I. Programs

- B.Sc.A. Génie informatique | B.A.Sc. in Computer Engineering
- B.Sc.A. Génie informatique - option Gestion et entrepreneuriat en ingénierie | B.A.Sc. in Computer Engineering, Engineering Management and Entrepreneurship Option

II. Evaluation Process (Outline of the visit)

This Final Assessment Report on the above programs was prepared from the following documents: 1) the self-study report produced by the academic unit; 2) the report of the external evaluation following the virtual visit; 3) the responses prepared by program leadership, Miodrag Bolic and a response by Michel Labrosse, Interim Dean of the Faculty of Engineering.

The site visit took place on April 27, 2023, covering undergraduate programs and was conducted by the following external evaluators: Stefano Gregori, University of Guelph and Frédéric Mailhot, Université de Sherbrooke.

During the site visit, the external evaluators met with the Vice-Provost, Academic Affairs, Aline Germain-Rutherford, the Dean of the Faculty of Engineering, Jacques Beauvais, the Vice-Dean, Undergraduate Studies at the time of the visit, Michel Labrosse, the Chair of the Curriculum Committee, Voicu Groza, the Director, School of Electrical Engineering and Computer Science, Herna Vikot and members of the support staff, regular professors and students.

III. Summary of Reports on the Quality of Programs

Strengths

The learning objectives aim at appropriate breadth and depth of understanding, and they are aligned to the OCAV learning objectives and the CEAB graduate attributes.

The teaching and evaluation procedures are consistent with the learning objectives, and they are based on a variety of methods appropriate for the subject and instructional level (including conventional lectures, hands-on laboratory activities, design projects, experiential learning).

The undergraduate Computer Engineering program has been periodically accredited by the Canadian Engineering Accreditation Board (CEAB) since 1989. It educates well-rounded and highly skilled professionals who fuel the Canadian computing industry and contribute to addressing societal needs with high-tech products and services.
Distinctive characteristics of the program include:

- Available with two options, General and Management.
- Includes a two-term capstone project.
- Offered both in English and French.
- Available in regular or co-op formats.
- The co-op format allows for two possible work–study sequences, accommodating different lengths of co-op terms which responds to employers’ needs.
- Available to both full-time and part-time students.

The program is very well recognized by prospective students and employers. Student demand is strong, as evidenced by the growing numbers of student applications and admissions, and by the high and increasing student admission averages (i.e. in the high 80s, which is higher than in the other engineering areas).

The students have access to state-of-the-art design spaces and are presented with the opportunity to strengthen their entrepreneurship skills.

The capstone project allows students to demonstrate their competence in technical domains while working on an open-ended engineering problem.

Dedicated faculty with leading-edge research expertise and excellent pedagogical skills contribute to a very positive learning environment, as evidenced by high student evaluations and multiple teaching awards.

Students are offered academic mentoring/tutoring from peers and specialized consultants (e.g. in mathematics for engineers).

Students can transfer between a range of programs in the first or second year; e.g. Electrical Engineering, Software Engineering, and Computer Science.

There are many computer engineering jobs in the Ottawa high-tech sector for co-op placements and permanent positions after graduation.

**Challenges**

Maintaining conformity to accreditation standards and professional guidelines is a challenge while abiding by the University’s commitment to bilingualism and providing effective learning opportunities to students.

There appears to be insufficient faculty and staff resources.

Participation of students in exchange programs is limited due to inflexibility of the program.

Some elective courses can be hard to offer in both languages for lack of a sufficient number of French speaking students.

Large class sizes in 1000-level to 3000-level courses can be harmful to active learning and student retention.

Large class sizes and increased teaching loads affect the ability of faculty and staff to keep up with fast technological advancements in computer engineering, and to respond to changes in students’ and employers’ needs and expectations.

As in many Computer Engineering programs elsewhere in Canada and around the world, female enrollment is relatively low.
Students experience difficulty obtaining individual guidance with laboratory and project activities (e.g. TA assistance in laboratories, and support with open-ended projects), receiving academic mentoring/tutoring, and accessing information and assistance related to administrative/clerical tasks/deadlines (e.g. online forms for registering to co-op terms).

Large class and laboratory sizes (especially of the courses in the English program) and the challenges related to scheduling and time conflicts (e.g. classes/labs in the evenings) negatively impact the student experience.

Weakness in high-school STEM training translates into difficulties faced by first and second-year students with mathematics and foundational courses.

IV. Opportunities for Program Improvement

The external evaluators’ recommendations are contained in the Unit’s Response and Action Plan, in the appendix.

V. Summary and Assessment of the Proposed Action Plan

The External Reviewer’s recommendations were addressed by program leadership via an action plan that was considered by the Senate Committee on the Evaluation of Undergraduate Programs (SCEUP) on May 23, 2024.

The program leadership agreed with all recommendations of the external evaluation. The actions to be taken and the timetable are clearly defined and have been endorsed by the Dean's Office. The SCEUP is satisfied with the program leadership's response and action plan.

VI. Conclusion

The review exercise confirmed the strength and stability of the programs offered, and it identified recommendations for their ongoing improvement. The members of the SCEUP would like to thank the external evaluators for their detailed assessment, as well as all the stakeholders involved in this cyclical program review process.

VII. Schedule and Timelines

A progress report that outlines the completed actions and subsequent results will be submitted to the evaluation committee by December 15, 2025.

The next cyclical review will take place in no more than eight years, in 2027-2028. The self-study brief must be submitted no later than June 15, 2027.

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1 See the Appendix for the Unit Response and Action plan.
Unit Response and Action Plan

Faculty:
  • Faculty of Engineering

Department:
  • School of Electrical Engineering and Computer Science

Programs evaluated:
  • Bachelor of Applied Science in Computer Engineering
  • Bachelor of Applied Science in Computer Engineering, Engineering Management and Entrepreneurship Option

Cyclical review period:
  • 2020-2021

Date:
  • March 11, 2024

General comments:
On October 16, 2023, the Computer Engineering program was made aware of the External Review Report produced in the context of the cyclical program evaluation. We were extremely pleased with the positive evaluation of our graduate program. Given that the Computer Engineering graduate program has committed to providing an outstanding training and research experience, we were gratified to see that the external reviewers found that our “MSc and PhD programs were of excellent quality”, that “student satisfaction was high” and that “no major issues with the program, the learning objectives, courses or management of the programs were discovered”. The report makes 9 recommendations, of which one is considered a high priority. We take all the recommendations seriously and feel confident that by addressing them, our graduate program will be even stronger. The recommendations and our responses are included below.
<table>
<thead>
<tr>
<th><strong>Recommendation 1</strong>: Decrease the student to faculty ratio</th>
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<tr>
<td><strong>Unit response</strong>: We agree to the recommendation unconditionally. This has been pursued vigorously for several years. We posted a position for a tenure-track professor position in Computer Engineering in the fall of 2022. We were looking for a Computer Engineer with research excellence in the area of embedded systems, including hardware/software codesign and interfaces, heterogeneous accelerators, multiprocessing systems and GPUs, and real-time/ concurrent/ distributed /application-specific software for standalone or network embedded systems. Four candidates were interviewed – however, the hiring committee decided not to offer any CEG position and to wait for a more suitable candidate. Indeed, as technology continues to pervade all aspects of life, the demand for professors in embedded systems grows. However, the specialized nature of the work and the rigorous training required mean that there are often fewer qualified individuals than needed, making it a competitive field to hire into. We will work on ensuring that computer engineering positions remain included in the EECS strategic hiring plan.</td>
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<tr>
<td><strong>Decanal response</strong>: I agree with the unit’s response</td>
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<td><strong>Priority Level</strong>: 2</td>
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<tr>
<td><strong>Actions to be undertaken</strong>: Ensure that computer engineering positions remain included in the EECS strategic hiring plan.</td>
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<td><strong>Assigned to</strong>: Associate Director of Program</td>
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<td><strong>Timeline</strong>: Ongoing</td>
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<td><strong>Curriculum change?</strong>: No</td>
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* PRIORITY LEVEL: 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)
**Recommendation 2: Update the curriculum**

**Unit response:** We agree to the recommendation unconditionally. We discussed this issue with the program's industrial advisory board. Their suggestions were to introduce a machine learning course in the CEG undergraduate program as well as to modernize several existing courses. We recognize the importance of machine learning for any computer engineering graduate. To this end, we are introducing an optional machine learning course in the fourth year. In addition, we will conduct a thorough review of the program’s required courses to identify the possibility of introducing the course as mandatory. In addition to the machine learning course, we will explore adding additional modern elective courses or, alternatively, cross-listing some graduate courses. It should be noted that our program is accredited by the CEAB, which limits the flexibility of adding mandatory courses.

**Decanal response:** I agree with the unit’s response

**Priority Level**: 1

**Actions to be undertaken:** Program changes request submission to the EECS Council for the new machine learning course

**Assigned to:** Associate Director of the Program

**Timeline:** Winter 2024

**Curriculum change?** Yes

**Priority Level**: 2

**Actions to be undertaken:** Formulation of program changes based on the committee's suggestion to modernize the curriculum

**Assigned to:** Associate Director of Program and all the Program Curriculum Committee members

**Timeline:** Fall 2024/Winter 2025

**Curriculum change?** Yes

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**Recommendation 3:** Improve scheduling and administrative support

**Unit response:** We agree, in principle, to the recommendation. There is a need to improve the scheduling of the courses and implement administrative procedures that enable students to take full advantage of the available options and effectively manage the uneven distributions of students in the French and English programs. However, the administrative procedures are the same for all the students and need to be changed at the University level. The uneven distribution of resources is due to the fact that there is a much smaller number of francophone students in the CEG program.

**Decanal response:** I agree with the unit’s response. In addition, a thorough revamping of the procedures followed by the Faculty scheduling team (in the Undergraduate Studies Office) is underway, which will yield better clarity and service for the students. Furthermore, all the academic units in the Faculty have now agree to a 3-yr planning of the offer of compulsory courses. While this still requires implementation, it will provide the students with improved clarity in terms of the courses available to follow, and their timing.

**Priority Level**: 3

**Actions to be undertaken:** We will discuss with the administration whether it is possible to let students know the course schedule one more semester in advance.

**Assigned to:** Associate Director of the Program, Faculty scheduling team and the Manager of the Engineering Undergraduate Office.

**Timeline:** Winter 2025

**Curriculum change?** No

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**Recommendation 4:** Plan and make available specific space for Computer Engineering students

**Unit response:** We agree to the recommendation unconditionally. It was pointed out: “It seems that students lack dedicated spaces where to connect with each other, while they share many courses in large classes with students from other disciplines during the first and second year.” Space allocation is a recurring request from students in the program. We hope to allocate room STE0109 for CEG students. We also plan to establish the Computer Engineering Student Association, which will greatly contribute to students’ sense of belonging to the program.

**Decanal response:** I agree with the unit’s response

**Priority Level**: 2

**Actions to be undertaken:** Communicate with students to discuss any assistance that may be provided to start the Computer Engineering Student Association. Assist students in implementing the determined actions.

**Assigned to:** Associate Director of Program

**Timeline:** Summer/Fall 2024

**Curriculum change?** No

**Priority Level:** 2

**Actions to be undertaken:** Prepare the room STE 0109 for CEG students

**Assigned to:** Associate Director of Program and EECS Director

**Timeline:** Summer 2024

**Curriculum change?** No

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**Recommendation 5:** Revise lab teaching model heavily based on TA contributions

**Unit response:** We agree, in principle, to the recommendation. It was pointed out: “...relying on many teaching assistants (TAs) for running large laboratory/tutorial sessions does not meet the needs of all students and requires addressing significant challenges with TA training and supervision.” We agree that we should look at enhancing the role of laboratory managers/technical staff and utilizing their talent effectively. However, we are limited by the number of lab technicians and the number of CEG sessions running in parallel. Therefore, we will have to, for the time being, continue to rely on the TAs to run the labs. We propose to improve the training of TAs and to make sure that they collaborate better with Lab technicians.

**Decanal response:** I agree with the unit’s response. In addition, it was agreed to have the TAs run the labs for themselves, with the lab technicians’ or professors’ support before assisting students.

**Priority Level**: 2

**Actions to be undertaken:** Ensure that the Lab technicians meet with TAs, explain the procedures and the Labs at the beginning of the semester. Introduce a TA orientation session with the program director at the beginning of the semester.

**Assigned to:** Associate Director of the Program, EECS Director and Lab Manager

**Timeline:** Summer/Fall 2024

**Curriculum change?** No

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**Recommendation 6:** Continue efforts to improve admission average and retention

**Unit response:** We agree to the recommendation unconditionally. It was pointed out that the retention numbers, time to completion and other indicators of success are not continuously monitored in the CEG program to advise appropriate actions. We agree that these numbers have not been discussed regularly within the program and will work on continued collection and provision of relevant data.

**Decanal response:** Admission averages at the Faculty of Engineering have risen significantly over the past ten years, and so has retention. Nevertheless, additional improvements to retention and time to completion are desirable, and the Faculty has been taking measures in this direction across all programs (e.g. hiring of Student Experience Officer, funding of Faculty Mentoring Centre, identification and removal of academic hurdles to progress through course sequence in program of study). Admission parameters (admission averages and targets) are set by the Vice-Dean Student Affairs in collaboration with the Dean, based on directives set by the central administration of the University.

**Priority Level**: 2

**Actions to be undertaken:** Obtain and analyze annual data regarding retention numbers, time to completion and other indicators of success.

**Assigned to:** Associate Director of the Program and the Manager of the Engineering Undergraduate Office.

**Timeline:** Ongoing

**Curriculum change?** No

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**Recommendation 7**: Target actions and publicity to improve female student enrollment

**Unit response**: We agree to the recommendation unconditionally. The Faculty of Engineering organizes many activities for girls in high school, such as “Go Code Girl,” which is a 4-hour event where the female student’s grades 7-12 are exposed to embedded systems and other topics of computer engineering. The Faculty of Engineering also brought a female engineering student to promote all the tech programs, including CEG, at the Ontario Universities Fair (OUF) in 2023. The Faculty of Engineering also has Commemorative scholarships just for girls, and in all of the marketing material, we use female representation. We are aware, however, that all these activities (except Go Code Girl for Computer Engineering) are for the Faculty of Engineering in general. We will aim to target the CEG program specifically in future.

**Decanal response**: I agree with the unit’s response. The contribution of female students to the total undergraduate enrollment in the Faculty of Engineering is inching upward towards 30% (currently at 26%, with 27% of first-year students).

**Priority Level**: 3

**Actions to be undertaken**: Review of the activities and discussion on how the activities could be tailored so that they target the CEG program

**Assigned to**: Head of Student Recruitment and Liaison at the Faculty of Engineering, Associate Director of Program

**Timeline**: End of 2024

**Curriculum change?**: No

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**Recommendation 8:** Continue with efforts to modernize laboratory equipment/software

**Unit response:** We agree to the recommendation unconditionally. It was pointed out that “Consideration should be given to gathering information/advice from industry stakeholders, co-op employers and students, and recent graduates.” We had a meeting with the CEG industrial advisory committee in March 2023, where the recommendation was to modernize CEG labs to include the hardware and software that is currently used in industry, such as ARM processors. In addition, we had numerous discussions with CEG students and Lab technicians about the equipment in the lab. As a result of these discussions, we decided to modernize the following Labs:

- CEG3136/CEG3536 – new labs will be based on embedded ARM-based microcontroller
- CEG4131/CEG4536 – new labs will be labs based on a modern multiprocessing system on chip platform
- CEG3185 – new labs will be based on newly donated equipment by Cisco

In addition, we plan to update Lab manuals for follow new hardware/software in all the labs.

**Decanal response:** I agree with the unit’s response

**Priority Level**: 2

**Actions to be undertaken:** Development of the new labs for two CEG courses. Purchasing equipment for these two Labs

**Assigned to:** Associate Directors of the Program and Lab Technician

**Timeline:** Summer/Fall 2024

**Curriculum change?** Yes

**Priority Level:** 2

**Actions to be undertaken:** Review the laboratory needs of the Computer Engineering programs to assess whether any specific courses could benefit from specialized hardware or software resources. If so, meet with the Finance team of the Faculty to negotiate budgetary support for any required purchases or licenses.

**Assigned to:** Associate Directors of the Program, Director of EECS and Lab Manager

**Timeline:** Winter/Summer 2025

**Curriculum change?** Yes

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**Recommendation 9: Enhance the involvement of industry stakeholders**

**Unit response:** [We agree to the recommendation unconditionally] It was pointed out: “In order to be up to date with the most recent technological developments, the program is connected to representatives from industry stakeholders to seek advice on the technologies and tools, both hardware and software, that are critical in the industry. This effort should be continued/expanded and perhaps formalized in a program advisory board holding regular meetings with representatives of local businesses, alumni, co-op employers, faculty, technical staff and student representatives.”

We have created the program advisory board in 2023 and have annual meetings with the advisory board members. The advisory board members reiterated that they are available for consultation outside these meetings. We agree that the effort should be expanded to include different industries and alumni.

**Decanal response:** I agree with the unit’s response. The newly-created program advisory boards were mandated by the Faculty in recognition of the importance of the involvement of external stakeholders in our quality assurance process.

**Priority Level**: 3

**Actions to be undertaken:** Organize meetings at Kanata North and make stronger connections between the CEG program and the industry stakeholders

**Assigned to:** Associate director and a member of Research Services

**Timeline:** Ongoing

**Curriculum change?** No

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