

DATE: May 22, 2020

TO: Senate

FROM: Dr. Dwight Deugo, Vice-Provost and Associate Vice-President (Academic), and Chair,  
Senate Quality Assurance and Planning Committee

RE: Final Assessment Report and Executive Summary: Undergraduate Programs in  
Engineering

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The purpose of this memorandum is to request that Senate approve the Final Assessment Reports and Executive Summaries arising from the cyclical reviews of the 13 undergraduate programs in Engineering.

The request to Senate is based on a recommendation from the Senate Quality Assurance and Planning Committee (SQAPC), which passed motions at its meeting of May 21, 2020 in which SQAPC recommends to SENATE the approval of the Final Assessment Reports and Executive Summaries arising from the cyclical program reviews of the undergraduate programs in Engineering.

The Final Assessment Reports and Executive Summaries are provided pursuant to articles 4.2.5-4.2.6 of the provincial Quality Assurance Framework and article 7.2.23 of Carleton's Institutional Quality Assurance Process (IQAP). Article 7.2.23.3 of Carleton's IQAP (passed by Senate on June 21<sup>th</sup>, 2019 and ratified by the Ontario Universities Council on Quality Assurance on November 22<sup>nd</sup>, 2019) stipulates that, in approving Final Assessment Reports and Executive Summaries 'the role of SQAPC and Senate is to ensure that due process has been followed and that the conclusions and recommendations contained in the Final Assessment Report and Executive Summary are reasonable in terms of the documentation on which they are based.'

In making their recommendation to Senate and fulfilling their responsibilities under the IQAP, members of SQAPC were provided with all the appendices in each of the Final Assessment Reports and Executive Summaries. These appendices constitute the basis for reviewing the process that was followed and assessing the appropriateness of the outcomes.

These appendices are not therefore included with the documentation for Senate. They can, however, be made available to Senators should they so wish.

Any major modifications described in the Action Plan, contained within the Final Assessment Reports, are subject to approval by the Senate Committee on Curriculum, Admission, and Studies Policy, SQAPC and Senate as outlined in articles 7.5.1 and 5.1 of Carleton's IQAP.

Once approved by Senate, the Final Assessment Reports, Executive Summaries and Action Plans will be forwarded to the Ontario Universities' Council on Quality Assurance and to Carleton's Board of Governors for information. The Executive Summaries and Action Plans will be posted on the website of Carleton University's Office of the Vice-Provost and Associate Vice-President (Academic), as required by the provincial Quality Assurance Framework and Carleton's IQAP.

**Omnibus Motion**

In order to expedite business with the multiple Undergraduate Engineering Final Assessment Reports and Executive Summaries that are subject to Senate approval at this meeting, the following omnibus motion will be moved. Senators may wish to identify any of the following 13 Final Assessment Reports and Executive Summaries that they feel warrant individual discussion that will then not be covered by the omnibus motion. Independent motions as set out below will nonetheless be written into the Senate minutes for those Final Assessment Reports and Executive Summaries that Senators agree can be covered by the omnibus motion.

**THAT** Senate approve the Final Assessment Reports and Executive Summaries as presented below.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Architectural Conservation and Sustainability Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Aerospace Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Civil Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Environmental Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Mechanical Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Biomedical and Mechanical Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Biomedical and Electrical Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Communications Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Computer Systems Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Electrical Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Engineering Physics.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Software Engineering.

**Senate Motion May 29, 2020**

**THAT** Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the undergraduate programs in Sustainable and Renewable Energy Engineering.

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Architectural Conservation and  
Sustainability Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Architectural Conservation and Sustainability Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Architectural Conservation and Sustainability Engineering reside in the Department of Civil and Environmental Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Architectural Conservation and Sustainability Engineering reside in the Department of Civil and Environmental Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The B.Eng. in Architectural Conservation and Sustainability Engineering program is unique in Canada and produces graduates with a unique and focused skill set which our industry partners identified as lacking in current university graduates. The two streams of the B.Eng. in Architectural Conservation and Sustainability Engineering program address specific industry needs for:

- engineering graduates with training in the area of heritage conservation and restoration
- engineering graduates with training in green building design
- engineering graduates with a focus on conservation and sustainability.

#### Students

Admission to the program is competitive and the program has attracted highly motivated students who have generally distinguished themselves in the courses they take in common with students from the other engineering programs. The program stands out among engineering programs in attracting a well-balanced population from a gender perspective and benefits from this mix of students.

Student surveys carried out in the Spring of 2013 for engineering programs comprise some 52 questions covering various aspects of the students' program and experience. Students responding in 2013 would have included mostly CIVE and ENVE students. The student feedback from 2013 was generally quite favorable, students citing and praising the interaction with professors in response to the question "what do you consider to be the major strength(s) of this program". When asked "to what extent have/did aspects of your courses most helped you achieve the graduate attributes or learning outcomes of your program?", "Instruction in class" and "attending classes" were the most frequently cited factors.

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

In the B.Eng. program, students have the option of following a Structures stream or an Environmental stream. The Structures stream provides students with ability to design new structures and assess and retrofit existing structures with a goal of conservation and sustainability. The Environmental stream provides students with the ability to design sustainable building practices with a focus on water quality and conservation, air quality, life cycle analysis and disposal of materials and waste streams.

The Conservation and Sustainability programs in engineering and architecture share a common vertical core of 16 courses; 8 in engineering, 7 in Architecture, and 1 in Canadian Studies. This program structure ensures that the engineering students work closely with the architecture students in this multidisciplinary field.

## **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made no recommendations for further improvement to the program. As result, the unit was not required to supply a Unit Response and Action Plan. The unit will continue to

report on new initiatives and directions in their next cyclical review.

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Architectural Conservation and Sustainability Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs Architectural Conservation and Sustainability Engineering will be conducted during the 2020-21 year.



**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Aerospace Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Aerospace Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Aerospace Engineering reside in the Department of Mechanical and Aerospace Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Aerospace Engineering reside in the Department of Mechanical and Aerospace Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Aerospace Engineering program at Carleton was the first to offer a Bachelor of Engineering (BEng) degree program in Aerospace Engineering in Canada in 1988, and it is currently recognized for the wide range of topics offered within four streams of study:

- A. Aerodynamics, propulsion, and vehicle performance;
- B. Aerospace structures, systems and vehicle design;
- C. Aerospace electronics and systems;
- D. Space systems design.

A unique aspect of the program is that it co-exists within a department that also offers the Mechanical, Biomedical and Mechanical, and Sustainable and Renewable Energy Engineering undergraduate programs. Since the departmental philosophy is that all faculty members participate in the delivery of all programs, this has significant beneficial effects such as a greater selection of elective courses, wider range of laboratory and computing facilities, and increased opportunity for students to be engaged in cross-disciplinary projects.

An innovative strength of the Aerospace Engineering program is the final-year group design project, in which teams of about 30 students are supervised by three Lead Engineers (faculty and industry experts) to design, build and test a major engineering device or assembly.

here students get foundational knowledge and skills in both biomedical

## Students

The Aerospace Engineering program has been, and continues to be, in high demand and successfully registers students with very high grades out of high school.

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and
- student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

Graduate Attributes data collected over the past 3 years suggests that, overall, the existing curriculum is effective in achieving the desired learning outcomes. The Graduate Attribute process is managed by a departmental committee for Graduate Attributes and Accreditation (GAA), which oversees the collection of the data and meets regularly to analyze and discuss it. Part of this process is a mechanism of annual review, whereby apparent weaknesses suggested by the GA data are analyzed and possible program changes are considered.

### **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made no recommendations for further improvement to the program. As result, the unit was not required to supply a Unit Response and Action Plan. The unit will continue to report on new initiatives and directions in their next cyclical review.

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in unit were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Aerospace Engineering will be conducted during the 2020-21 year.

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Civil Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Civil Engineering provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Civil Engineering reside in the Department of Civil and Environmental Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Civil Engineering reside in the Department of Civil and Environmental Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
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- Students in years 1-4 of the program
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- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Civil Engineering program has been offered at Carleton for nearly 50 years with periodic reviews and changes implemented in the program over the years. The program provides a solid grounding in Structural, Geotechnical and Transportation Engineering, with some knowledge of Municipal Engineering. There are no formal concentrations or streams, but a student may choose to focus in a specific area (i.e. Structural Engineering) through choice of engineering electives, or may choose breadth by selecting electives in Geotechnical Engineering, Urban Planning, Municipal Hydraulics, Project Management, Fire Safety, Green Building Design or Water Resources Engineering.

#### Students

A student satisfaction survey was carried out as part of an internal program review process across the university in 2013. When asked to describe the major strengths of the program, a significant number of students mentioned the faculty as adding strength to the program.

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically



coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and
- student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The graduate attribute process is managed by a departmental committee which oversees the collection of the data and meets regularly to analyze and discuss it. Part of this process is a mechanism of annual review, whereby apparent weaknesses suggested by the GA data are analyzed and possible program changes are considered. The committee makes recommendations to the department's curriculum committee when it identifies potential ways to improve the program. The departmental GA committee also works closely with the faculty-level committee (indeed, some of the membership overlaps) that oversees faculty wide GA data collection and the process of continual program improvement.

Although the current program in civil engineering is both strong and well recognized, the department is cognizant of the need for continuous monitoring and review in order to respond to the expanding frontiers of knowledge, the new demands on technology, the need to preserve our environment and the changing responsibility and role of engineers in modern society. To serve this need, in addition to the CEAB Accreditation, and the Internal Quality Assurance Program (IQAP) procedures, the Department has established an Advisory Committee consisting of up to twelve members many of whom are Carleton graduates from our Civil Engineering Program.

### **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made no recommendations for further improvement to the program. As result, the unit was not required to supply a Unit Response and Action Plan. The unit will continue to report on new initiatives and directions in their next cyclical review.

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Civil Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Civil Engineering will be conducted during the 2020-21 year.

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Environmental Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Environmental Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Environmental Engineering reside in the Department of Civil and Environmental Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Environmental Engineering reside in the Department of Civil and Environmental Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

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- Departments offering service courses
- Dean of the Faculty of Engineering
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- Vice-President (Research and International)
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- Associate Vice-President (Teaching and Learning)
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The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
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- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

In many institutions across North America the study of environmental engineering can be found as an option or major within civil engineering or chemical engineering degrees, or as a Civil and Environmental Engineering degree. Carleton's ENVE program is thus unique in bringing the chemical engineering fundamentals and civil engineering practice within a department of Civil and Environmental Engineering. The offering of individually designed CIVE and ENVE programs in a Department of Civil and Environmental Engineering can be regarded as a very tangible practice of interdisciplinarity, a desirable principle much talked about but not always practiced in a meaningful way. The result of this bold approach to establishing a new program has meant that our students are exposed to a unified treatment of fundamentals in different media and are able to address industrial, as well as municipal environmental problems, be they related to air, water, soil, or sustainability.

#### Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

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- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The B.Eng. ENVE program prepares students not only for engineering careers in the implementation of solutions to environmental problems but also prepares them for careers in research and development by focusing on fundamentals throughout the curriculum.

Enhancing our Environmental Engineering program is the addition of new B.Eng. program in Architectural Conservation and Sustainability Engineering to the programs offered by the Department of Civil and Environmental Engineering. The new program has led to the development of two new ENVE courses, ENVE 4105 Green Building Design and ENVE 4106 Indoor Environment Quality, which our Environmental Engineering students can take as engineering elective courses. Another relatively new B.Eng. program in Sustainable and Renewable Energy Engineering offered by the Faculty of Engineering and Design has introduced two courses that can also be taken as engineering electives: SREE3001 Sustainable and Renewable Energy Sources, and SREE4200 The Energy Economy, Reliability and Risk.

## **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made no recommendations for further improvement to the program. As result, the unit was not required to supply a Unit Response and Action Plan. The unit will continue to report on new initiatives and directions in their next cyclical review.

## **The Outcome of the Review**

As a result of the review, the undergraduate programs in Environmental Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

## **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Environmental Engineering will be conducted during the 2020-21 year.

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Mechanical Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Mechanical Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Mechanical Engineering reside in the Department of Mechanical and Aerospace Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).



## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Mechanical Engineering reside in Mechanical and Aerospace Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Mechanical Engineering program is one of four undergraduate degree programs offered by the Department. Faculty, staff, and departmental infrastructure are shared by all four programs. This is a significant strength of the Carleton University Mechanical Engineering program as it benefits from a wealth of expertise, resources, and course offerings that are attributed to the size and diversity of the Department. There are two primary ways that the program distinguishes itself from other Mechanical Engineering programs: (1) the format of our capstone project in 4<sup>th</sup> year and (2) through unique synergies with the other programs offered by the same academic unit.

The Carleton University Mechanical Engineering program is a strong hands-on laboratory experience, a unique large-team-based final-year capstone design experience, and exposure and close interaction with students studying the closely-related fields of aerospace engineering, biomedical and mechanical engineering, and sustainable and renewable energy engineering. The program is also distinct due to its close integration with other programs. As such, lab experiences, example applications of the technology, and capstone projects are heavily influenced by Aerospace, Sustainable Energy, and Biomedical engineering.

#### Students

Overall, the Mechanical Engineering program is considered to be a mature, solid, and well-delivered program. Strengths reported by students during surveys include comprehensive and well-rounded curriculum; good, effective, and caring professors, technical staff, and support staff; final-year capstone design project; relevant laboratory work; and good overall course selection including fourth-year electives.

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

Although it has continually evolved with changes in technology, the Mechanical Engineering curriculum has been taught at Carleton University since 1963. The longevity and continued growth and strength of the program attest to the fundamental importance of mechanical engineering in society. While the core material comprising the program is fundamental, its continuous evolution keeps it current in terms of technological advance and relevant in terms of best practices for its application. Depending on societal need, concentrations or spin-off programs have developed from the core mechanical engineering program. As examples, to address a surge in industrial automation, a concentration in "Computer-aided Manufacturing" was introduced and continues to run today. Recently, dedicated programs in Sustainable and Renewable Energy Engineering (SREE) as well as biomedical and mechanical engineering (BIOM) were spawned from Carleton's broader core Mechanical Engineering program.

With the introduction of graduate attributes, learning outcomes, and degree level expectations, a process for the continual evaluation of the Mechanical Engineering program against these metrics is currently a major departmental focus for identifying potential improvements. This will result in both a data set and a review process that can be used to assess the overall quality and strength of the program with regards to these metrics and allow for the rapid detection and resolution of any issues that arise. The strategy for collecting and analyzing graduate attribute (GA) performance, and ultimately

implementing changes to improve our program based on the GAs, has been developed over the last 5 years or so and continues to grow and evolve. The continued refinement of this process over the next few years is seen as a significant means of identifying and addressing issues relevant to the maintenance and improvement of the established strength of the Mechanical Engineering program.

### **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made no recommendations for further improvement to the program. As a result, the unit was not required to supply a Unit Response and Action Plan. The unit will continue to report on new initiatives and directions in their next cyclical review.

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in unit were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Mechanical Engineering will be conducted during the 2020-21 year.

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Biomedical and Mechanical  
Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Biomedical and Mechanical Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Biomedical and Mechanical Engineering reside in the Department of Mechanical and Aerospace Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made one recommendation for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Biomedical and Mechanical Engineering reside in the Department of Mechanical and Aerospace Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
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- Students in years 1-4 of the program
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- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Department runs four unique but inter-related undergraduate programs: Mechanical Engineering, Aerospace Engineering (comprised of 4 streams), Sustainable and Renewable Energy Engineering (SREE) and the BIOM program. At their core, the latter three programs are all specializations of mechanical engineering, and as such all four of these programs build on core fundamental principles of engineering science, mathematics and design. As students progress from first to fourth year of their studies, they start with fundamental core courses common to all branches of engineering, and then take progressively more focussed and specialized courses to develop their program-specific knowledge. As such, part of the strength of the BIOM program is its reliance on the well-established history of excellence of the Department of Mechanical and Aerospace Engineering (and of the Faculty of Engineering and Design in general), and the concomitant expertise in delivering the fundamental courses.

A significant feature of the program compared to those offered by engineering departments across Canada is the final year design project (for the BIOM program: MAAE 4907). This format was pioneered by our department, and has since been copied by many similar departments across the country. In each project, students design, build and test sophisticated engineering devices or systems, working in teams of 20-30 students supervised by three Lead Engineers (faculty members

or practicing engineers from industry). The projects closely simulate the environment of a small engineering company or design department of a large firm. A unique aspect of these projects is that they each have a multi-year life cycle of three or more years, allowing students to build year-to-year on the complexity of the design and see how “real” engineering systems are created. New projects are brought on line from time to time, as old projects are completed or as new programs are created (such as the introduction of BIOM).

## Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton’s Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The Department believes that it is important for engineering graduates to have a reasonably broad knowledge of engineering fundamentals, including fundamentals not necessarily central to their own particular discipline. Reflecting this belief, the first year Biomedical and Mechanical Engineering curriculum follows the faculty wide ‘common core’, and ‘common core’ courses exist within the remaining three years of the program. The ‘common-core’ courses are taught by the same department to students in all engineering disciplines. For example, ECOR1101 - Mechanics I is currently taught to all engineering students by faculty members affiliated with the Department of Civil and Environmental Engineering.

The curriculum of the Biomedical and Mechanical Engineering program has some common material with three of the Aerospace Engineering streams, the Mechanical Engineering program, and Stream B of the Sustainable and Renewable Energy Engineering program.

## **Recommendations Offered By the Visiting Team for Consideration**



The Report of the Visiting Team made 1 recommendation for improvement:

Weakness: Some indicators for graduate attribute (3.1.6) were misaligned or inadequately sampled to demonstrate compliance. (CEAB Criterion 3. 1)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Biomedical and Mechanical Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendation that was put forward as a result of the review process was productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified one weakness which was agreed to by the unit unconditionally. The unit took action to address this recommendation in 2017.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Biomedical and Mechanical Engineering will be conducted during the 2020-21 year.

**Action Plan  
Biomedical and Mechanical Engineering  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1. Weakness: Some indicators for graduate attribute (3.1.6) were misaligned or inadequately sampled to demonstrate compliance. (Criterion 3. 1)</b></p>	<p>At the time of the last visit, GA 6 (individual and teamwork) was only assessed in the 4<sup>th</sup> year capstone project at the Applied level. This was addressed shortly after the 2015 visit, and we now measure GA 6 in the 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> years of the program at all three levels (IDA). Data from these indicators has been collected several times during the intervening years, with good results. Complete details can be found in Exhibit 1 of the 2019 CEAB submission.</p>	<p><i>Ron Miller</i></p>	<p><i>Completed, 2017</i></p>	<p><i>n</i></p>

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Biomedical and Electrical  
Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Biomedical and Electrical Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Biomedical and Electrical Engineering reside in the Department of Systems and Computer Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Biomedical and Electrical Engineering reside in the Department of Systems and Computer Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
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- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Biomedical and Electrical Engineering program at Carleton University has been the first in Canada to combine both biomedical and electrical engineering. here students get foundational knowledge and skills in both biomedical engineering and electrical

#### Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;

- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The Biomedical and Electrical Engineering program gives students a broad base in Electrical Engineering fundamentals as well as knowledge of biomedical engineering. At the same time it imparts biomedical specific knowledge. The Electrical Engineering course content includes electronic circuit design, electronic device, electromagnetism and radio communication, and signal processing. The program curriculum is updated on an ongoing basis based on input from faculty and other stakeholders.

### **Recommendations Offered By the Visiting Team for Consideration**

The Report of the Visiting Team made 1 recommendation for improvement:

Deficiency: The set of specific technical engineering courses that distinguishes the Biomedical and Electrical Engineering program from an Electrical or Computer Systems program are confined to the 4th year. Students taking the Capstone Design project course in the 7th semester have not had any program-specific technical courses before-hand. The question remains as to whether this is an engineering program or an option in an existing program. (Criterion 3.6.6 and Appendix 4 "Interpretive Statement on curriculum content for options and dual-discipline programs)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in unit were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendations that were put forward as a result of the review process were productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified one deficiency which was agreed to by the unit unconditionally. The unit took action to address this recommendation in 2014.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Biomedical and Electrical Engineering will be conducted during the 2020-21 year.

**Action Plan  
Biomedical and Electrical Engineering  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1.</b> <i>Deficiency: The set of specific technical engineering courses that distinguishes the Biomedical and Electrical Engineering program from an Electrical or Computer Systems program are confined to the 4th year. Students taking the Capstone Design project course in the 7th semester have not had any program-specific technical courses before-hand. The question remains as to whether this is an engineering program or an option in an existing program. (Criterion 3.6.6 and Appendix 4 "Interpretive Statement on curriculum content for options and dual-discipline programs)</i></p>	<p>1) A new course SYSC 3610 – Biomedical Systems Modeling and Control was created and replaced SYSC 3600 – Systems and Simulations.                  2) SYSC 3203 – Bioelectrical Systems was added to replace ELEC 3509 Electronics II                  3) The course SYSC 4201 – Ethics, Research Methods and Standards for Biomedical Engineering was updated and</p>	<p>The Department of Systems and Computer Engineering</p>	<p>The changes in curriculum were made and were applied to students entering the program in Fall 2014</p>	<p>Y</p>



	<p><i>moved from 4<sup>th</sup> year to 3<sup>rd</sup> year.</i></p> <p><i>4) SYSC 4203 – Bioinstrumentation and Signals, with SYSC 3203 as a prerequisite was significantly modified to focus on bio-compatibility issues in the context of biomedical instrumentations.</i></p> <p><i>The four courses are opened only to students in the biomedical engineering programs.</i></p>			
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**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Communications Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Communications Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Communications Engineering reside in the Department of Systems and Computer Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Communications reside in Systems and Computer Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

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The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

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- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Communications Engineering program results from the collaboration between the Department of Systems and Computer Engineering and the Department of Electronics, and forms the foundation for the specialization in advanced communication systems. The objective of the program is to train students to become Professional Engineers in the area of Communications Engineering, with an emphasis on the following:

- (i) the design and development of the computer and electrical infrastructure to support communications between devices;
- (ii) the design and development of the next generation of integrated data, image, voice and video communications; and
- (iii) the design and development of distributed software (web applications, cloud computing model).

It is the only program in Canada that integrates hardware design and software design in computer networking and communications.

#### Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

The most-commonly recognized strengths of the program in student surveys are: the program-specific courses and the small class size in these courses; the comprehensive and well-rounded curriculum; experienced instructors and TAs; and relevant laboratory work.

## Curriculum

The unit reports being the only program in Canada that integrates hardware design and software design in computer networking and communications. The curriculum is designed to balance (a) Electronics and Hardware implementation, (b) Telecommunications Systems and Protocols and (c) Software development. The program offers a unique course in Telecommunications Engineering (SYSC 4700) whose lectures are given by industry and government telecommunications experts; the course not only gives students exposure to a variety of relevant topics but also gives them a heightened appreciation of the importance of communications engineering to society.

## **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers' made 4 recommendations for improvement:

- 1.Weakness: The process described is well designed but documentation and formality of the process is lacking. Communications Engineering lacks a defined process to link graduate attribute results to improvement actions. (CEAB Criterion 3.2.1)
- 2.Weakness: The program has not addressed an observation from the previous visit that exposure to other disciplines is limited. This is a repeat finding. (CEAB Criterion 3.4.4.2)

3. Weakness: Undergraduate students indicated that the overwhelming majority of lab work consisted of simulations and more hands-on practical work was needed. (CEAB criterion 3.4.7)

4. Weakness: Laboratories were equipped with only the most basic tools and test equipment (e.g., computer stations, signal generators, oscilloscopes and power supplies). (CEAB criterion 3.5.1.2)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Communications Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendation that was put forward as a result of the review process was productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified four recommendations. The unit agreed unconditionally to recommendation #2 and disagreed with #1, 3, 4. For the items not agreed to the unit provided a rationale which was found by SQAPC to be acceptable.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Communications Engineering will be conducted during the 2020-21 year.

**Action Plan  
Communications Engineering  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards: Concern: Criterion satisfied; potential exists for non-satisfaction in near future. Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained. Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1.</b> <i>Weakness. The process described is well designed but documentation and formality of the process is lacking. Communications Engineering lacks a defined process to link graduate attribute results to improvement actions. (Criterion 3.2.1)</i></p>	<p><i>None</i></p>	<p><i>The Department of Systems and Computer Engineering</i></p>	<p><i>N/A</i></p>	<p><i>N</i></p>
<p><b>2.</b> <i>Weakness: The program has not addressed an observation from the previous visit that exposure to other disciplines is limited. This is a repeat finding. (Criterion 3.4.4.2)</i></p>	<p><i>The new core curriculum includes ECOR 1056 Introduction to Engineering Disciplines II, which presents specific topics in all engineering disciplines</i></p>	<p><i>Faculty of Engineering and Design</i></p>	<p><i>New program is effective in Fall 2019</i></p>	<p><i>Y</i></p>

	<i>offered by the faculty</i>			
<b>3.</b> <i>Weakness: Undergraduate students indicated that the overwhelming majority of lab work consisted of simulations and more hands-on practical work was needed. (criterion 3.4.7)</i>	<i>None</i>	<i>The Department of Systems and Computer Engineering</i>	<i>N/A</i>	<i>N</i>
<b>4.</b> <i>Weakness: Laboratories were equipped with only the most basic tools and test equipment (e.g., computer stations, signal generators, oscilloscopes and power supplies). (criterion 3.5.1.2)</i>	<i>None</i>	<i>The Department of Systems and Computer Engineering</i>	<i>N/A</i>	<i>N</i>



**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Computer Systems Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Computer Systems Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Computer Systems Engineering reside in the Department of Systems and Computer Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Computer Systems Engineering reside in the Department of Systems and Computer Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Computer Systems Engineering Program is unique, and distinguishes itself from Computer Engineering programs, in that it recognizes that systems nowadays not only include computers but rather include hardware (sensors and actuators in addition to computing capability) and software (operating systems, application logic), are typically distributed and require communication capabilities.

The Computer Systems Engineering Program has four main objectives:

- (i) The design and development of the interface between the software and hardware of a computer system.
- (ii) The design and development of computer systems which are used to interact with their environment through sensing from and control of the hardware.
- (iii) The design and development of computer-based systems that are distributed and communicate.
- (iv) The application of best practices in software engineering to develop reliable systems in a timely and cost-effective manner.

## Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The program is in line with Carleton University's plan to promote new digital media and to encourage interdisciplinary collaboration. The curriculum includes Basic Science, Mathematics and Statistics, Electronics, Computer Science, Computer Networking.

The program offers a well-balanced curriculum which includes Hardware Design, Software Engineering, Communication and Systems Integration. The program aims at providing the technical expertise at the level of the system components and at providing the methodologies for integrating system components.

### **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers' made 1 recommendation for improvement:

1. Weakness. Sufficient exposure to appropriate elements of discrete mathematics does not appear to be present in the curriculum. The numerical methods course is an elective. (CEAB Criterion 3.4.3.1)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs Computer Systems Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD**

**QUALITY** (Carleton's IQAP 7.2.12).

**The Action Plan**

The recommendation that was put forward as a result of the review process was productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The unit agreed to the recommendation and took active action to address it in 2016.

**The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Computer Systems Engineering will be conducted during the 2020-21 year.

**Action Plan  
Computer Systems Engineering  
Undergraduate Programs**

**May 21 2020**

<b>External Reviewer Recommendation &amp; Categorization</b>  <b>Note: Definitions from CEAB Accreditation Standards:</b> <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b> <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b> <b>Deficiency: Criterion not satisfied.</b>	<b>Action Item</b>	<b>Owner</b>	<b>Timeline</b>	<b>Will the action described require calendar changes? ( Y or N)</b>
<p><i>1. Weakness. Sufficient exposure to appropriate elements of discrete mathematics does not appear to be present in the curriculum. The numerical methods course is an elective. (Criterion 3.4.3.1)</i></p>	<p><i>The course ECOR 2606 – Numerical methods was added as a required course, instead of being an elective in the final year. The change is effective beginning 2016.</i></p>	<p><i>Department of Systems and Computer Engineering</i></p>	<p><i>Changes effective in 2016</i></p>	<p><i>Y</i></p>

**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Electrical Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Electrical Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Electrical Engineering reside in the Department of Electronics.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Electrical Engineering reside in the Department of Electronics. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.



This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Electrical Engineering program at Carleton University was developed in symbiosis with development of the telecommunications industry in the National Capital Region. The program has always closely followed the tools and techniques used in industry. The result has been a program with a unique focus on Electronics and that provides a practical training with particular strengths in semiconductor devices, integrated circuit design, and communications hardware.

#### Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The curriculum in Electrical Engineering builds on interdisciplinary fundamentals from mathematics, physics, and chemistry to develop device, circuit, and system design skills. Senior courses develop transferrable skills in specific application areas. These elective courses respond to changing technology requirements to produce graduates with contemporary industry-standard skill sets.

The Electrical Engineering program-level objectives are the following:

- 1) To produce engineering graduates who have a very good understanding of mathematics, physics, and engineering science, and are able to apply this knowledge to solve problems in Electrical Engineering;
- 2) To prepare engineering graduates for a career in Electrical Engineering and, after suitable work experience, to become a Professional Engineer in Canada;
- 3) To produce engineering graduates who have an understanding of the impact of technology on society and the environment, and their responsibility for public safety;
- 4) To produce engineering graduates who are able to communicate effectively with specialist and non-specialist audiences.

## **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers made 2 recommendations for improvement:

1. Weakness: Exposure to other engineering disciplines is minimal. (CEAB Criterion 3.4.4.2)
2. Weakness: There are instances where the capstone design experience is being supervised by a non licensed individual. (CEAB Criterion 3.4.4.4)

## **The Outcome of the Review**

As a result of the review, the undergraduate programs in Electrical Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC)) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

## **The Action Plan**

The recommendations that were put forward as a result of the review process were productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified two weaknesses. The unit agreed unconditionally to take action on recommendation #2 and agreed to act on recommendation #1 if resources permit. The unit implemented changes which addressed both of these recommendations in 2019.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate Electrical Engineering will be conducted during the 2020-21 year.

**Action Plan  
Electrical Engineering  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1.</b> <i>Weakness: Exposure to other engineering disciplines is minimal. (Criterion 3.4.4.2)</i></p>	<p><i>The first year engineering core has been modified to address this issue</i></p>	<p><i>Faculty and units</i></p>	<p><i>Implemented fall 2019</i></p>	<p><i>Y</i></p>
<p><b>2.</b> <i>Weakness: There are instances where the capstone design experience is being supervised by a non licensed individual. (Criterion 3.4.4.4)</i></p>	<p><i>Capstone design projects under the supervision of a non licensed faculty member include a fully licensed co-supervisor</i></p>	<p><i>Unit</i></p>	<p><i>Implemented fall 2019</i></p>	<p><i>N</i></p>



**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Engineering Physics**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Engineering Physics are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Engineering Physics reside in the Department of Electronics.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Engineering Physics reside in the Department of Electronics.. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Engineering Physics program was established as a key source of talented graduates in the rapidly developing field of semiconductor devices , nanoelectronics, photonics, and integrated circuit design and fabrication. The program has continued to evolve to keep pace with this continuously changing field.

#### Students

The Carleton University IEEE student branch is one of the largest and most successful branches and has won numerous awards since its founding in 1965. The branch runs popular technical workshops and professional development activities. The EP program strives to engage students with practical and interesting laboratory projects which become more challenging and applied as they progress through the program.

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.



The primary avenues for student involvement and to obtain student feedback include:

- student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;
- communications shared by student association representatives with faculty and staff;
- individual student feedback to course instructors and teaching assistants;
- student surveys which are conducted periodically to assess student views on the programs;
- 4th year students are invited to a session to provide feedback on their program;
- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

### Curriculum

The curriculum in Engineering Physics builds on interdisciplinary fundamentals from mathematics, chemistry, and especially physics to develop device, circuit, and system design skills. Senior courses develop transferrable skills in specific application areas. These elective courses respond to changing technology requirements to produce graduates with contemporary industry-standard skill sets.

Students are encouraged to develop key soft-skills. The student branch of the Institute of Electrical and Electronics Engineers (IEEE) at Carleton is very active in organizing workshops and competitions to allow students to hone their skills. This organization has won numerous awards for their activities.

The Engineering Physics program-level objectives are the following:

- 1) To produce engineering graduates who have a very good understanding of mathematics and engineering science, as well as a deep understanding of physics, and are able to apply this knowledge to solve problems in engineering;
- 2) To prepare engineering graduates who have a strong physics background for a career in an area of high technology, and after suitable work experience, to become a Professional Engineer in Canada;
- 3) To produce engineering graduates who have an understanding of the impact of technology on society and the environment, and their responsibility for public safety;
- 4) To produce engineering graduates who are able to communicate effectively with specialist and non-specialist audiences.

### **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers' made 2 recommendations for improvement:

1. Weakness: Exposure to other engineering disciplines is minimal. (CEAB criterion 3.4.4.2)
2. Weakness: There is insufficient coverage of safety. Scheduling Engineering Economics in fourth year may limit the ability of students to apply this content to work term experiences and the capstone design experience. (CEAB criterion 3.4.5.)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Engineering Physics were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendations that were put forward as a result of the review process were productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified two weaknesses. The unit unconditionally agreed to recommendation #2, and agreed to recommendation #1 if resources permit. The unit completed action to address both items in Fall 2019.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Engineering Physics will be conducted during the 2020-21 year.

**Engineering Physics  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1.</b> <i>Weakness: Exposure to other engineering disciplines is minimal. (Criterion 3.4.4.2)</i></p>	<p><i>The first year engineering core has been modified to address this issue</i></p>	<p><i>Faculty and units</i></p>	<p><i>Implemented fall 2019</i></p>	<p><i>Y</i></p>
<p><b>2.</b> <i>Weakness: There is insufficient coverage of safety. Scheduling Engineering Economics in fourth year may limit the ability of students to apply this content to work term experiences and the capstone design experience. (Criterion 3.4.5)</i></p>	<p><i>These are two separate issues. Emphasis on safety in labs and capstone project has been increased. Engineering Economics has moved to 3<sup>rd</sup> year in all programs.</i></p>	<p><i>Unit</i></p>	<p><i>Implemented for fall 2019 entry</i></p>	<p><i>Y</i></p>



**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Software Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Software Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Software Engineering reside in Systems and Computer Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Software Engineering reside in Systems and Computer Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

The accreditation site visit was conducted by the review team of the CEAB and stands in place of the cyclical review site visit. A typical CEAB accreditation visit includes meetings with the following parties:

- Department Chair
- Faculty members
- Administrative staff
- Technical staff
- Students in years 1-4 of the program
- Teaching assistants
- University librarian
- Student Academic Success Centre
- Departments offering service courses
- Dean of the Faculty of Engineering
- Vice-President (Academic) and Provost
- Vice-President (Finance and Administration)
- Vice-President (Research and International)
- Vice-President (Students and Enrolment) and University Registrar
- Associate Vice-President (Teaching and Learning)
- President

The Report of the Visiting Team offered a very positive assessment of the program.

This Final Assessment Report provides a summary of the following:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan

This report draws on five documents:

- Cyclical Review Supplement
- The Accreditation recommendations (private)
- The response and action plan from the unit Director and Dean of the Faculty of Engineering and Design
- The internal discussant's recommendation report

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### *General*

*The Software Engineering Program has four main objectives:*

- 1. The design and development of software intensive systems, covering all major steps of typical software development methodologies: software requirements elicitation and analysis, software design, software construction, software verification and validation, maintenance.*
- 2. A strong focus on software development methodologies that focus on creating and exploiting domain models (i.e, model-driven development) rather than on the computing (or algorithmic) concepts, without neglecting the latter.*
- 3. A strong focus on principles, techniques and tools to achieve and ensure software quality.*
- 4. The application of these principles in varied domains, including but not limited to: information technology ( banking, insurance, human resources), telecommunication, health care, transportation (e.g., aerospace), digital media.*

#### *Students*

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

*The primary avenues for student involvement and to obtain student feedback include:*

- *student participation on departmental and faculty board and committee meetings where program improvements, calendar changes, and other relevant issues are discussed;*
- *communications shared by student association representatives with faculty and staff;*
- *individual student feedback to course instructors and teaching assistants;*
- *student surveys which are conducted periodically to assess student views on the programs;*
- *4th year students are invited to a session to provide feedback on their program;*
- *student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.*

### *Curriculum*

The curriculum of Software Engineering can be divided into main areas:

- a. Programming*
- b. Design and Architecture*
- c. Software Engineering lifecycle*
- d. Operating Systems and Databases*
- e. Hardware*

The department has consulted with will continue its discussion with industrial partners, to define their expectations of graduates from Software Engineering program.

Concurrently, the department is also exploring the option to offer more electives (in Web Development, in Cloud Computing, in Artificial Intelligence ...) to respond to students' suggestions.

### **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers made 4 recommendations for improvement:

- 1. Weakness: There is misalignment of corresponding indicators with some graduate attributes. (Criterion 3.1.3)*
- 2. Weakness: Space in labs for individual and team work is insufficient. (criterion 3.4.7)*



3. *Weakness: Student space, especially for organizations and extracurricular projects, is lacking. There is insufficient classroom space. (Criterion 3.5.1.2)*
4. *Concern: The educational experience of students is potentially negatively impacted by the quality and accountability of the teaching assistants and by understaffed technical support. Interactions and training for IT technical staff are insufficient for keeping up to date on curriculum. There is a perceived need for onsite staff training. (Criterion 3.S.1. j)*

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Software Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendations that were put forward as a result of the review process were productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified three weaknesses and one concern. The unit did not agree to any of the recommendations and stated no further action was needed. This rationale was reviewed by SQAPC on May 7, 2020 and their response was found to be appropriate.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Software Engineering will be conducted during the 2020-21 year.

**Software Engineering  
Undergraduate Programs**

**May 21 2020**

<p align="center"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p align="center"><b>Action Item</b></p>	<p align="center"><b>Owner</b></p>	<p align="center"><b>Timeline</b></p>	<p align="center"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1.</b> <i>Weakness: There is misalignment of corresponding indicators with some graduate attributes. (Criterion 3.1.3)</i></p>	<p align="center"><i>None</i></p>	<p align="center"><i>The Department of Systems and Computer Engineering</i></p>	<p align="center"><i>N/A</i></p>	<p align="center"><i>N</i></p>
<p><b>2.</b> <i>Weakness: Space in labs for individual and team work is insufficient. (criterion 3.4.7)</i></p>	<p align="center"><i>None</i></p>	<p align="center"><i>The Department of Systems and Computer Engineering</i></p>	<p align="center"><i>N/A</i></p>	<p align="center"><i>N</i></p>
<p><b>3.</b> <i>Weakness: Student space, especially for organizations and extracurricular projects, is lacking. There is insufficient classroom space. (Criterion 3.5.1.2)</i></p>	<p align="center"><i>None</i></p>	<p align="center"><i>The Department of Systems and Computer Engineering</i></p>	<p align="center"><i>N/A</i></p>	<p align="center"><i>N</i></p>

<p><b>4.</b> <i>Concern: The educational experience of students is potentially negatively impacted by the quality and accountability of the teaching assistants and by understaffed technical support. Interactions and training for IT technical staff are insufficient for keeping up to date on curriculum. There is a perceived need for onsite staff training. (Criterion 3.S.1. j)</i></p>	<p><i>None</i></p>	<p><i>The Department of Systems and Computer Engineering</i></p>	<p><i>N/A</i></p>	<p><i>N</i></p>
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**CARLETON UNIVERSITY COMMITTEE ON  
QUALITY ASSURANCE  
Cyclical Review of the  
undergraduate programs in  
Sustainable and Renewable  
Energy Engineering**

**Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's undergraduate programs in Sustainable and Renewable Energy Engineering are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

**EXECUTIVE SUMMARY**

The undergraduate programs in Sustainable and Renewable Energy Engineering reside in the Department of Mechanical and Aerospace Engineering.

A cyclical review of these programs was completed in conjunction with the accreditation review process undertaken by the CEAB.

As a result of the review, the programs were categorised by the SQAPC as being of **GOOD QUALITY**. (Carleton's IQAP 7.2.12).

The Report of the Visiting Team offered a very positive assessment of the programs. Within the context of this positive assessment, the report nonetheless made one recommendation for the continuing enhancement of the programs. These recommendations were productively addressed by the unit Director, and Dean of the Faculty of Engineering and Design in a Unit Response and Action Plan that was submitted to SQAPC May 7, 2020.

## **FINAL ASSESSMENT REPORT**

### **Introduction**

The undergraduate programs in Sustainable and Renewable Energy Engineering reside in the Department of Mechanical and Aerospace Engineering. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a result of the review, the programs were categorised by the (SQAPC) as being of good quality. (Carleton's IQAP 7.2.12).

The undergraduate programs in the Faculty of Engineering and Design is accredited by the Canadian Engineering Accreditation board (CEAB). As result, the Office of the Vice-Provost and the Faculty of Engineering Design entered an agreement to align the cyclical review and accreditation processes.

To facilitate this alignment, the criteria required as part of the CEAB accreditation was mapped to the generic criteria requirements of Carleton's Institutional Quality Assurance Process, and the Quality Assurance Framework. Documents required for the CEAB accreditation were reviewed in place of cyclical review documentation and were compliant with the requirements of the IQAP. Units were asked to submit an additional cyclical program review supplement to address areas which were not sufficiently covered in the accreditation standards. The four content areas which units were asked to report on include alignment with strategic mission, learning outcomes, distinctiveness, enrolment planning, and student involvement.

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The Report of the Visiting Team offered a very positive assessment of the program.

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This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Dean of the Faculty of Engineering and Design the implementation of recommendations for program enhancement identified as part of the accreditation process.

The Action Plan identifies who is responsible for implementing the agreed upon recommendations, as well as the timelines for implementation and reporting.

### **Strengths of the programs**

#### General

The Sustainable and Renewable Energy (SREE) program was added in 2008 as two streams: stream A dealing with Smart Technologies for Power Generation and Distribution, and stream B concerned with Efficient Energy Generation and Conversion. These programs have had minor changes since being introduced. SREE-A is delivered mainly by the Department of Electronics while SREE-B is delivered mainly by the Department of Mechanical and Aerospace Engineering.

#### Students

Across all engineering programs, student engagement and involvement in the program improvement process is achieved by providing various opportunities for students to offer feedback and recommendations throughout the year. Efforts to collect feedback from the students are typically coordinated by the Department Chair or Associate Chair. Feedback that is related to program content and delivery is also shared with the departmental Graduate Attributes Committee and Undergraduate Program Committee as appropriate.

The primary avenues for student involvement and to obtain student feedback include:

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- student input is also sought during Carleton's Quality Assurance Process; and student interviews are conducted by the Canadian Engineering Accreditation Board during accreditation visits.

## Curriculum

The Department believes that it is important for engineering graduates to have a reasonably broad knowledge of engineering fundamentals, including fundamentals not necessarily central to their own particular discipline. Reflecting this belief, the first year Sustainable and Renewable Energy Engineering curriculum follows the faculty wide 'common core', and 'common core' courses exist within the remaining three years of the program. The 'common-core' courses are taught by the same department to students in all engineering disciplines.

### **Recommendations Offered By the Visiting Team for Consideration**

The external reviewers' made 1 recommendation for improvement:

1. Weakness: Some indicators for graduate attribute (3.1.6) were misaligned or inadequately sampled to demonstrate compliance. (CEAB criterion 3. 1)

### **The Outcome of the Review**

As a result of the review, the undergraduate programs in Sustainable and Renewable Energy Engineering were categorized by the Senate Quality Assurance and Planning Committee (SQAPC) as being of **GOOD QUALITY** (Carleton's IQAP 7.2.12).

### **The Action Plan**

The recommendations that were put forward as a result of the review process were productively addressed by the Dean of the Faculty of Engineering and Design in a response to the Report of the Visiting Team that was considered by SQAPC on May 7, 2020. The external reviewers identified one weakness which was agreed to by the unit unconditionally. The unit took action to address this recommendation in 2017.

### **The Next Cyclical Review**

In aligning the review process with the schedule for accreditation review, the next cyclical review of the undergraduate programs in Sustainable and Renewable Energy Engineering will be conducted during the 2020-21 year.



**Action Plan  
Sustainable and Renewable Energy Engineering  
Undergraduate Programs**

**May 21 2020**

<p style="text-align: center;"><b>External Reviewer Recommendation &amp; Categorization</b></p> <p><b>Note: Definitions from CEAB Accreditation Standards:</b>  <b>Concern: Criterion satisfied; potential exists for non-satisfaction in near future.</b>  <b>Weakness: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.</b>  <b>Deficiency: Criterion not satisfied.</b></p>	<p style="text-align: center;"><b>Action Item</b></p>	<p style="text-align: center;"><b>Owner</b></p>	<p style="text-align: center;"><b>Timeline</b></p>	<p style="text-align: center;"><b>Will the action described require calendar changes? ( Y or N)</b></p>
<p><b>1. Weakness: Some indicators for graduate attribute (3.1.6) were misaligned or inadequately sampled to demonstrate compliance. (Criterion 3. 1)</b></p>	<p>At the time of the last visit, GA 6 (individual and teamwork) was only assessed in the 4<sup>th</sup> year capstone project at the Applied level. This was addressed shortly after the 2015 visit, and we now measure GA 6 in the 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> years of the program at all three levels (IDA). Data from these indicators has been collected several times during the intervening years, with good results. Complete details can be found in Exhibit 1 of the 2019 CEAB submission.</p>	<p><i>Ron Miller</i></p>	<p><i>Completed, 2017</i></p>	<p><i>N</i></p>