# FINAL ASSESSMENT REPORT

**PERIODIC PROGRAM REVIEW (PPR)**
**Bachelor of Engineering**
**In Electrical Engineering**
**Faculty of Engineering and Architectural Science**

In accordance with the Institutional Quality Assurance Process (IQAP)**,** this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the undergraduate **Electrical Engineering** program. The report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The Implementation Plan identifies who will be responsible for leading the implementation of the recommendations; who will be responsible for providing any resources entailed by those recommendations; and timelines for acting on and monitoring the implementation of the recommendations.

**SUMMARY OF THE PERIODIC PROGRAM REVIEW OF THE ELECTRICAL ENGINEERING PROGRAM**

The Electrical Engineering (ELE) program submitted a self-study report to the Vice-Provost Academic on January 28, 2019. The self-study presented the program description and learning outcomes, an analytical assessment of the program, and program data including the data collected from student and alumni surveys along with the standard University Planning data tables. Appended were the course outlines for all core required and elective courses in the program and the CVs for all faculty members in the Department of COE and other faculty who have recently taught core courses (required and/or elective).

One arm's-length external reviewer, Dr. Tim Davidson, Chair of the Department of Electrical and Computer Engineering, McMaster University, and one internal reviewer, Dr. Eric Harley, Department of Computer Science at Ryerson University, were appointed by the Dean of the Faculty of Engineering and Architectural Science from a set of proposed reviewers. They reviewed the self-study documentation and then conducted a site visit at Ryerson University on May 29 and 30, 2019.

The visit included meetings with the Vice-Provost Academic; Dean, Faculty of Engineering and Architectural Science; Chair, Electrical, Computer and Biomedical Engineering; Associate Chair, Student Affairs; and the Chief Librarian. The Peer Review Team (PRT) also met with several members of the ELE program within the Department of Electrical, Computer and Biomedical Engineering, including staff, students, and faculty members. A general tour of the campus was provided, including a tour of the program facilities, labs, classrooms, and the library.

In their report, dated June, 2019, the PRT provided feedback that describes how the ELE program meets the IQAP evaluation criteria and is consistent with the University's mission and academic priorities. The main areas of strength identified by the PRT include:

- The faculty have exceptional research output and funding. This naturally translates to a very up to date curriculum, as well as exceptional graduate students. The graduate students in turn become graduate assistants (GA) for the courses, which leads to high quality experience for the students in the labs. The department spends close to a million dollars per year on GAs, keeping the number of students per lab low

(max 22). The excellent GA support helps the professors, both in teaching and in research, forming a positive feedback loop

- The administrative and technical staff are highly skilled and highly motivated. The morale is high, and they enjoy their work for a variety of reasons. The staff are very responsive to both students and faculty.
- The location in downtown Toronto is attractive for many reasons, such as culture, diversity, industry, jobs, accessibility by public transport.
- There are enough high quality students eager to get into the program, that entrance levels can be set high (above 80%).
- The co-operative internship program (CIP) provides students with an opportunity to obtain experience on the job and to earn money.
- The transition program helps students keep up with the pace of the program by offering courses in the Winter term that repeat Fall term courses, and courses in the Summer term that repeat Winter term courses. The repeated courses are usually first year courses where students, being new to the university environment, are most likely to struggle with course load. However, courses in later years are also repeated as necessary.
- The First Year Engineering Office provides counseling and guidance for entering students, and meets at least once a year with the instructors to identify and correct any problems.
- The Department holds two 'stream' meetings each year with the instructors of courses in each stream, to identify and correct problems as they arise.

The PRT also identified areas for improvement, such as updating lab materials and assignments, increasing female enrolments, and a need to build the internship program with sufficient placements offering top quality work and experience.

The Chair of the Electrical, Computer, and Biomedical Engineering program submitted a response to the PRT Report in March, 2020. The response to both the PRT Report and the Program's Response was submitted to the Vice-Provost Academic by the Dean of the Faculty of Engineering and Architectural Science on March 23, 2021.

The Academic Standards Committee completed its assessment of the Computer Engineering Program Review on May 6, 2021**.** The Committee indicated that a thorough, analytical and self-critical program review was conducted. The School integrated into the developmental plan feedback from students, alumni, employers and peer reviewers, and outlined a comprehensive plan for program enhancements moving forward.

The Academic Standards Committee recommends that the program continue, as well as provide a one-year and a two-year follow-up report, as follows:

1. The mandated One-Year Follow-up Report be submitted by June 30, 2022 to include:
    a. Updates on the status of the initiatives outlined in the Implementation Plan;
    b. Expanded Learning Outcomes (per April 16, 2021 feedback memo); and
    c. Report on update of course outlines to ensure currency and compliance with Senate policy.

2. A Two-year Follow-up Report be submitted by June 30, 2023 to include:
    a. Employer Survey follow-up (per April 16, 2021 feedback memo).

Presented to Senate for Approval: **June 1, 2021**

Start date of next Periodic Program Review: **2024-25**

**SUMMARY OF THE REVIEWERS' RECOMMENDATIONS WITH THE PROGRAM'S AND DEAN'S RESPONSES**

**RECOMMENDATION 1. The general consensus during our discussions with the Chair, Associate Chair and Dean was that the Admission requirements are appropriate, but that one approach to improving female enrolment might be to reach out to high school counselors to make them aware of the opportunities for female students in Electrical Engineering.**

***Department's Response:*** The department and the FEAS Dean's office recognize the difficulty in attracting female students to the Electrical Engineering program. We continue to support, invest, and engage with all initiatives at the faculty, school and student level to help increase awareness to young girls of the Electrical Engineering profession. The department closely collaborates and supports the Institute of Electrical & Electronics Engineering (IEEE) Women In Engineering group and we regularly and diligently attend high-school recruitment opportunities. Furthermore, we strive to put our female faculty and students in the forefront in all our media and web content. Unfortunately, this is not enough. We know this, thus we continue our discussions other Electrical Engineering department heads and IEEE societies, to figure out what more we can do. We believe that one promising direction is to "market" electrical engineering, (or engineering in general), as the academic path that will allow women to "make a change" in the world and to "help make it a better place", rather than presenting it as "cool", or "tech heavy", as has traditionally been done.

***Dean's Response:*** Recently we have undertaken a series of actions to transform FEAS traditional focus on Women in Engineering (WIE) to Equity, Diversity and Inclusion (EDI). For example, Dean Duever has spoken at a number of public events on the topic, reiterating a message he stated in an OpEd published in OSPE's Voice Magazine in December 2017. The Dean also arranged for all senior FEAS staff and faculty leadership to participate in a full day of professional development on the topic of inclusion with Ritu Bhasin. In 2017 FEAS carried out two student surveys that provided direction regarding what students want FEAS to do to create a more inclusive learning environment. One survey was administered to female engineering students only (through the Hydro One Partnership) and another was targeted strategically to students who were affiliated with an identity-based group or expressed interest in tackling identity issues on campus. The results were revealed in an identity dialogue survey as well as focus groups. This feedback is informing the development of a new Office of Equity, Diversity and Inclusion to replace what was formerly called the Women in Engineering Office.

In the 2020/2021 academic year, the Engineering Admissions team will be conducting 70+ virtual school visits/events in addition to the current schools Ryerson Central Admissions visits. The team also liaises with the Aboriginal Outreach and Recruitment Officer, Thunder Alphonse in Ryerson's Aboriginal Student Services when it comes to providing application support and admission academic counselling applicants who self-identify as Indigenous.

**RECOMMENDATION 2. Students felt that the labs could be better designed, so that the requirements would be less like following a script and more like creating something.**

***Department's Response:*** We are in agreement with the student comments and we are diligently working to upgrade and change some of our labs, (where it makes most sense), to be more "open-ended". This will create opportunities for student creativity and independent thinking. Towards this end we have already secured $170K from the FEAS Dean to begin upgrading and equipping lower year labs, starting May 2020.

***Dean's Response:*** The reviewers recommended that both the physical labs and the pedagogical approach to learning could be improved and the Department agrees. FEAS has made investments toward lab improvements for lower year lab spaces which resulted in construction starting in May 2020. The Department is in the process of identifying ways to enhance the role of technical staff in the development and delivery of labs to ensure they are more creative and open-ended.

**RECOMMENDATION 3. Explore the possibilities of either hiring another departmental assistant to help with CIP or asking Ryerson's Co-operative Education Office to provide a support person for Electrical Engineering students seeking internships.**

***Department's Response:*** The FEAS Dean is well aware of the support needed for our (and other departments') internship program. So much so that the Dean has begun the first phase of centralizing and expanding the co-operative internship program. Three staff members have been hired in the last year. In the next phases, more staff members will be hired that will be able to identify and source new employers and increase the number of placement opportunities.

***Dean's Response:*** In late 2017, FEAS launched a central office to manage optional co-operative internship programs (CIP) for all of the engineering programs except Chemical Engineering which has a mandatory co-operative program. Since this time, the team has grown from 1 staff member to 5. This team collaborates with existing embedded staff within departments (including ECBE) to support all aspects of CIP including new on-line platforms (Salesforce and Orbis) for efficient student and employer engagement related to applications, job postings, etc; student and employer recruitment events and workshops; administration and evaluation of the placement experiences; and delivery of soft skill development modules associated with career readiness and professional networking. In Fall 2019, the FEAS CIP office rolled out the first centralized student enrolment in FEAS CIP.

The FEAS CIP office is continuing to work on improving the co-op placement rate of electrical and other engineering students through the following activities: 1) identifying and working closely with students who are less engaged (i.e. do not apply to posted jobs, apply but do not secure interviews and/or job offers), 2) continuing to work with existing employers and promote jobs that are more relevant to specific engineering disciplines, 3) developing more partnerships with new employers/industries interested in specific engineering disciplines, aiming towards a 3 job postings to 1 student ratio, and 4) planning employer engagement events/opportunities that target specific engineering discipline students. We are reaching first and second year students to promote CIP earlier so that they are better prepared to meet the expectations set by the program and employers.

**RECOMMENDATION 4. Engage the technical staff in creating and improving the lab material. Ask for three new staff positions -- one administrative staff devoted to the internship program (CIP), one technical staff devoted to BME, and one public relations administrative role if not solely for this department, shared among departments in the faculty. The new administrative role for CIP should free up enough time from other staff to allow more devoted time to BME.**

**Department's Response:** The department has currently hired one front office staff member (approved for 1 year) that is helping to support the biomedical engineering program at the front office. We have asked the FEAS Dean to make this position a full-time permanent position. In regards to the engineering staff, we have already begun discussions and plans with them to help us to make the labs more "open-ended" as discussed and recommended previously. We are fortunate that our technical staff members are professional engineers and are quite capable in helping us to create new labs.

**Dean's Response:** In recognition of the workload and relative size of the department's administrative team, a new Department Administrative Manager was hired in November 2019 who is responsible for improving the efficiency and work delegation among team members. Furthermore, a new Departmental Assistant position was recently created to help with the front office load.

**RECOMMENDATION 5. Discuss with the Chair of Computer Science and the Registrar's office the possibility of creating a lecture section in CPS 125 that includes only the electrical and computer engineers, with the premise that that group of students would be taught at a higher level than the other sections. The separation in itself would tend to create that effect. Assessments in the course could remain the same for all sections. This would be a simple first step in improving the training in software development. (Requires both internal and external action).**

**Department's Response:** We are going one step further to deal with this issue. We have already requested from the Department of Computer Science to create a *new* and *separate* introductory computer programming course specifically for electrical, computer, and biomedical engineering students. This has been discussed already at the CS department and tentatively approved. We are awaiting final word and expect this new course to be available to 1st year ELE, COE and BME students starting Fall 2021.
**Dean's Response:** no response

**RECOMMENDATION 6. Hire a staff member to coordinate with the Career Office and work directly on improving the number of placements for Electrical Engineering students in CIP. When a CIP-dedicated position is created, then work could be rearranged among the current departmental assistants so that one assistant is devoted to the BME program. (Requires both internal and external action).**
**Department's Response:** As discussed above, FEAS has initiated consolidation and growth of CIP which will improve the number and diversity of EE placements.
**Dean's Response:** see response to recommendation 3 above.

**RECOMMENDATION 7. Hire a staff member with responsibilities in web page management, advertising and social presence. This role could be faculty wide, covering all of the departments in FEAS. If a similar position already exists, perhaps it could be enhanced, since currently some of this workload is handled by the Chair, who is busy enough with higher level tasks. (Requires both internal and external action).**
**Department's Response:** The department feels that this is an excellent recommendation as it is important to publicize our programs, accomplishments and also to reach out to our students, using modern platforms and tools. FEAS has a marketing and communications team, which has helped to some extent on this in the past however, any real effort requires someone to be assigned only for the ECB department. We will be discussing with the FEAS Dean the possibility of hiring a staff member for this role.
**Dean's Response:** no response

**As proposed by the program in the self-study:**

1. **Update and Refresh early core circuit course ELE 202 & ELE 302 laboratory experience. The laboratory experiments have not been changed or updated for a very long time and the lecture content is not in synch with labs.**
2. **Create common lab courses, or "lower years engineering design projects", where semester-long or year-long extended lab projects will support multiple courses. Work on the list of elective courses, to remove ones of little interest and to add new course reflecting shifts in the discipline. (short term goal)**
3. **Fourth year professional electives need to be evaluated for currency, program need and student interest.**
4. **Improve TA support to undergraduate courses with overall increased stringency on the requirements for selection and also with adequate training and preparation**
5. **Integrate opportunities for students to improve and build on soft skills (e.g., leadership, oral presentation, professionalism)**
6. **Increase the number of co-op internship jobs available to students**

**IMPLEMENTATION PLAN**

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| **Priority Recommendation 1 -** Update and Refresh early core circuit course ELE 202 & ELE 302 laboratory experience. The laboratory experiments have not been changed or updated for a very long time and the lecture content is not in synch with labs. |
| **Rationale:** This issue was Identified in student survey. Students struggle with the laboratory experiments for the following reasons:<br>• Lecture content is not in synch with lab experiment content and thus students feel lost<br>• Experiments are very time-consuming and considered "too long" to be done in the allotted time |

- Many TAs are not trained enough to be able to help students in the lab

**Objective:** Change lab experiments completely and provide increased and improved training for TAs.

**Implementation Actions:**

- Design new experiments;
- Test experiments for difficulty and for reasonable time requirements for completion;
- Hire a "Lab Lead" to supervise Lab TAs and to provide additional support during lab supervision;
- Provide more preparation hours for all TAs to perform all labs before they supervise to ensure they are aware of what the students are required and expected to do;
- Have "Lab Lead" train TAs on lab supervision and on the actual lab experiments.

**Timeline:**

ELE 302:

- Summer 2018: design and test new labs
- Fall 2019: introduce new labs into course and sync lecture material
- Hire CUPE as Lab Lead

ELE 202:

- Winter 2019 Hire CUPE as Lab Lead
- Summer 2019: design and test new labs
- Winter 2020: introduce new labs into course and sync lecture material

**Responsibility for leading initiative:** Course instructors

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:**

Department Chair

**Priority Recommendation 2:** Create common lab courses, or "lower years engineering design projects", where semester-long or year-long extended lab projects will support multiple courses.

**Rationale:** Our student survey identified a weakness in creativity and open-ended design along with a disconnect between various courses and their content. By creating a "Lab Studio" we can create and offer lab projects (rather than experiments) that draw on the various courses taken during the academic year (and previous) instead of having individual stand-alone lab experiments for each course.

**Objective:** This recommendation will allow for students to have a better grasp on how the components of various classes fit together in an overall design. For example, a Lab Studio could have as a project a more interesting, involving and practical project that requires knowledge that is taught in the lecture component of numerous courses in the term and/or academic year.

**Actions:**

- Identify courses that can be part of the common lab course
    - Remove lab hours from these courses
- Design and test lab projects to be part of the common lab course
- Schedule extended common lab hours for students

**Timeline:**

- 2019/20 Investigate, analyze and plan
- Departmental approval: by end of September 2020
- Implementation 2021/22

**Responsibility for leading initiative:** Department Chair, Program Director

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:**

Department Chair, Program Director, Curriculum Committee, Department Stream Committees

**Priority Recommendation 3:** Fourth year professional electives need to be evaluated for currency, program need and student interest.

**Rationale:** There are a relatively large number of 4th year professional electives; some of which have not run in the past few years due to low student demand or industrial relevance and some have become "stale".
**Objective:** ELE has a wide range of specialization areas and some of these have changed considerably in the last few years while others have just become extremely significant with an increased industrial, commercial and research interest.

**Actions:**

- Analyze enrollment data of all courses over the last 10 years;
- Identify courses that are essential;
- Identify courses whose content has not changed in the last 5 years and also those that have had very low student demand;
- Identify areas/topics that are currently in demand that we do not offer;
- Update "stale" courses
- Delete courses with historically low interest and/or currently irrelevant topics
- Introduce new courses covering topics in emerging and new areas (e.g. AI)

**Timeline:**

- 2018/19: analyze enrollment data, identify courses for deletion/refresh, propose new courses
- 2019/20: roll-out updated professional electives table

**Responsibility for leading initiative:** Department Chair, Program Director, Curriculum Committee, Stream Committees

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:** Stream, Curriculum Committee, Department Council, Dean

**Priority Recommendation 4:** Improve TA support to undergraduate courses with overall increased stringency on the requirements for selection and also with adequate training and preparation

**Rationale:** Notwithstanding our efforts to select appropriate graduate students as teaching assistants in our labs, our recent surveys have indicated that there are courses where the TAs are not well prepared to assist students.
**Objective:** Provide more hours for increased and specialized training for TAs in core courses.

**Actions:**

- identify key courses that have a large number of TAs;
- increase preparation/training hours for TAs in those courses;
- require TAs to perform and complete all labs that undergraduate students will be doing;
- introduce and hire Lab Leads to roam labs and provide extra support and supervision.

**Timeline:** 2018/19 academic year

**Responsibility for leading initiative:** Department Chair

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:** Department Chair

**Priority Recommendation 5:** Integrate opportunities for students to improve and build on soft skills (e.g., leadership, oral presentation, professionalism)

**Rationale:** Our student survey identified skill areas that are not well addressed. Soft skills are not formally part of the engineering curriculum but they are essential skills for a professional engineering in industry.
**Objective:** Introduce more oral presentations in all years, particularly in 2nd and 3rd year, while also providing

avenues to cultivate leadership skills.

**Actions:**

- identify key core courses where students can present orally
- provide leadership opportunities to senior graduate students by creating a program that will allow them to mentor students in early years
- work with career centre to have them visit classes and hold seminars to relay to students the aspects of professionalism that are essential and to help them cultivate them

**Timeline:**

2018/19:

- investigate courses that can easily have oral presentations included in labs and/or group work
- invite career centre to plan seminars on professionalism

2019/20

- formally integrate into courses

**Responsibility for leading initiative:** Department Chair, Program Director

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:** Department Chair, Stream

**Priority Recommendation 6:** Increase the number of co-op internship jobs available to students

**Rationale:** Our internship program is proving to be very popular. In 2018/19 we will be having 80 students on internship, which is a record. Unfortunately, 60 students were not able to secure an internship position primarily due to an insufficient number of positions available.

**Objective:** Even though our co-op internship is "optional" and students must meet a minimum requirement, there is high demand in the last couple of years. Unfortunately, we have not been proactive to contact new employers for possible internship positions and have relied on our existing employers. With this increased demand we need more potential employers that can provide valid co-op internship jobs.

**Actions:**

- Identify potential employers in GTA and Southern Ontario
- Create 1-page prospectus/flyer that provides quick info on our co-op internship and benefits to the employer
- Plan site-visits with potential employers to discuss their participation

**Timeline:**

Fall 2018

- create prospectus/flyer;
- identify possible new employers;
- send out email and flyer
- follow up and initiate discussion;

Winter 2019-

- continue constant contact with existing employers and continue identifying and inviting new employers.

**Responsibility for leading initiative:** Program Chair/Director

**Responsibility for approving recommendation, providing any resources made necessary by the recommendation, and overall monitoring of the implementation of the recommendation:**
Internship Co-ordinator, Program Director, Internship Admin, Department Chair