the codes for ethical improvements.

The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria. The results indicate that the minimum acceptable performance level of 80% was met on the performance criteria for this program outcome.

Table 7 – Outcome (4): REE 463, Winter 2021, Dr. Robert Melendy

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >1
ABILITY TO RECOGNIZE ETHICAL AND PROFESSIONAL RESPONSIBILITIES IN ENGINEERING SITUATIONS	0	0	9	100%
ABILITY TO IDENTIFY GLOBAL, ECONOMIC, ENVIRONMENTAL, AND SOCIETAL CONTEXTS IN ENGINEERING SITUATIONS	0	0	9	100%
ABILITY TO JUDGE THE IMPACT OF ENGINEERING SOLUTIONS ON GLOBAL, ECONOMIC, ENVIRONMENTAL, AND SOCIETAL CONTEXTS	0	0	9	100%

3.3.7 Targeted Assessment for Outcome (5): REE 413, Spring 2021, Dr. Chitra Venugopal

Outcome: 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

This outcome was assessed in REE 413 Electric Power Conversion System - Spring 2021. The outcome was assessed using the course Electric Power Conversion Systems. This assessment was done in the project which as team based. A common project, "Analysis of PV Array with MPPT-Boost Converter" was given to the entire class. There were 8 students in the class. Three teams were formed with 3 member in 2 groups and 2 members in one grope. The each section of the project was discussed in the lecture with similar topics throughout the course. Students were asked to do a power point presentation and submit a group report. The guidelines of report and important section that needed to be addressed during the presentation were given at the first lecture. Students were asked to run the given project using Matlab software and discuss the answers for the questions during the presentation session. Students teamed up to work on the project and engaged in discussions sections related to the project during and after lecture sessions. In week 10, each team presented the project. Each member of team selected a section of the project and completed their parts, resulting in the completion of the whole work as teams. All the teams successfully presented the project and submitted the report addressing the questions and important points related to the topic.

8 students were assessed in term Spring 2021 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.

The table below 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; they demonstrated their abilities to function on multi-disciplinary teams. It is observed that student team work was improved significantly through this project assessment.

Table 8 – Outcome (5): REE 413, Spring 2021, Dr. Chitra Venugopal

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >1
ABILITY TO PROVIDE TEAM LEADERSHIP	0	1	7	100%
ABILITY TO CREATE A COLLABORATIVE AND INCLUSIVE ENVIRONMENT AS A TEAM MEMBER	0	0	8	100%
ABILITY TO ESTABLISH GOALS, PLAN TASKS, AND MEET OBJECTIVES AS A TEAM MEMBER	0	0	8	100%

3.3.8 Targeted Assessment for Outcome (6): EE 419, Winter 2021, Dr. Chitra Venugopal

Outcome: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

The outcome was assessed in the course POWER ELECTRONICS, WINTER 2021. In power electronics course there were 4 experiments conducted in the lab as part of the course. There were 15 students participated in the following lab exercises.

Lab 1: Power Electronics Devices

Lab 2: The Buck Converter

Lab 3: The Boost Converter

Lab 4: The SCR Light Dimmer

The lab 1 is analysis of power electronics devices based on the device parameters and datasheet provided. The lab 2, 3 and 4 are design exercises which includes theoretical, simulation and prototype design of the converters. The students were expected to derive the design calculations and device parameters such as L and C values and

thyristor firing angles from the equation provides in the text book and lecture notes. In the second stage of the design, the design in the LT spice simulation to predict the experimental errors. The third stage is the design of the converters using appropriate components and conducting the experiment successfully. The students spent sufficient time in analyzing the results by testing the output voltage ripples, output current ripples in addition to the buck converter and boost converter output voltage and current values. In the SCR light dimmer circuit, students analyzed the output by varying the firing angle and its effect on the SCR voltage and the load voltage. The interpretation of these experimental data was included in the lab report. The comparison of theoretical, simulation and experimental table was included in the lab report to show the engineering judgement of the results obtained from the experiment conducted.

14 students were assessed in term winter 2021 and 1 student was assessed in term Spring 2021. The lab report was assessed 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.

The table below 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; they demonstrated their develop and conduct experimentation, analyze and interpret data and use engineering judgement to draw conclusion.

Table 9 – Outcome (6): EE 419, Winter 2021, Dr. Chitra Venugopal

Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >1
ABILITY TO DEVELOP AND CONDUCT AN EXPERIMENT	0	0	15	100%
ABILITY TO ANALYZE AND INTERPRET DATA	0	3	12	100%
ABILITY TO USE ENGINEERING JUDGEMENT TO DRAW CONCLUSIONS	1	3	11	93.3%

3.3.9 Targeted Assessment for Outcome (7): REE 337, Winter 2021, Dr. Hope Corsair

Outcome: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

The outcome was assessed using a term project in the REE 337 Materials for RE Applications class in Winter 2021. The project was open-ended in that it allowed students to research the properties of materials utilized in a renewable energy application of their own interest. Papers were developed using the Question Formulation Technique, and were aided by peer review throughout the term. Question Formulation Technique involved the

instructor giving the students a question focus: "materials for renewable energy applications." From that students were tasked with rapidly writing down as many questions as they could that related to that question focus. Only after the initial period of rapid question formation were they allowed to go back and rethink, refine, or re-word questions. From among these questions, students chose one that most closely tied to there are of interest for the paper, and refined and expanded the question further. The question was rephrased as the working title of the paper, and they built outlines based on categories of information they would need to answer their questions. Students found credible sources of information (largely though not exclusively peer-reviewed literature) to write their papers based on a schedule of deadlines they created individually. Through their research, some students adjusted the focus of their questions as they gained information. At each stage and each draft, students provided feedback to one another on the direction and quality of the paper. At the end of the term, students provided a reflection on the use of the Question Formulation Technique as a starting point, whether they deviated from their questions in their research, and the utility of approaching a research topic with that learning strategy combined with a more traditional research strategy.

Eight junior and senior students were assessed in term Winter 2021 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.

The table below 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: they demonstrated an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Table 10 – Outcome (6): REE 337, Winter 2021, Dr. Hope Corsair

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	% STUDENTS >1
ABILITY TO ACQUIRE NEW KNOWLEDGE USING APPROPRIATE LEARNING STRATEGIES	0	2	6	100%
ABILITY TO APPLY NEW KNOWLEDGE AS NEEDED	0	3	5	100%

3.3.10 Targeted Assessment for Outcome (7): REE 453, Fall 2020, Dr. Eklas Hossain

This outcome was assessed in REE 453 Power System Analysis – Fall 2020. The outcome is focused on the students' ability to acquire and apply new knowledge as needed, using appropriate learning strategies. For assessing the outcome, REE 453 in Fall 2020 was used. The students were instructed to use the power-flow system to determine the acceptable generation range at a particular bus, keeping the line and transformer loaded at a particular MVA limit. The students were guided to solve the problem using PowerWorld software. It was

expected that from the obtained knowledge in REE 453, the students would design the setup in the software, run the simulation, and tune the parameters to determine the final result. This would test their ability to obtain results and apply the acquired knowledge to determine the best strategy. Students were provided with the questions in the form of an assignment and individual results were collected to summarize the scores.

14 senior students were assessed in term Fall 2020 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 11 below 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; they demonstrated their abilities to acquire and apply new knowledges.

Table 11 – Outcome (7): REE 453, Fall 2020, Dr. Eklas Hossain

Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >1
Ability to acquire new knowledge using appropriate learning strategies	1	1	12	92.86%
Ability to apply new knowledge as needed	0	5	9	100%

3.3.11 2020-21 Indirect Assessments

In addition to direct assessment measures, the student outcomes were indirectly assessed through a senior exit survey conducted every year in the spring term. Question BREE 1 in the survey asked students "Program Student Learning Outcomes for Renewable Energy Engineering B.S. Please rate your proficiency in the following areas."

Figure 1 show the results of the indirect assessment of the BSREE student outcomes for the 2020-21 graduating class.

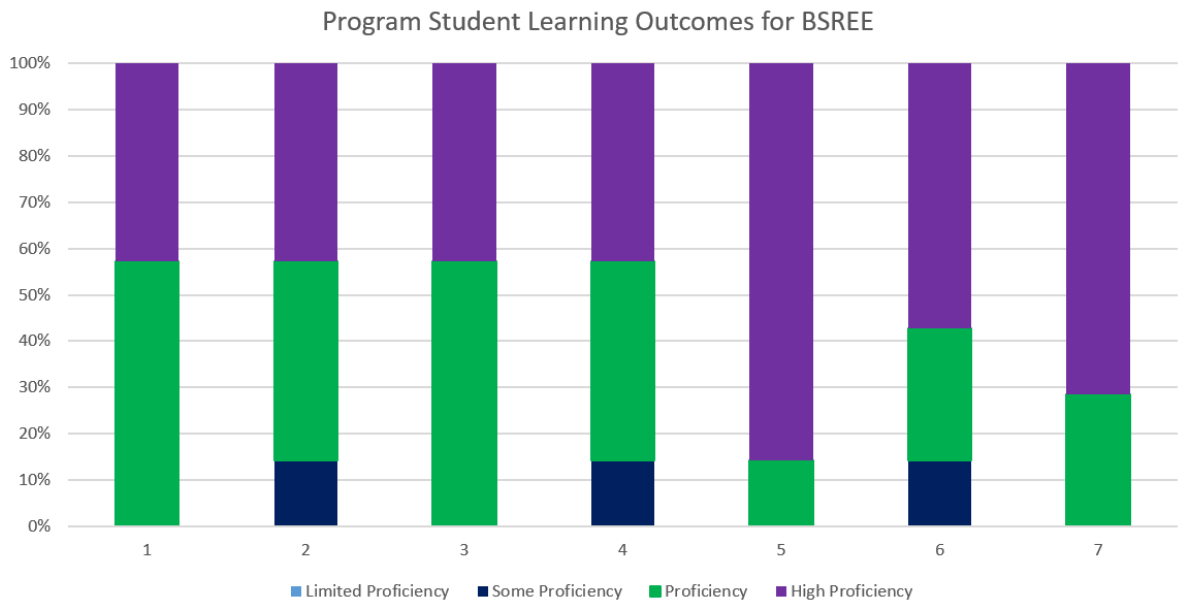

Figure 1 - Graph of results of the indirect assessment for the BSREE Student Outcomes as reported in the Senior Exit Survey (2020-21)

Table 12 show the results of the indirect assessment of the BSREE student outcomes for the 2020-21 graduating class. Seven (7) BSREE graduating seniors completed the survey, with respondents indicating that as a result of completing the BSREE program they feel proficient or highly proficient in each of the student outcomes. More than 80% of the respondents rated themselves, upon completion of the BSEE program, they were "Proficient" or "Highly Proficient" in all categories.

Table 12 - Results of the indirect assessment for the BSREE Student Outcomes as reported in the Senior Exit Survey (2020-21)

#	Question	High proficiency		Proficiency		Some proficiency		Limited proficiency		Total
1	1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	42.86%	3	57.14%	4	0.00%	0	0.00%	0	7
2	2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well	42.86%	3	42.86%	3	14.29%	1	0.00%	0	7

	as global, cultural, social, environmental, and economic factors									
3	3. An ability to communicate effectively with a range of audiences	42.86%	3	57.14%	4	0.00%	0	0.00%	0	7
4	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	42.86%	3	42.86%	3	14.29%	1	0.00%	0	7
5	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	85.71%	6	14.29%	1	0.00%	0	0.00%	0	7
6	6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	57.14%	4	28.57%	2	14.29%	1	0.00%	0	7
7	7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	71.43%	5	28.57%	2	0.00%	0	0.00%	0	7

These results suggest that the BSREE graduating students feel they have attained the BSREE student outcomes, and agree with the direct assessment results.

4. Changes Resulting from Assessment

This section describes the changes resulting from the assessment activities carried out during the year 2020-21. 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 will meet on 22 October, 2021 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 13 provides a summary of the 2020-21 assessment results for the outcomes which were directly assessed.

Table 13 - Summary of BSREE direct assessment for 2020-21

	Total Students	Students >= 2	% Students >=2
Outcome (2): (EE 461, Spring 2021, Dr. Eklas Hossain)			
1. Ability to apply engineering design to produce solutions that meet specified needs	19	17	89.47%
2. Ability to design solutions accounting for broader considerations, such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	19	18	94.74%
Outcome (2): (REE 412, Winter 2021, Dr. Slobodan Petrovic)			
1. Ability to apply engineering design to produce solutions that meet specified needs	13	12	92.31%
2. Ability to design solutions accounting for broader considerations, such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	13	12	92.31%
Outcome (4): (REE 463, Winter 2021, Dr. Robert Melendy)			
1. Ability to recognize ethical and professional responsibilities in engineering situations	9	9	100%
2. Ability to identify global, economic, environmental, and societal contexts in engineering situations	9	9	100%
	9	9	100%

3. Ability to judge the impact of engineering solutions on global, economic, environmental, and societal contexts			
Outcome (5): (REE 413, Spring 2021, Dr. Chitra Venugopal)			
1. Ability to provide team leadership	8	8	100%
2. Ability to create a collaborative and inclusive environment as a team member	8	8	100%
3. Ability to establish goals, plan tasks, and meet objectives as a team member	8	8	100%
Outcome (6): (EE 419, Winter 2021, Dr. Chitra Venugopal)			
1. Ability to develop and conduct an experiment	15	15	100%
2. Ability to analyze and interpret data	15	15	100%
3. Ability to use engineering judgement to draw conclusions	15	14	93.3%
Outcome (7): (REE 337, Winter 2021, Dr. Hope Corsair)			
1. Ability to acquire new knowledge using appropriate learning strategies	8	8	100%
2. Ability to apply new knowledge as needed	8	8	100%
Outcome (7): (REE 453, Fall 2020, Dr. Eklas Hossain)			
3. Ability to acquire new knowledge using appropriate learning strategies	14	13	92.86%
4. Ability to apply new knowledge as needed	14	14	100%

4.1 Changes Resulting from the 2020-21 Assessment

The results of the 2020-21 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 October 22, 2020 with respect to these results. These areas include:

- **Outcome (2):**
  - **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 with the scores. However, the faculties identified that the description of the assignments were not properly mapped with the performance criteria. Hence,

recommendations were made to make sure that the assignments selected for assessment are adequate to assess the particular outcome, and if they are, the faculties are needed to clearly explain how the assignment relates to the outcome under assessment. Changes were made in this report to address the aforementioned recommendation.

- **Outcome (4):**
  - **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 with the scores. However, the faculties identified that the description of the assignments were not properly mapped with the performance criteria. Hence, recommendations were made to make sure that the assignments selected for assessment are adequate to assess the particular outcome, and if they are, the faculties are needed to clearly explain how the assignment relates to the outcome under assessment. Changes were made in this report to address the aforementioned recommendation.
- **Outcome (5):**
  - **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 with the scores. However, the faculties identified that the description of the assignments were not properly mapped with the performance criteria. Hence, recommendations were made to make sure that the assignments selected for assessment are adequate to assess the particular outcome, and if they are, the faculties are needed to clearly explain how the assignment relates to the outcome under assessment. Changes were made in this report to address the aforementioned recommendation.
- **Outcome (6):**
  - **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 (7):**
  - **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.

Appendix:

Table A1: Rubric for EAC-1- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY TO IDENTIFY A COMPLEX ENGINEERING PROBLEM	An engineering problem is not identified, or the identification is too vague or unclear.	An engineering problem of reasonable complexity is adequately identified and its significance minimally explained.	A complex engineering problem is properly identified and clearly stated. Its significance is thoroughly explained.	
ABILITY TO FORMULATE A COMPLEX ENGINEERING PROBLEM BY APPLYING PRINCIPLES OF ENGINEERING, SCIENCE AND MATHEMATICS	A complex engineering problem is not properly formulated in engineering, scientific, and/or mathematical terms. Most of the assumptions and specifications are either missing or unclear.	A complex engineering problem is adequately formulated in engineering, scientific, and/or mathematical terms, but some of the assumptions and specifications may be missing or not clearly presented.	A complex engineering problem is clearly formulated with a valid and complete set of assumptions and specifications.	
ABILITY TO SOLVE A COMPLEX ENGINEERING BY APPLYING PRINCIPLES OF ENGINEERING, SCIENCE AND MATHEMATICS	The solution to a complex engineering problem is not developed according to engineering, scientific, and mathematical principles, or it does not follow the original set of assumptions and specifications.	The solution to a complex engineering problem is developed according to engineering, scientific, and mathematical principles. The solution reasonably meets most of the original set of assumptions and specifications.	The solution to a complex engineering problem is very well developed according to engineering, scientific, and mathematical principles. The solution meets or exceeds the original set of assumptions and specifications.	

Table A2. Rubric for EAC-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

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY TO APPLY ENGINEERING DESIGN TO PRODUCE SOLUTIONS THAT MEET SPECIFIED NEEDS	Does not follow the engineering design process, or the designed solution does not meet the specified need(s).	Reasonably follows the engineering design process to produce a solution that adequately meets the specified need(s).	Methodically follows the engineering design process to produce a solution that thoroughly meets the specified need(s).	
ABILITY TO DESIGN SOLUTIONS ACCOUNTING FOR BROADER CONSIDERATIONS, SUCH AS PUBLIC HEALTH, SAFETY, AND WELFARE, AS WELL AS GLOBAL, CULTURAL, SOCIAL, ENVIRONMENTAL, AND ECONOMIC FACTORS	The solution provided does not take into account broader practical considerations, such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	The solution provided takes into account and partially addresses some of the broader practical considerations, such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	The solution provided takes into account and thoroughly addresses several of the broader practical considerations, such as public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	

Table A3: Rubric for EAC-3- An ability to communicate effectively with a range of audiences

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY FOR EFFECTIVE ORAL COMMUNICATION	The main ideas are not clearly presented. Low volume or monotonous tone make it hard for audience to engage. Speaker does not transmit any interest or enthusiasm about the topic.	The main ideas are clearly presented. Adequate volume and dynamic tone are used to engage audience. Speaker occasionally transmits interest and enthusiasm about the topic.	Speaker is an excellent communicator. The main ideas are clearly presented. Speaker is eloquent and dynamic, effective at engaging the audience. Speaker displays and transmits a strong interest and enthusiasm about the topic.	
ABILITY FOR EFFECTIVE WRITTEN COMMUNICATION	Content is disorganized, the main ideas are not clearly stated and developed. Writing style is rough or imprecise. Frequent grammar/spelling errors. Document presentation and format rough or inconsistent.	Content is well organized and the main ideas are clearly stated and reasonably developed. Writing style is adequate for purpose and readable. Grammar/spelling mostly correct. Document presentation and format adequate and consistent.	Content is very well organized and easy to follow, main ideas are clearly presented and thoroughly developed. Writing style is adequate for purpose, readable, and tailored to intended audience. Grammar/spelling correct. Work is professionally presented and very well formatted.	
ABILITY FOR EFFECTIVE GRAPHICAL COMMUNICATION	Inadequate use of figures, charts, and/or tables to display data. Figures are not well placed, many figures, charts, and tables missing key formatting elements, such as titles, labels, units, captions, etc. Overall, figures do not contribute to a better understanding of key ideas or results.	Adequate use of figures, charts, and tables to display data. Figures are well placed, most figures, charts, and tables are properly labeled and formatted. Figures moderately contribute to a better understanding of key ideas or results.	Excellent use of figures, charts, and tables to display data. All figures, charts, and tables properly labeled and formatted, easy to read and interpret. Figures substantially and effectively contribute to a better understanding of key ideas or results.	
ABILITY TO ADDRESS A RANGE OF AUDIENCES	Does not address target audience. Content is too technical or too superficial to be	Adequately addresses the target audience. Content has a reasonable balance of technical and non-technical information to be understood	Effectively addresses the target audience. Content has the right balance of technical and non-technical information to be understood	

	understood by and of interest to a wide range of audiences.	by and of interest to a wide range of audiences.	by and of interest to a wide range of audiences.	

Table A4: Rubric for EAC-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

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY TO RECOGNIZE ETHICAL AND PROFESSIONAL RESPONSIBILITIES IN ENGINEERING SITUATIONS	Description of ethical and professional responsibilities is limited or rudimentary.	Description of ethical and professional responsibilities is substantive.	Description of ethical and professional responsibilities is complete and thorough.	
ABILITY TO IDENTIFY GLOBAL, ECONOMIC, ENVIRONMENTAL, AND SOCIETAL CONTEXTS IN ENGINEERING SITUATIONS	Identifies a single context area relevant in an engineering situation. Explanation of the context is rudimentary.	Identifies most context areas relevant in an engineering situation. Explanation of the contexts is substantive.	Identifies all context areas relevant in an engineering situation. Explanation of contexts is complete and thorough.	
ABILITY TO JUDGE THE IMPACT OF ENGINEERING SOLUTIONS ON GLOBAL, ECONOMIC, ENVIRONMENTAL, AND SOCIETAL CONTEXTS	Analysis and judgement of the impact of engineering solutions on contexts is rudimentary.	Analysis and judgement of the impact of engineering solutions on contexts is substantive.	Analysis and judgement of the impact of engineering solutions on contexts is complete and thorough.	

Table A5: Rubric for EAC-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

CRITERIA	1—DEVELOPING	2—ACCOMPLISHED	3—EXEMPLARY	SCORE
ABILITY TO PROVIDE TEAM LEADERSHIP	Lacks adequate ability to resolve problems and conflicts. Lacks ability to provide adequate leadership in decision making, planning, and goal setting. Does not show appreciation for other team members' contributions. Exhibits poor team communication skills (e.g., interrupts others, gets defensive, does not ask questions, gets distracted). Does not motivate others or lead by example.	Capable of resolving problems and conflicts. Demonstrates adequate leadership ability in decision making, planning, and goal setting. Occasionally shows appreciation for other team members' contributions. Exhibits reasonable team communication skills. Capable of motivating others. Willing to share problems and progress. Mainly does assigned work instead of willingly taking on additional responsibilities.	Proficient in resolving problems and conflicts and exhibits proficient leadership ability in decision making, planning, and goal setting. Appropriately recognizes and shows appreciation for other team members' contributions. Exhibits proficient team communication skills including good body language and active listening. Transparent about expectations and objectives. Motivates others and leads by example. Willing to share problems and take on additional responsibilities and help others when necessary.	
ABILITY TO CREATE A COLLABORATIVE AND INCLUSIVE ENVIRONMENT AS A TEAM MEMBER	Rarely uses respectful language or show cooperative communication skills. Does not demonstrate mutual respect and tends to dismiss others' unique perspectives, opinions, or ideas. Does not demonstrate ability and willingness to compromise with other group members.	Generally, uses respectful language and shows cooperative communication skills. Does not disrespect other group members or dismiss their unique perspectives, opinions, or ideas. Demonstrates adequate ability and willingness to compromise with other group members. Does not dismiss the sharing of ideas.	Uses respectful language and shows cooperative communication skills. Actively demonstrates mutual respect and welcomes others' unique perspectives. Demonstrates high ability and willingness to compromise with other group members. Makes other group members feel safe and valued through openly encouraging the sharing of ideas.	
ABILITY TO ESTABLISH GOALS, PLAN TASKS, AND MEET OBJECTIVES AS A TEAM MEMBER	Lacks basic awareness of team duties and responsibilities. Lacks basic awareness of the links between project goals and tasks. Fails to identify risks to meet project deadlines.	Capable of performing most team duties and responsibilities. Capable of establishing goals and performing necessary talks on time to meet project deadlines and identifies most issues impacting project success.	Proficient execution of all team duties and responsibilities. Proficient in establishing goals and performing necessary tasks on time to meet project deadlines and identifies issues impacting projects success.	

Table A6: Rubric for EAC-6- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY TO DEVELOP AND CONDUCT AN EXPERIMENT	Demonstrates inadequate knowledge and abilities for conducting experiments with standard test and measurement equipment to collect experimental data. May not observe lab safety and procedures.	Demonstrates adequate knowledge and abilities for conducting experiments. Able to use standard test and measurement equipment to collect experimental data. Reasonably capable of troubleshooting to overcome measurement problems. May require supervision and steering in the right direction. Overall, observes lab safety plan and procedures.	Demonstrates comprehensive knowledge, exceptional abilities, and resourcefulness for conducting experiments. Selects appropriate equipment and measuring devices and methodology for conducting experiments. Demonstrates a proficient ability to troubleshoot, predict and overcome measurement problems. Observes established lab safety plan and procedures. Proposes improvements as necessary.	
ABILITY TO ANALYZE AND INTERPRET DATA	Demonstrates inadequate knowledge and abilities for analyzing and interpreting experimental results. Reporting methods are unsatisfactory.	Demonstrates adequate abilities for experimental data analysis, interpretation, and visualization. Able to draw some reasonable conclusions based on experimental results. Demonstrates an awareness for measurement error. Reporting methods are satisfactorily organized, logical, and complete	Demonstrates exceptional ability for experimental data analysis, interpretation, and visualization. Able to draw insightful conclusions based on experimental results. Analyzes and interprets data using appropriate theory, accounts for measurement error into analysis and interpretation, reporting methods are well-organized, logical, and complete.	
ABILITY TO USE ENGINEERING JUDGEMENT TO DRAW CONCLUSIONS	Lacks the ability and awareness for interpreting experimental data to draw meaningful conclusions, decide, act, and/or communicate suggestive actions using of appropriate scientific/engineering principles, standards, and practices. Not adept at navigating complexity, open ended problems, or ambiguous data.	Adequately capable of interpreting experimental data to draw meaningful conclusions, decide, act, and/or communicate suggestive actions based upon the use of appropriate scientific/engineering principles, standards, and practices. May require significant guidance in the face of complexity, open ended problems, or ambiguous data.	Proficient in interpreting experimental data to draw meaningful conclusions, decide, act, and/or communicate suggestive actions based upon the use of appropriate scientific/engineering principles, standards, and practices. Able to make quality engineering decisions/conclusions, especially in the face of complexity, open-ended problems, or ambiguous data.	

Table A7: Rubric for EAC-7- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
ABILITY TO ACQUIRE NEW KNOWLEDGE USING APPROPRIATE LEARNING STRATEGIES	Shows poor ability and little openness to acquire new knowledge and diagnosing their learning needs. Does not identify proper opportunities or resources to expand knowledge and skills. Unable or uninterested to find new information without significant guidance and prompting. Lacks awareness at one's current knowledge and skills for identifying basic gaps in understanding. Lacks the strategies and motivation necessary for self-directed learning.	Shows sufficient ability and openness to acquire new knowledge and diagnosing their learning needs. Able to identify some opportunities or resources to expand knowledge and skills. Able and interested to find new information, perhaps with some prompting. Uses current knowledge and skills to identify basic gaps in understanding. Exhibits adequate strategies and motivation necessary for self-directed learning.	Demonstrates proficient ability and openness to acquire new knowledge and diagnosing their learning needs. Independently identifies and uses a diverse range of resources to expand knowledge and skills. Able and interested to find new information with minimal prompting. Uses current knowledge and skills to identify key gaps in understanding. Exhibits exemplary strategies and motivation necessary for self-directed learning.	
ABILITY TO APPLY NEW KNOWLEDGE AS NEEDED	Inadequately unmotivated and skilled at applying new knowledge as needed for decision making, completing tasks, drawing conclusions, and/or understanding a topic in more depth. Insufficiently understands and determines the significance or relevance of the learned information needed for the task.	Adequately motivated and skilled at applying new knowledge as needed for decision making, completing tasks, drawing conclusions, and/or understanding a topic in more depth. Partially understands and determines the significance or relevance of the learned information needed for the task.	Proficiently skilled and motivated at applying new knowledge as needed for decision making, completing tasks, drawing conclusions, and/or understanding a topic in more depth. Understands and determines the significance or relevance of the learned information needed for the task.	