ACADEMIC COUNCIL REPORT

ACTION REQUESTED:

Recommendation	☐
Decision	☐
Discussion/Direction	☐
Information	☒

DATE: 25 January 2022

FROM: Undergraduate Studies Committee

SUBJECT: Program Review Final Assessment Report – Bachelor of Engineering in Electrical Engineering

COMMITTEE MANDATE:
In accordance with Article 10 of the Ontario Tech University Institutional Quality Assurance Process (IQAP) Cyclical Program Review (CPR) Procedures, the appropriate standing committee of Academic Council (USC or GSC) is responsible for examining the outcomes of the review and approving the Final Assessment Report (FAR). This report will be presented to Academic Council for information and subsequently posted to the Ontario Tech corporate website.

Additionally, in accordance with Article 6 of the IQAP Curriculum Change Procedures, editorial revisions to Program Learning Outcomes are considered Minor Program Adjustments and are sent to the standing committee for approval. Minor Program Adjustments are presented to Academic Council for information.

BACKGROUND/CONTEXT & RATIONALE:
In academic years 2019-2021 a program review was scheduled for the Bachelor of Engineering in Electrical Engineering. The site visit was conducted in June 2021. At the completion of a CPR the self-study brief, reviewers' report(s), Dean's and IAT's response, and the Academic Resource Committee's (ARC) summary report are presented to the appropriate standing committee of Academic Council (USC or GSC).

The standing committee will examine the outcomes of the review and approve a Final Assessment Report (FAR) that synthesizes the reports and recommendations resulting from the review, identifies the strengths of the program as well as the opportunities for program improvement and enhancement, and outlines the agreed-upon implementation plans for this improvement.

Additionally, during a CPR the Program Learning Outcomes (PLOs) are reviewed and revised. If these revisions are deemed editorial in nature, they are included with the FAR for approval by the standing committee, in accordance with the procedure for Minor Program Adjustments.

A report from the program outlining the progress that has been made in implementing the recommendations will be put forward in eighteen months' time. The report is sent to ARC for review. If outstanding items remain from the implementation plan at the time of the eighteen-month report, ARC will review these outstanding items with the Dean. The Committee may recommend further monitoring of these items on a case-by-case basis.

RESOURCES REQUIRED:
The Faculty's plans to address any resource needs are outlined in the action plan. Information and support will be required from various areas of the University in order to implement the plan.

COMPLIANCE WITH POLICY/LEGISLATION:
The Ontario Universities Council on Quality Assurance (Quality Council), established by the Council of Ontario Universities in July 2010, is responsible for oversight of the Quality Assurance Framework processes for Ontario Universities. The Council operates at arm's length from both Ontario's publicly assisted universities and Ontario's government. Under the Quality Assurance Framework, academic programs must undergo a cyclical review at least every eight years following their implementation. The purpose of the cyclical program review is to critically examine the components of a program with the assistance of outside reviewers with the goal of continuous improvement. A program review's purpose is not solely to demonstrate the positive aspects of the program, but also to outline opportunities that will lead to improvements for the future.

NEXT STEPS:
- Following presentation to Academic Council and the Board of Governors for information, the FAR will be sent to the Quality Council as required under the Quality Assurance Framework. A summary report is then posted on the Ontario Tech corporate website.

SUPPORTING REFERENCE MATERIALS:
- Final Assessment Report
- PLO Enhancement and UDLE Mapping

FINAL ASSESSMENT REPORT
September 2021
Bachelor of Engineering in Electrical Engineering
Program Review
Dean: Dr. Hossam Kishawy

Under Ontario Tech University's Quality Assurance Framework, all degree programs are subject to a comprehensive review every eight years to ensure that they continue to meet provincial quality assurance requirements and to support their ongoing rigour and coherence. Program reviews involve several stages, including:

1. A comprehensive and analytical self-study brief developed by members of the program under review.
2. A site visit by academic experts who are external to and arm's length from the program who prepare a report and recommendations on ways that it may be improved based on a review of the program's self-study and supporting material, and a two-day site visit involving discussions with faculty, staff and students and a tour of the facilities.
3. Development of a plan for improvement by the program and proposed timelines for implementation.

On the completion of the program review, the self-study brief together with the reviewers' report and the assessment team's response are reviewed by the Resource committee, the appropriate standing committee of Academic Council (USC/GSC), and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In academic years 2019-2021 a program review was scheduled for the Bachelor of Engineering in Electrical Engineering.

This is the second program review for this program and the internal assessment team is to be commended for undertaking this assignment in addition to an already challenging workload and within a very tight timeline. The following pages provide a summary of the outcomes and action plans resulting from the review, identifying the strengths of the program as well as the opportunities for program improvement and enhancement. A report from the program outlining the progress that has been made in implementing the recommendations will also be put forward in eighteen months' time.

External Reviewers:
- Dr. Christopher Nielsen, University of Waterloo
- Dr. Mehrdad Saif, University of Windsor

Site Visit: June 14th – June 16th, 2021

Program Overview

The Bachelor of Engineering in Electrical Engineering focuses on the design and development of electrical and computer technologies and their component parts. The curriculum includes the analysis, design and implementation of electrical, power, control, electronic, and wireless systems. The program is accredited by the Canadian Engineering Accreditation Board (CEAB), having gone through its last accreditation review in 2017, and offers two educational streams; the regular Electrical Engineering stream, or the Smart Grid specialization.

The Smart Grid Specialization leverages communications and networking technology with the aim of moving our aging power grid into the 21st century. Students study all aspects of the smart grid, including networking and security, smart metering, electric energy storage systems, power quality, and transportation electrification.

The first three years of courses are common for both streams. In first year, students study fundamental engineering courses such as mathematics, sciences, engineering design, programming and technical communications. These courses represent the foundation building blocks of most engineering programs. The second year covers basic engineering courses, including in electrical engineering fundamentals, introductory to electronics, complex analysis, differential equations, and circuit analysis. Third and fourth year provide a range of applied and advanced electrical engineering courses, including in electronic circuit design, electric machines, probability and random signals, wireless communications, power systems, and advanced control systems. In fourth year, students in the Smart Grid option take specialization courses such as Fundamentals of Smart Grid, Smart Grid Networking, and Power System Protection Relaying. Students in both streams also take a two-term capstone design course, with those in the specialization completing a project related to Smart Grid.

The program has co-op and internship options available to students completing their third year, which provide an excellent opportunity for students to apply classroom and lab concepts to real-world situations. Students in Electrical Engineering and the specialization option Smart Grid may also elect to have the Engineering and Management option. Students in these programs normally take two semesters of

business and management courses for 30 credit hours after successfully completing third year. The regular fourth year of the engineering program is then taken in Year 5 of the program. Students will gain critical management skills in key areas of business including accounting, finance, operations, human resources and marketing.

Significant Strengths of the Program
1. A fairly young but a strong, CEAB accredited, program featuring:
    a. Innovative curriculum with comprehensive coverage, yet maintains best features of traditional Electrical Engineering programs
    b. State of the art classrooms, featuring multimedia equipment, WiFi availability, and Ethernet connectivity for every student
    c. State of the art labs and software packages
    d. Class sizes for Years 2 to 4 are small, promoting more instructor-student interaction
    e. A wide range of entrance and in-program scholarships for qualified students

2. Expert and exceptional committed faculty members:
    a. All faculty members are experts in their fields of research, and hold various research grants, including NSERC grants.
    b. More than one third of the tenured or tenure-track Electrical Engineering faculty members are female; this is considered very high in engineering, as they can represent exceptional role models for female students.
    c. Majority of Electrical Engineering faculty members have significant related industrial experience, which is very useful for an applied engineering program.

Opportunities for Program Improvement and Enhancement
The Electrical Engineering program is fairly young, but has strong foundational components with faculty committed to making it one of the best in the country. The following improvements need to be addressed:

1. Enrolment: Year 1 full time enrolment in Electrical Engineering program has been declining during the past 5 years. There may be a number of contributing factors. Efforts should be made to thoroughly investigate the cause of this issue, to better promote Electrical Engineering programs, and explore new program options.

2. Evening Classes: Due to limited classrooms, some courses are scheduled in the evening; however, faculty prefer not to teach in the evening. This is also problematic for students who may need to attend early morning classes and must stay on campus for late evening classes. Scheduling efforts should be

made to offer Engineering courses in the morning when students' minds are fresh.

3. Lab equipment and delivery: The hardware equipment needs to be renewed, and new equipment purchased. In addition, as the program grows it is important to increase the quantity of the equipment available. The issue of lecture/lab synchronization continues to be an issue. There needs to be coordination and good lines of communications between the faculty member delivering the lectures and those delivering the labs along with inputs from teaching assistants and students for continuous improvement and to give the students the most effective learning experience. Currently, it's not clear that a proper planning stage is consistently happening prior to a course offering and lab manuals can go a long time between updates. The quality of teaching assistants (T.A.s) should also be carefully monitored, and the program should try to match a teaching assistant's skills to their assigned course.

4. Curriculum: Overall, the curriculum places a strong emphasis on the foundations of electrical engineering which is commendable. The program is strong on the signal and systems (including communications, control, and power systems) side. However, there are foundational mathematics as well as specialized senior courses that are not necessarily required in other electrical engineering programs that are required in this program. This has resulted in a somewhat rigid program without much flexibility for students to select electives of their own choosing. There is also a glaring lack of faculty members and courses in the area of integrated (analog and/or digital) electronics which is one of the pillars of electrical engineering. Since the curriculum is very prescriptive and requires certain courses that are not necessarily part of the core requirements of a typical electrical engineering degree, it creates certain inflexibilities that affect the sequencing and timely offering of certain courses.

5. Student feedback: The department and Faculty leadership should discuss and implement means for incorporating valid feedback from the students in their continuous improvement process of the course and curriculum which is also a requirement of Canadian Engineering Board Accreditation. Further, students need to be better informed as to how their feedback is being used and be assured that the Faculty and the Department will address valid concerns of theirs. Currently, students feel that course evaluations that they fill at the end of every class have no effect and their constructive feedback and criticisms are for the most part ignored. As a result, they have a very skeptical view of the usefulness of even filling out the course evaluation.

The External Review
The site visit took place on June 14th to 16th, 2021. Drs. Nielsen and Saif met with members of the Faculty as well as key stakeholders at the University, including Dr. Langis Roy, Deputy Provost, Dr. Hossam Kishawy, Dean of the Faculty of Engineering and Applied Science, Dr. Min Dong, Associate Dean, Dr. Masoud Makrehchi, out-going

Program Chair, Dr. Vijay Sood, in-coming Program Chair, and members of the internal assessment team and a number of faculty, staff, and students.

The Faculty was grateful for the thoughtful and thorough review provided. The external reviewers recognized the high quality of the faculty, the rigorousness of the program, and the innovation in the content and delivery of the programs.

The reviewers identified eleven recommendations, some of which have multiple components. The Faculty values the recommendations and have been very thoughtful in their responses.

Summary of Reviewer Recommendations and Faculty Responses

Recommendation 1

It is important that the Department have an honest and strategic discussion on what type of electrical engineering program it wishes to offer and what would be the program's objectives and outcomes. As a general electrical engineering program, we believe that serious efforts should be made to re-evaluate the entire program with an attempt to increase program flexibility and to give students more options to tailor their degree program according to their interests while maintaining the core competencies and satisfying the accreditation requirements. It is not clear that any of the courses that are currently in fourth year should be mandatory. Giving students more agency over their final year may help retain and attract students to the Electrical Engineering program. Such flexibility has been achieved at other institutions within the confines of accreditation. Flexibility doesn't necessarily mean introducing more specializations, it means giving students the ability to take the senior courses that most interest them.

Program's Response

The Program agrees a careful review is required to determine what type of skills the program is offering. As mentioned by the Reviewers, to ensure a general engineering program, serious effort must be made to review the entire program. We also agree that many existing core courses can be considered as electives, including 4th year courses. This is a task that the curriculum committee needs to revisit and provide recommendations to the department. However, it is not an easy task to re-arrange the program map without serious consideration.

Dean's Response

It is recommended that the Program Curriculum Committee (PCC) reviews the program and ensure that the basic elements in general electrical engineering are covered and balanced across the second and third year. The review of the fourth-year courses should provide a clear direction to determine which course is appropriate to be a basic course or an elective one. The recommendations from the PCC would

require constructive discussions among members of the department council to ensure that any modifications will benefit the students learning and attract more enrollment.

Recommendation 2
The curriculum lacks advanced courses in microelectronics. This is an important growth area in electrical engineering and the program should consider increasing its capacity in this area.

IAT's Response
The committee agrees that electronics is an important growth area which is under-represented in the program map and recommends that the program curriculum committee consider this point meaningfully while reviewing the entire program.

Dean's Response
The review by the PCC will ensure that all basic elements of the electrical engineering program are covered and will determine the program's needs in the area of microelectronics.

Recommendation 3
The department should collegially discuss a vision for future faculty hiring and program expansion that considers the program's needs and research opportunities.

Program's Response
The Program agrees and recommends that the future faculty hiring should reflect the changes and modifications in the entire program. Also, the student-to-faculty ratio must be considered when hiring.

Dean's Response
The Dean has asked each department to develop a strategic research plan. A committee will be formed in each department to develop the strategic research plan. This plan along with the program teaching needs will help the department to prioritize the hiring areas.

Recommendation 4
Classroom and laboratory space remain to be an issue. It should be a priority to have no classes in semi-permanent buildings. The program should continue to increase its lab space and space for capstone design projects.

Program's Response
There are still many temporary or semi-permanent buildings used for classes; however, this situation is improving rapidly with new spaces for classes and laboratories being added. However, further access to lab space for capstone projects is still needed.

Dean's Response
Classrooms are under review/watch across the university. The planned transition of many courses across the university to online delivery will eventually impact the rooms availability. Regarding lab space, the Dean has already started discussions with department chairs and recommended a full review of the existing space to ensure suitable and efficient use of existing space. A Faculty committee will be formed to review all the existing space to ensure better space utilization, determine any other needs, and provide recommendations to the Dean.

Recommendation 5
The process of reviewing/updating lab manuals and ensuring synchronization between labs and lectures should be formalized. The current approach of leaving it to the instructors does not seem to have solved the lab/lecture synchronization problem. There needs to be greater engagement and communication by all stakeholders with an ultimate objective to better serve the students' interests.

Program's Response
It is agreed that there is not enough lab space to synchronize the lab/lecture process entirely. The Program recommends that course instructors should have more oversight on the lab deliverables. The lab learning outcomes are an integral part of course deliverables and thus lab instructors are expected to synchronize with the lecture materials. The Program also recommends that each stream reviews its existing course labs to ensure the synchronization of course deliverables and remove any possible duplication and/or improve existing materials.

Dean's Response
The Dean agrees with the Program's response and believes that a review of existing labs in each curriculum stream is needed to provide a vehicle to update/modify existing labs and develop new labs as needed. Since a laboratory component is an integral part of a course, inputs from PCC and follow up with course instructors are needed. There are very successful cases in FEAS, where course instructors are working closely with the lab instructors and identify changes to the existing lab(s) or cancel lab(s) that does not provide new learning outcomes.   The review of the existing courses should include a review of existing labs.

Recommendation 6
The communication channel for students to provide feedback to the department should be made clearer and more transparent. It is not sufficient to solely rely on course critiques. Even if certain mechanisms currently exist, clearly the general student population is unaware of how they can provide feedback or even the fact that they may have representatives on certain committees. In general, students need to be

better informed of services that may be available to them, and avenues for having their concerns and feedback heard.

Program's Response
The Program agrees that there is always room to improve communication for student feedback beyond their participation in the Curriculum committee. The department needs to discuss this further as to how to meaningfully engage with the students.

Dean's Response
The Faculty has included one student in each program curriculum committee and is planning a regular feedback meeting opportunity to include student representatives to provide feedbacks and concerns in each program. Each department will need to discuss this and provide recommendations.

Recommendation 7
Resources allocated to co-op advising need to be increased. There is a danger that Electrical Engineering students see no value in the University's services and seek employment outside the co-op system.

Program's Response
The Program agrees that this problem exists and the reviewers' comment is correct. The Dean has embarked on new changes to engage the Associate Dean to help improve the engineering co-op system.

Dean's Response
This is an inherited issue that existed over three years ago when the program was administrated outside FEAS. Over the past two years, the program has moved to FEAS and has seen significant improvement in terms of increasing the number of participating students and quality employment places. With the newly submitted program modification, the program will be recognized as part of the academic degree and will allow international students' participation.   The increase of student enrollment in the program will increase the program revenues and provide more program support.

Recommendation 8
There is an urgent need for more technical staff to maintain labs and infrastructure and to ensure the health and safety of the student body in labs and during capstone project development.

Program's Response
The Program agrees that there is a serious shortage of lab technical support and this creates a serious concern for the safety of the students due to lack of enough supervision while doing their experimental exercises. The Program also agrees that there is shortage of lab space for capstone projects. And that it is not acceptable for

students to do experiments in their own space outside the university. The Program recommends that the university administration take actions to address this serious issue.

Dean's Response
The Dean agrees and is currently in discussion with the provost to improve the shortage of technical support.

Recommendation 9
The new organizational structure for student advising should be closely monitored to ensure that the communication channel between the associate dean and the advisors is open and that the Electrical Engineering program's needs are being met.

IAT's Response
The Program agrees that since the new structure is already in place, we will work together to ensure efficiency and better service to the students. The Program recommends that the Associate Dean should have clear authority on the advising activity to avoid potential issues with CEAB. CEAB expects that academic advising is performed at a program/faculty activity and we need to show compliance with the accreditation body.

Dean's Response
This is a new advising structure that is currently evolving. The Faculty will continue to provide the necessary feedback to ensure the students are well served and the program integrity is preserved to meet the CEAB requirements and standards.

Recommendation 10
Quality control of teaching assistants should be improved to ensure that graduate students are matched to courses that in which they are competent. Less experienced teaching assistants (T.A.s) should be mentored by experienced T.A.s and/or given non-student facing roles. Some form of mandatory TA training before TAs take on their duties is also recommended.

Program's Response
The current TA allocation system is governed by an existing Collective Agreement and the Program suggests a careful review for improving the TA quality and TA allocation. Perhaps an important issue that needs to be emphasized is that TA allocation is not a graduate scholarship but a work contract that requires mentoring and feedback on students who are conducting the work. And the students should not consider this as a scholarship.

Dean's Response

The Dean agrees with the Program. The department chairs had a few discussions during the weekly meeting and reviewed the existing TA allocation and provided some suggestions to the Faculty graduate committee to consider for improving students funding and the TA allocations.

Recommendation 11

The percentage of female, black, and indigenous students in the program is very low (8% female; 0.3% indigenous out of 364 Electrical Engineering students). To some extent this is a common problem in many engineering programs. Nevertheless, the Faculty and the department should be continuously working to improve the number of underrepresented groups in engineering, and to ensure that these groups feel a sense of belonging in the program. Where possible the program should strive to incorporate indigenous content into the curriculum and to explore ways where the engineering program can address the reconciliation efforts. It is important for future engineering graduates to have a good understanding and appreciation for equity, diversity and inclusion.

Program's Response

This issue is complex and will take time to improve. It's a nationwide problem, and not unique to us. The Program recommends to hire more female and other minorities within the staff and faculty.

Dean's Response

The Faculty takes this issue seriously and continues to work to improve the percentage of underrepresented groups among students, faculty and staff members. Some of our ongoing and new initiatives include but are not limited to:

- The Faculty is actively working with our 'Indigenous Education and Cultural Services' to integrate indigenous content across the engineering curriculum. Integration of indigenous content in the first-year Introduction to Engineering courses is planned to start Fall 2022
- The Faculty is working on developing an engineering elective that focuses on Indigenous Design and Technology, which will be offered to all engineering programs.
- As part of our Engineering Outreach (engineering.ontariotechu.ca/outreach) we offer a variety of STEM programs to K-12 students and work with schools in the Durham region, with special STEM clubs designed for Indigenous and Black youth. Also, the Faculty is part of the 'Women in Engineering' initiative which is funded by Hydro One.
- The newly revised Co-op stream for all of our Engineering programs will include a 'Co-op Preparation' course that students in the Co-op stream must complete in the first semester of Year 2. This new course will include a module on EDI.

- A discussion is ongoing with University partners of the Hydro One Women in Engineering to develop a shared module on EDI for all Engineering students in the country.

Plan of Action

The table below presents a timeline of the actions planned to address the recommendations from the external report.

Recommendation	Proposed Follow-up	Responsibility for Leading Follow Up*	Timeline	Resources/Support Needed
Recommendation 1-2 • Re-evaluate the entire program with an attempt to increase program flexibility and to give students more options to tailor their degree program according to their interests while maintaining the core competencies and satisfying the accreditation requirements. • Review the addition of advanced course in microelectronics.	Program Curriculum Committee (PCC) will review the program map and consider the recommendation provided by reviewers.	Chair of PCC and Department Chair	Work to start Fall 2021 and expected to be done my Winter 2023.	None
Recommendation 4 • Classroom and laboratory space remain to be an issue. It should be a priority to have no classes in semi-permanent buildings. The program should continue to increase its lab space and space for capstone design projects.	Ongoing	Provost and VP-Administration	Ongoing	Yes
Recommendation 5 • The process of reviewing/updating lab manuals and ensuring synchronization between labs and lectures should be formalized.	PCC in consultation with Lab Instructors will make recommendations	Department Chair and Assistant Dean for Eng. Laboratories	Work to start in 2021 expected recommendations in Fall 2022	Maybe

Recommendation 6 • The communication channel for students to provide feedback to the department should be made clearer and more transparent	In addition, to having student representation at the PCC, Department will discuss and propose plan to create a mechanism obtain student feedback.	Department Chair	Winter 2022	None
Recommendation 8 • There is an urgent need for more technical staff to maintain labs and infrastructure and to ensure the health and safety of the student body in labs and during capstone project development.	Dean is in discussion with the Provost and VP- Administration to provide the needed resources.	Dean, Provost, VP-Administration	2021-2022	Yes

*The Dean of the Faculty, in consultation with the Program Review Chair shall be responsible for monitoring the Implementation Plan. The details of progress made will be presented to the Academic Resource Committee, Academic Council and the Board of Governors and filed in the Office of the Provost and Vice-President (Academic).

Recommendations not Addressed

Recommendations not addressed and rationale from the Decanal response.

Recommendation not Addressed	Rationale
Recommendation 3 • The department should collegially discuss a vision for future faculty hiring and program expansion that considers the program's needs and research opportunities.	The Department was asked to develop a research strategic plan. While during hiring the coverage of undergraduate courses is a priority the research area will also be considered in consultation with the Department.
Recommendation 7 • Resources allocated to co-op advising need to be increased.	Co-op is now part of the program degree. Resources will be available to reflect the student registration. Additional student enrollment will provide the needed resources to hire more as needed.
Recommendation 9 • The new organizational structure for student advising should be closely monitored to ensure that the communication channel between the associate dean and the advisors is open and that the program's needs are being met.	This is a new advising structure that is currently evolving. The Faculty will continue to provide the necessary feedback to ensure the students are well served and the program integrity is preserved to meet the CEAB requirements and standards.
Recommendation 10 • Quality control of teaching assistants should be improved to ensure that graduate students are matched to courses that in which they are competent. Some form of mandatory TA training before TAs take on their duties is also recommended.	TA quality is an ongoing issue. Offering TA's is governed by the collective agreement. Effort will be made at the Department level to collect information about TA performance and provide feedback or document any issues.
Recommendation 11 • The Faculty and the department should be continuously working to improve the number of underrepresented groups in engineering, and to ensure that these groups feel a sense of belonging in the program. Where possible the program should	Low enrolment of female and indigenous students in engineering is not limited to engineering students at Ontario Tech University. At the Faculty level, we are taking this very seriously and efforts is made to improve the pipe line through high school such as our engineering outreach activities.

strive to incorporate indigenous content into the curriculum and to explore ways where the engineering program can address the reconciliation efforts.	

Due Date for 18-Month Follow-up on Plan of Action: February 2023
Date of Next Cyclical Review: 2027-2029

Cyclical Program Review: Summary of program learning outcome enhancements
[This form should be used in cases where program learning outcomes have been enhanced for an existing undergraduate or graduate program. These updated program learning outcomes should be the result of a program review and have been developed with guidance from CIQE. This form will be appended to the Final Assessment Report]

Faculty: Engineering and Applied Science
Program: Electrical Engineering
Review year: 2019-21

Undergraduate: ☒	**Graduate**: ☐

Original program learning outcome(s): (Provide all of the initial program learning outcomes)

- Apply knowledge of mathematics, physics, chemistry, engineering science and engineering techniques to identify, formulate, analyze and solve problems.
- Find innovative solutions to significant problems and advance the state of knowledge in electrical engineering.
- Utilize a systems approach to the design and operational performance of electrical engineering systems and processes.
- Understand and apply the principles and practice of sustainable design and development.
- Apply general principles of design and development to analyze, produce and evaluate designs for systems, components or processes to fulfill specified requirements.
- Make use of information technology and of computer hardware and software to solve problems, to acquire and process data.
- Understand the social, cultural, ethical, environmental, safety and economic consequences of technical decisions in local, national and global context.
- Communicate effectively in written, spoken and visual form with both technical experts and with members of the general public on electrical engineering matters.
- Have strong independent learning and analytical skills and be an effective member of multi-disciplinary and multi-cultural teams, either as a team member or as a project manager.
- Recognize and value the alternative outlooks that people from various social,

ethnic and religious background may bring to electrical engineering.
- Understand and apply the principles and key provisions of the Canadian electrical engineering framework.
- Appreciate the importance of new and emerging technologies, and the strategies available for life-long learning.
- Understand and apply management and business practices relevant to electrical engineering, including the importance of quality management and quality assurance.

Total number of original outcomes: 13

Proposed enhanced learning outcomes: (Updated outcomes as a result of the program review learning outcome workshops)

- Solve real-world problems using electrical engineering related skills and state-of-the-art tools.
- Demonstrate ethical and professional behavior as a member of the electrical engineering community.
- Communicate electrical engineering related concepts with both technical experts and members of the public.
- Apply, analyze and evaluate electrical engineering related design processes
- Practice effective teamwork skills in electrical engineering related environments.
- Participate in scholarly pursuits and professional endeavours that contribute to the enhancement of health, wellness and sustainability in their communities.

Total number of enhanced outcomes: 6

Have the enhanced outcomes been mapped to the degree-level expectations (DLEs)?

☒ **Yes**   ☐ **No**

If no, this should be completed no later than:

Are you providing any additional supporting documents? ☒ **Yes**   ☐ **No**

If yes, which (list all)?

DLE alignment map to enhanced PLOs.

<u>CIQE INTERNAL APPROVAL</u>

Appended to FAR	November 2021
FAR approved by USC/GSC	
Final Approved FAR & Outcomes Posted and sent to Faculty	