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 Software 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 Software 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
November 2021
Bachelor of Engineering in Software 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 Software 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. Abdallah Shami, Western University
Dr. Muhammad Jaseemuddin, Ryerson University

Site Visit: June 21st – 24th, 2021

Program Overview
The Bachelor of Engineering in Software Engineering focuses on the design, analysis and development of reliable and secure software systems. The curriculum emphasizes the integration of software into complex systems, and examines timely and cost-effective methods of software delivery that meet today's changing requirements. The Software Engineering 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 Software Engineering stream, or the Internet of Things ("IoT") specialization.

The Internet of Things Specialization centres around the architectural framework that connects billions of devices and the exchange of data which enables smart interactions between people and physical systems. Students in the specialization take courses in the design and analysis of IoT software systems, connecting IoT devices and services to the cloud, and mobile programming.

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 object-oriented programming and design, web programming, digital system, data structure, and the principles of software requirements engineering. Third and fourth year provide a range of applied and advanced electrical engineering courses, including in software design and architecture, systems programming, operating systems, distributing systems, computer networks, and embedded systems. In fourth year, students in the IoT option take specialization courses such as Design and Analysis of IoT Software Systems, Mobile Application Development, and Machine Learning and Data Mining. Students in both streams also take a two-term capstone design course, with those in the specialization completing a project related to IoT.

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 the Software Engineering program and the specialization option IoT 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

Since it launched in September 2005, the Software Engineering program has been one of the key undergraduate engineering programs at Ontario Tech University. While the program is fairly young, it is strong, accredited by CEAB, and has the following distinguishing features:

- ***Expert Faculty Members in Software Engineering***
  The Software Engineering program was developed on a strong foundation at Ontario Tech University. There is a resident pool of extremely high qualified faculty members whose fields of expertise in the Software Engineering program. Collectively, the SE faculty members have rich expertise in Software Design, Mobile Computing, Database Systems, Software Quality, Evolutionary Computing, and Data Mining and Social Computing. These faculty members are dedicated to teaching, research and professional services in Software Engineering. In addition to teaching, the faculty members are conducting world class Software Engineering research, which is supported by external operating funds of different research grant sources. The funding sources include NSERC, CFI, Industry research contracts, and provincial funding. The expert faculty members are committed to ensure a successful implementation of the innovative Software Engineering curriculum.

- ***Design Content Focused Curriculum***
  One of the most significant components is design and its implementation in the courses, especially in core-courses where it is considered crucial and given utmost attention. The Software Engineering program at Ontario Tech University was developed with a focus on software engineering design. There are engineering design courses almost every semester, culminating in the courses of Software Engineering Systems Design I and II, the capstone design course series, during the final year. The strength of this program curriculum is reflected by our students' innovative design projects

- ***Laboratory Component Emphasized Curriculum***
  To provide students with hands-on and practical skills, projects and experimental labs are integrated in the engineering core courses, program core courses, and the final year capstone project courses. Additionally, several more courses leverage the Laptop Program to provide additional software laboratory experiences in the course tutorials. The faculty has sixteen

undergraduate teaching labs, of which six are used for the Software Engineering program. Each lab is equipped with up-to-date teaching and industry equipment appropriate to covering undergraduate engineering principles, while exposing the students to cutting-edge engineering processed.

- ***Contemporary Engineering Tool Supported Teaching***
  The Software Engineering program is strongly supported by the contemporary engineering tools available at Ontario Tech University. Ontario Tech University's laptop-based learning approach provides a unique mobile learning environment, where our students can learn and work anywhere on campus since they have wireless access to the internet. All courses utilize the CANVAS Learning Management System. Canvas offers course specific email tools, discussion boards, online chat sessions, assignment delivery and submission, online testing, multimedia presentations, marks reporting as well as numerous other services at the choice of the course instructor.

Opportunities for Program Improvement and Enhancement

- ***Graduate Teaching Assistants***
  There is a limited number of Teaching Assistant ("TA") positions available, which means courses can be operating with half of the required Tas. This affects the quality of teaching experience provided to students as instructors need to reduce the assignments and quizzes to be marked by the TAs, or mark them themselves. Furthermore, there needs to be better selection of TAs based on their competency and supervision of TAs.

- ***Scheduling***
  Due to limited classrooms, some courses need to be scheduled in the evening; however, faculty prefer not to teach in the evening. There needs to be a better scheduling for lectures. There needs to be a better scheduling for exams. In many cases, exam schedules are very tight.

- ***Course content***
  Some senior students feel they may have challenges in fining internship opportunities due to lack of Programming skills such as C++. In addition, some students suggest to have more programming courses in first year that seems very challenging due to the common first year for all Engineering programs.

- ***Class sizes***
  The number of students in a class can affect the teaching qualities. Therefore, the class size needs to be reasonably decided. For example, teaching over 100 students in a class may affect the quality.

The External Review

The site visit took place on June 21st to 24th, 2021. Drs. Shami and Jaseemuddin met with members of the Faculty as well as key stakeholders at the University, including

Dr. Lori Livingston - 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 nineteen 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

Increase the number of Software Engineering research-track faculty members -- two new hires will help. Because of the rapid extension of the Software Engineering program, the resources available to the program are very stretched. Department had to rely on a very high level of non-research faculty (i.e., teaching-only faculty members), who deliver good number of courses in the program.

Program's Response

Dr. Sanaa Alwidian (female Assistant Professor) and Dr. Mohamed El-Darieby (a Tenured Associate Professor who will join in Jan 2022) have recently joined the department, so this is already implemented.

Dean's Response

As stated in the Program's Response, two new faculty members were hired. Also, Software Engineering is a growing program which will have a higher priority in the future.

Recommendation 2

Add at least one dedicated lab technician for the Software program to ensure consistent lab delivery and help faculty members in developing new labs. There is currently no Software Engineering lab technician for the program. This has affected the program/labs delivery and development of labs. TA assignments should be based on their TA qualifications and performance.

Program's Response

Engineering Lab Technician (Mihir Mistry) has recently joined the department, so this is already implemented.

Dean's Response
The laboratory service for Engineering at Ontario Tech is structured as one unit to service all Engineering programs. There is currently a lack of technical support for undergraduate programs and the Dean is working with the Provost to remedy this issue.

Recommendation 3
Add Software Engineering Program Director or coordinator role to coordinate with the streams and the curriculum committee for consistent delivery, development of courses, and continual improvement of the program.

Program's Response
The Program is not against this recommendation. A knowledgeable Program Director (one for each department) can assist the Chair in organizing course loads. There should be a clear demarcation of the roles of the Chair and Program Coordinator. This role is also used in other universities such as Waterloo, McMaster and Queens.

Dean's Response
There is misunderstanding as the Department Chair's main responsibility is the undergraduate programs. Unlike other Departmental structures in Canadian Universities, the undergraduate programs are the main responsibilities of the Department Chair at Ontario Tech.

Recommendation 4
Dedicated SOFE 2170U delivery (preferably a dedicated new course for SOFE students) for SOFE students with more in-depth coverage of object-oriented programming and extensive labs/projects.

Program's Response
The Program Director could assist in implementing meaningful changes to this course. This course should be offered in two different sessions – one for SOFE students with increased coverage and one for other students. Python should be a part of this course as a basic language.

Dean's Response
The Dean believes the reviewers are referring to SOFE 2710U not SOFE 2170U. It is recommended that this item to be referred to the Software Engineering Program Curriculum Committee. The Program Curriculum Committee will need to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 5

Dedicated ENGR 1200U delivery (if possible) for Software students with more in-depth coverage of programming and extensive labs/projects.

Program's Response

The first year is a common year across all engineering programs. Hence, Software students take ENGR 1200U - Introduction to Programming for Engineers along with all other engineering students. ENGR 1200U delivery specifically to SOFE with more intensive coverage is not possible in its present form.

Dean's Response

The Dean agrees with Program's Response.

Recommendation 6

Enhance exposure to the implementation of data structures and algorithms in software with examples from industrial applications.

Program's Response

This is doable and the Program Coordinator could assist in providing examples from industrial applications to be introduced into the curriculum in various SOFE courses. The SOFE program contains a good set of courses including foundational courses on data structure (SOFE 2715U), design and analysis of algorithms (SOFE 3770U); software system design courses (SOFE 2720U, SOFE 3200U, SOFE 3650U, SOFE 3980U, SOFE 4820U, SOFE 3490U); computer systems (SOFE 3200U, SOFE 3850U, SOFE 3950U, SOFE 4830U, SOFE 4890U); application software and systems (SOFE 2800U, SOFE 3700U, SOFE 4590U, SOFE 4630U, SOFE 4640U, SOFE 4790U, SOFE 4840U, SOFE 4850U, SOFE 4860U); and advanced concepts (SOFE 3720U, SOFE 4610U, SOFE 4620U).

Dean's Response

The Dean recommends the Program Curriculum Committee to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 7

Enhance the coverage of software design patterns and incorporate its use in the labs to provide hands-on experience.

Program's Response

Again, this requires a SOFE professors to examine the curriculum in various courses offered by the department.

Dean's Response
The Dean recommends the Program Curriculum Committee to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 8
Review labs of early programming courses to introduce the use of IDE and debugging tools.

Program's Response
Again, this requires a SOFE professors to examine the curriculum in various courses offered by the department. It is proposed that recommendations 4-8 be lumped together and looked at by an ad-hoc committee of SOFE professors to examine the curriculum.

Dean's Response
The Dean recommend the Program Curriculum Committee to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 9
Improve student feedback process.

Program's Response
This is a reasonable request. The Department Chair to initiate, and meet with students at a townhall meeting to gather this feedback which could be beneficial to the department improve its services and image.

Dean's Response
The Dean agrees with the Program's Response, and also sees this as part of the ongoing discussion across all engineering programs to improve the student feedback process.

Recommendation 10
Improve the employer feedback process received from the employers of co-op students. This process should incorporate employers' feedback on the students' background/skills and readiness for an industrial job.

Program's Response
This is a reasonable request for the Co-Op office to initiate and meet with employers to gather this feedback which could be beneficial to the department improve its services and image.

Dean's Response
This process has already been in place and the employer's feedback on each student is collected at the end of the co-op placement.

Recommendation 11
Improve the coordination of the academic advising office in FEAS with the program. The advising office in FEAS is the right model.

Program's Response
The program agrees with the reviewers' comments. The change to a centralized model occurred recently, and the program agrees that the advising office should be in FEAS.

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 12
Library is offering good resources including selective titles of O'Reiley e-books that are practice oriented. The SOFE program and instructors should provide the relevant titles to the library to continuously update its arsenal of e-books.

Program's Response
This can be done to reach out to Library (Kate Gibbings) and ask the instructors to provide the relevant titles to the library to continuously update its arsenal of e-books.

Dean's Response
The Dean recommends that the Department Chair to communicate this with the library.

Recommendation 13
The co-op office is currently understaffed.

Program's Response
This is currently being re-vamped and is already being investigated.

Dean's Response
Co-op is currently under discussion and a new model will be placed across the University. The new model will have program/faculty resources and university wide one for central/common services.

Recommendation 14

The co-op and career office should develop links with more Software/Software Engineering related companies. Most of the companies currently in contact are in electrical engineering sector.

Program's Response

The program agrees with the reviewers' recommendation, and will work with the FEAS Co-op office in identifying and developing relationships with more Software-focused industry partners.

Dean's Response

Please see Dean's response in Recommendation 13.

Recommendation 15

Student feedback process must be communicated with the students. The students we interviewed mentioned that they have no well-identified mechanism to raise issues with the program.

Program's Response

Same response as recommendation 4-8, and 9 above.

Dean's Response

The Dean agrees with the Program's Response, and also sees this as part of the ongoing discussion across all engineering programs to improve the student feedback process.

Recommendation 16

It would be useful for the department to review carefully the details of the program and map it explicitly to the ACM/IEEE model curriculum. Having such a mapping would have been useful for this review.

Program's Response

Same response as recommendation 4-8, and 9 above.

Dean's Response

The Dean recommends the Program Curriculum Committee consider this item as they review the Software Engineering program.

Recommendation 17

Python should be incorporated in the SOFE curriculum as its integral part.

Program's Response

Same response as recommendation 4-8, and 9 above.

Dean's Response
The Dean recommends the Program Curriculum Committee to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 18
Tracking initiatives, that are/will be implemented to improve the quality of the program, assessment of these initiatives, and the associated learning outcomes and teaching environment.

Program's Response
Course Outlines are being monitored and recommendations will be made in days to come.

Dean's Response
The Dean recommends the Program Curriculum Committee to study this suggestion among other possible changes/improvement in the undergraduate program.

Recommendation 19
Strengthen the outreach and recruitment efforts for female and other under-represented groups.

Program's Response
We agree with this recommendation and will reach out to the FEAS Co-Op office and Academic Advising Office (AAO).

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 • Increase the number of Software Engineering research-track faculty members -- two new hires will help. Because of the rapid extension of the Software Engineering program, the resources available to the program are very stretched. Department had to rely on a very high level of non-research faculty (i.e., teaching-only faculty members), who deliver good number of courses in the program.	2 TTT have been hired. 2 more will be planned in the next budget ask	Dean/Provost	2023-2024	Yes
Recommendation 2 • Add at least one dedicated lab technician for Software Engineering to ensure consistent lab delivery and help faculty members in developing new labs.	An ask was made to the Provost	Dean/Provost	2022-2023	Yes
Recommendations 4,6,7,8,16,17 & 18 • Dedicated SOFE 2710U delivery for Software students with more in-depth	The Dean has delegated this action to Program Curriculum Committee	Program Curriculum Committee	2023-2024	No

coverage of object-oriented programming and extensive labs/projects. • Enhance exposure to the implementation of data structures and algorithms in software with examples from industrial applications. • Enhance the coverage of software design patterns and incorporate its use in the labs to provide hands-on experience. • It would be useful for the department to review carefully the details of the program and map it explicitly to the ACM/IEEE model curriculum. • Python should be incorporated in the SOFE curriculum as its integral part • Tracking initiatives, that are/will be implemented to improve the quality of the program, assessment of these initiatives, and the associated learning outcomes and teaching environment.				
Recommendation 9 &15 • Improve student feedback process • Student feedback process must be communicated with the students.	In discussion in the Dean Advisory Council	Department Chair	Ongoing	No

Recommendation 12 Library is offering good resources including selective titles of O'Reiley e-books that are practice oriented. The SOFE program and instructors should provide the relevant titles to the library to continuously update its arsenal of e-books.	Dean recommends the Department Chair to communicate this with the library.	Department Chair	2021-2022	No

*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 • Add SOFE Program Director or coordinator role to coordinate with the streams and the curriculum committee for consistent delivery, development of courses, and continual improvement of the program.	There is misunderstanding as the Department Chair's main responsibility is the undergraduate programs. Unlike other Departmental structures in Canadian Universities, the undergraduate programs are the main responsibilities of the Department Chair at Ontario Tech.
Recommendation 5 • Dedicated ENGR 1200U delivery (if possible) for SOFE students with more in-depth coverage of programming and extensive labs/projects.	The first year is a common year across all engineering programs. Hence, SOFE students take ENGR 1200U - Introduction to Programming for Engineers along with all other engineering students. ENGR 1200U delivery specifically to Software Engineering with more intensive coverage is not possible in its present form.
Recommendation 10 • Improve the employer feedback process received from the employers of co-op students.	This process has already been in place and the employer's feedback on each student is collected at the end of the co-op placement.
Recommendation 11 • Improve the coordination of the academic advising office in FEAS with the program.	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 13 & 14 • The co-op office is currently understaffed. • The co-op and career office should develop links with more Software/Software Engineering related companies. Most of the companies currently in contact are in electrical engineering sector.	Co-op is currently under discussion and a new model will be placed across the University. The new model will have program/faculty resources and university wide one for central/common services.
Recommendation 19 • Strengthen the outreach and recruitment efforts for female and other under-represented groups.	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.

Due Date for 18-Month Follow-up on Plan of Action: April 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: Software 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 software engineering.
- Utilize a systems approach to the design and operational performance of software 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 software 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 software engineering.
- Understand and apply the principles and key provisions of the Canadian software 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 software 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)

- Identify and describe the importance of new and emerging software engineering technologies for lifelong learning.
- Explain and demonstrate leadership skills needed as a multi-disciplinary team member or project manager.
- Develop written and oral forms of communication in both technical and non-technical areas related to software engineering.
- Recognize and describe the professional ethics and accountabilities associated with being a software engineer.
- Employ the principles of sustainable software engineering design and development.
- Solve software engineering problems.
- Use a systematic approach to tackle real world software engineering problems.

Total number of enhanced outcomes: 7

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.

CIQE INTERNAL APPROVAL

Appended to FAR	
FAR approved by USC/GSC	

Final Approved FAR & Outcomes Posted and sent to Faculty	