FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

Electrical and Computer Engineering Graduate Programs

Date of Review: April 14th -16th

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the graduate programs delivered by Electrical and Computer Engineering. This 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 report includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the Final Assessment Report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the Electrical and Computer Engineering program submitted a self-study in April 2021 to the Vice-Provost and Dean of Graduates Studies to initiate the cyclical program review of its graduate programs. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained all course outlines associated with the program and the CVs for each full-time member in the department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean, Faculty of Engineering, and selected by the Vice-Provost and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a remote review on April 14th – 16th, 2021. The review included interviews with the Provost and Vice-President (Academic); Vice-Provost and Dean of Graduate Studies, Associate Dean, Graduate Studies and Research, Chair of the department and meetings with groups of current students, full-time faculty and support staff.

The Chair of the Department and the Dean of the Faculty of Engineering submitted responses to the Reviewers' Report (May 2021). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

- **Strengths**
    - **The Student Experience**: Graduate students express a high level of satisfaction with respect to their programs. The percentage of international ECE graduate students is one of the highest among all graduate programs offered at McMaster. Equity, diversity, and

inclusion seem to be important priorities for the ECE department, which is of clear benefit to international graduate students.

- **Community Engagement**: The cooperative education program provides experiential learning opportunities for graduate students as part of their degree. This is an essential complement to their academic and research training, and provides them with critical skills to succeed in industrial careers.
- **Research**: The ECE Department offers an outstanding research training environment and many opportunities for collaborative projects.

- **Areas for Enhancement or Improvement**
  - **Program Governance**: It would be beneficial to enhance departmental processes to review and evolve graduate course offerings.
  - **Communication**: There seemed to be a lack of common understanding among faculty about certain aspects of the graduate program (e.g. faculty mentorship, grading practises). Enhancing the level of discussions relating to the graduate program would be beneficial.
  - **Student Interactions**: Enhancing the degree to which graduate students have the opportunity to interact with each other, outside of their immediate lab groups, would be beneficial.

Summary of the Reviewers' Recommendations with the Department's and Dean's Responses

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
Recommendations highlighted in review report's Executive Summary			
Consider whether there would be a benefit in normalizing the minimum grade admission requirement for all programs to B+.	We agree that the admission requirement for the MEng in Electrical & Biomedical Engineering (currently a B minimum) could be adjusted to match the current minimum for the other programs (B+). We will put this change through the official approval process in the coming academic year, so it will come into effect in Sept 2022, if approved.	Assoc Chair	Sept 2022

Monitor the impact of the tuition differential between international PhD and international MASc students.	We agree that it will be important to track the impact of the tuition differential on our MASc enrollment and to make sure that we can maintain a high-quality Masters program. Current enrollment patterns are being impacted greatly by COVID restrictions across the world, so we will need to monitor the effects of the tuition differential over the next few years as things hopefully normalize.	Chair, Assoc Chair, Administrator	Initial review before 18-month progress report; Analyze again in May 2024
Communicate to faculty the departmental process to review and coordinate yearly graduate course offerings.	We agree with the reviewers that our graduate programs could benefit from greater coordination amongst instructors. Given the breadth of subdisciplines within ECE, we have been working on forming Graduate Teaching Clusters to facilitate such discussions, as described in the IQAP self-study document. This model has worked very well for the ongoing assessment and continuous improvement of our undergraduate programs, and the department as a whole has agreed to implement teaching clusters also at the graduate level. Cluster chairs were assigned for the 2020-21 academic year, but in light of the continuation of the pandemic, the deadline for their initial meetings was extended until the summer of 2021.	Chair, Assoc Chair, Graduate Teaching Cluster leaders	Dec 2021

Enhance the curriculum so that there is a better balance between theoretical and applied content, between physics-based modelling and data-driven paradigms. In particular, there is a clear need for more machine learning courses taught from an application-centric viewpoint.	Overall discussions about curriculum improvements will best take place in our Graduate Teaching Clusters, so that they can be customized to the difference subdisciplines of ECE within our department. In regards to machine learning courses, Dr. Sorina Dumitrescu introduced a new 4th-year undergraduate elective in Machine Learning this past year, and she is now developing a graduate-level course that will be offered first as a Special Topics course in Winter 2022. We anticipate the development of further courses on data-driven approaches as we continue to hire faculty in the computer engineering area.	Chair, Assoc Chair, Graduate Teaching Cluster leaders	Winter 2022
Consider implementing a minimum number of students necessary to hold a graduate class.	The distribution of enrollments in our courses has been a topic of discussion at department gatherings over the last year, with a number of well-thought out mechanisms being proposed. However, the finalization of a policy was put on hold during the pandemic. We will discuss this at our department retreat this summer, with a proposal to be developed in the next academic year based on discussion at department meetings.	Chair, Assoc Chair	Fall 2022
Provide more opportunities and reasons for MEng students to engage with course instructors and peers.	We will look at developing a series of meetings each academic year for MEng students, to promote cohesion among this cohort. We will also work on integrating MEng students more fully into existing social events, department seminars, etc.	Chair, Assoc Chair	Fall 2022

Facilitate the creation of a graduate student social club.	We agree that an ECE grad student club could greatly benefit our students, particularly as they look to re-engage with each other after pandemic restrictions are lifted. We will look at developing an election process and budget that can encourage formation of this club, while maintaining some oversight by the department, to ensure that it works to meet the needs of all our graduate students. We do not want the activities of this department-level club to conflict with the existing faculty-level Engineering Graduate Society (EGS), so we will make sure that it is created in consultation with the EGS leadership.	Chair, Assoc Chair, Administrator	Winter 2022
Ensure that ECE faculty members have a clear understanding of departmental policies and best practises relating to junior faculty mentorship.	The Chair will continue our practice of annual (or more often) one-on-one meetings with faculty members on tenure track and the early stages of a tenured career. These meetings offer the opportunity to review the faculty member's research and teaching portfolios and to provide constructive, personalized advice on the balance of each. The Chair will also inform the department at large over this process to ensure that there is a clear understanding of the expectations amongst all junior faculty and their mentors.	Chair	Dec 2021
Additional recommendations in specific review report sections			

Provide enhanced course outlines that will allow students to get a better understanding about the content and learning outcomes of the courses.	We have recognized that there was a fair degree of inconsistency in the level of detail provided in graduate course outlines, so in Summer 2020 we started having the grad course instructors move to a more detailed, and standardized, course outline template. The template is based on that of our undergrad course outlines. With the help of the department admin staff, we have almost completed the updating of all grad course outlines to match the new template and will make these available to the students for the coming academic year.	Assoc Chair, Administrator, Grad Admin	July 2021
Provide alternatives to 3MT presentations in ECE 790.	Overall, we have found the 3MT format for ECE 790 to be very positive and have been very impressed with the communication skills and confidence gained by our graduate students. However, we recognize that some	Chair, Assoc Chair, MacPherson Institute	Winter 2022

	hesitancy about this format by a small number of students was raised in our anonymous student survey and in the meetings with the IQAP reviewers. It is not clear whether this hesitancy is being expressed by students who have completed ECE 790 and did not find it to be a completely positive experience, or if students who have not yet taken ECE 790 are anxious about the experience. Therefore, we propose to carry out a structured review out this course, led by the MacPherson Institute, incorporating surveys of students before, during and after taking ECE 790, as well as focus-group discussions with a subset of students in the course. Initial planning meetings for this structured review have already taken place. We will also conduct an anonymous survey of the faculty in ECE to gain a better understanding of the supervisors' views on how ECE 790 is functioning to help their students improve their communication skills and confidence.		
Consider offering more project-based graduate courses.	We recognize that there is a broad spectrum of research styles among research groups within the program, and that project-based courses may be appropriate ways for some students to prepare for their research programs. We will ask the cluster leaders to make this suggestion one of the top topics for discussion at the Graduate Cluster meetings this year. The availability of "Special Topics" courses would enable a pilot	Chair, Assoc Chair, Graduate Teaching Cluster leaders	Winter 2023

	study to be conducted reasonably quickly if a cluster wishes to do so.		
Consider encouraging teamwork in graduate courses (via projects).	We recognize that we have only a few graduate courses so far that incorporate a large component of group work, and we agree that this is something that could be explored further. We will have initial discussion at graduate teaching cluster meetings and then follow up with a workshop by the MacPherson institute on best practices for forming groups, encouraging healthy group dynamics, and assessing individual contributions to group projects. The availability of "Special Topics" courses would enable a pilot study to be conducted reasonably quickly if a cluster wishes to do so. If a pilot does go ahead, we will ensure that the instructor receives the appropriate training on the formation and management of groups to ensure that our process is consistent with the Faculty's and University's goals of equity, diversity and inclusion.	Chair, Assoc Chair, Graduate Teaching Cluster leaders	Fall 2022
Consider offering graduate courses focused on recent academic papers, that would reflect the state of the art in their field.	We have had some discussions previously about the possibility of developing an Independent Study graduate course in ECE but no consensus was reached. We will make this a major discussion point for our department retreat this Summer, and then the Graduate Affairs Committee will develop a proposal to bring to a department meeting in the coming academic year.	Chair, Assoc Chair	Fall 2021
Consider integrating student feedback into	We will ask the cluster leaders to incorporate into every meeting of their Graduate	Chair, Assoc Chair, Graduate Teaching Cluster leaders	Summer 2022

a loop for course improvement	Teaching Cluster a discussion of how instructors are working to incorporate feedback from students into course improvements. We will also suggest that instructors consider making use of the MacPherson Institute's mid-course review process, rather than relying solely on the end-of-term course evaluations. The Chair and Assoc Chair will also organize an annual stakeholders' meeting with graduating students from our graduate programs, to create another pathway for feedback on our programs and courses. Such stakeholder meetings for our undergraduate programs have provided insightful feedback.		
Consider a succession plan for the Graduate Administrative Assistant Cheryl Gies. While her dedication and enthusiasm are impressive, it might be hard to find a new graduate assistant with the willingness to take on her heavy workload when Cheryl retires. It might be a good idea to plan for hiring one Graduate Administrative Assistant for MASc and PhD Programs, and a second one for the MEng Program.	Our Accounting & Academic Administrative Assistant, Ms. Tracey Coop, has been assisting Ms. Gies over the past few years in managing external graduate scholarship nominations in the department, in overseeing facility access for our graduate students, and in moving our graduate course outlines to a new template. In that way, she will be well situated to be able to take on more graduate program administration tasks if required at some point in time. Of course, we will hold an open application process for Cheryl's position when she retires. We will also discuss the overall staffing needs for our graduate programs with the Dean's office.	Chair, Administrator,	Fall 2021
The Department could provide more	Our department found it difficult to maintain and update our previous centralized HPC	Chair, Assoc Chair, IT staff	Winter 2022

centralized computing.	system, so we have suggested that our students use resources provided by Compute Canada and other HPC-specific entities. We will look to enhance local services that provide access to Compute Canada, for example by promoting the annual seminar on these facilities hosted by RHPCS/SHARCNET. We will also conduct a survey of ECE graduate students and faculty to find out their software needs. From the survey results we will determine where software licensing and/or support can be centralized at the department or university level.		
It is not recommended to achieve an enhanced use of physical resources by combining on-line and in-person graduate student activities after the pandemic. This might lead to a decrease in the community spirit of the graduate students belonging to the same lab. In-person activities should be encouraged as much as possible after the pandemic.	We agree that this is important. We plan to take a graduated approach to transitioning back to in-person actives in alignment with the Faculty of Engineering Return to Work Taskforce' policies currently being developed. In the short term, we will need to balance cohesion among graduate students with access by student unable to return immediately to campus. But after pandemic restrictions are lifted, we will promote a full return to in-person activities, and will ensure that physical resources are allocated in ways that will only enrich the spirit of our graduate student community.	Chair, Assoc Chair	Fall 2022

Faculty Response

The reviewers in their assessment of the Department of Electrical and Computer Engineering have provided a report that is very similar to a previous IQAP review, denoting a strong program with global recognition of its research, a collaborative and collegial faculty and staff, high satisfaction by the students with the curricula and climate, and excellent focus on experiential learning and skills development. From the recommendations offered in the report, the Faculty can see that the department has identified areas for improvement in their curricula and enhancements to the student experience.

The attention on types of courses, class sizes, course outlines and coordinated course offerings is welcomed and the Faculty will endeavour to assist the department in approving these changes, as required, through the different committees of the university. A student club to arrange social activities is always appreciated since they can be very effective in bringing new and senior students together in a friendly and enjoyable manner, though the Faculty will want to see this club working under the EGS, not set up to be in competition. The approach of the department to the suggestion of giving alternatives to their 3MT-style communications exercise seems appropriately tempered. Due to the benefits of this exercise and appropriateness in preparing students for a skill that will demand lifelong improvement, the concerns of the few students should be considered but formulating alternatives seem undesirable, especially in light of the fact that it could mean an uneven evaluation standard being applied throughout a cohort.

There are some recommendations, however, that the Faculty feels the reviewers exceeded their mandate. The Faculty does not consider there to be any issue with the tuition differential between domestic and international Masters students and does not intend to contribute to this item listed by the department. In regards to staffing, the department is adequately covered and may need to re-organize the roles and responsibilities of its people, but these on-going organizational issues seem beyond the scope of this review since they have not been shown to affect the learning experience. Similarly, the given recommendation, which seems to be against blended learning, is far too prescriptive for the review and does not align with the views of the Faculty. The Faculty seeks to capitalize upon the resources that were developed through the pandemic, not retreat back to the previous norm, so long as the student experience is better for this change.

Quality Assurance Committee Recommendation

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation and the committee recommends that the program should follow the regular course of action with a progress report and subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.