FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

Chemical Engineering, M.A.Sc., Ph.D.

Date of Review: April 9 and 10, 2018

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 Chemical 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 Chemical Engineering program submitted a self-study in March 2018 to the Vice-Provost and Dean of Graduate 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 site visit to McMaster University on April 9th and 10th, 2018. The visit included interviews with the Provost and Vice-President (Academic); Vice-Provost and Dean of Graduate Studies, Associate Dean, Grad Studies and Research, Chair of the program and meetings with groups of current students, faculty and support staff.

The Chair of the program and the Dean of the Faculty of Engineering submitted responses to the Reviewers' Report (June 2018). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

- Very high-quality faculty and high-quality students in the graduate programs.
- Research intensive department with both basic and applied research through industry collaborations, interdisciplinary and collaborative initiatives.
- Very collaborative environment both for the faculty members and students. Collaboration is considered part of the "DNA" of the department and critical to its culture.
- Accelerated Master's program.
- Internship/Co-op programs in research intensive graduate degrees (Ph.D. and Master's).

Areas for Enhancement or Improvement

- The professional development of graduate students is an area of significant potential for the department. The department has a clear commitment to the graduate student experience and this would help the department to compete for graduate students with other universities.
- The committee has commented extensively on the language requirements and sees the resolution of this issue as a top priority.

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
That the department continue its practices of intermingling graduate student office spaces between research clusters.	We will continue our current practice, as we agree with the recommendation that this is a strength area of the Department.	Chair and Departmental Administrator	Already implemented and to be maintained
The University and Faculty need to ensure that the space commitments to the department are honoured.	We believe that no follow-up is needed, since the Faculty of Engineering has always honoured the commitments made to our Department and trust is a cornerstone of how the Faculty has always interacted with our Department	Chair and Dean	Immediate and on-going
Continue to develop, in collaboration with the Faculty of Engineering, its graduate student teaching assistant workshops and career development initiatives. There was very positive support for these initiatives at the Faculty level.	We thank the reviewers for pointing out how valuable these programs are. The Dean and his office have been exceptional in establishing and supporting these programs, and we will continue to mandate and/or strongly encourage participation in these initiatives among our graduate students as well as participate in the delivery of such workshops/initiatives as needed.	Chair, Dean and Associate Deans	Already implemented and to be maintained
The department should begin using the TA teaching evaluations currently available at the University level.	This is a very valuable comment and we fully appreciated the need for TAs to receive feedback on their work. The current teaching evaluation questionnaires include a section regarding the TAs. The information on these sections is already typically passed on to the TAs by the course instructor, as long as confidentiality is maintained	Chair and Associate Chair (Graduate)	Already in place and reminder from Chair to be given to all faculty members every term.

	and after the comments are screened by the instructors for inappropriate content. The		

	quantity and quality of the feedback is usually limited, but we have to ensure that in case specific feedback is given, that instructors do send it to the appropriate TAs. Every term the Chair will remind all faculty members that TA feedback should be sent to the TAs, if available in the questionnaires - if appropriate and maintaining confidentiality. The Chair will also encourage all faculty to provide specific feedback to their TAs independently of the student evaluations, as we agree this is valuable feedback for improving TA best practices as well as providing content for future teaching portfolios among the graduate students.		

Ensure that all students who wish to challenge themselves through various TA positions and teaching fellowships are provided an opportunity as appropriate.	We agree with the reviewers and would love to be able to provide as many opportunities as possible, but these opportunities are limited by budgets. Our Department is already overextended in terms of the allocated budget for TAs. As a minimum, all graduate students get at least one term of TAing per year. If the budget allocated by the faculty is increased, we will happily give more TA opportunities to the students. We already provide a TA preferences questionnaire to graduate students to gauge their interest in various types of TA positions and will continue to use this questionnaire to best match student interests to available positions, while at the same time taking into account the appropriateness of the student's background for	Chair, Dean, Departmental Administrator, Associate Dean (Graduate) and Director of Finance/Administration	Budgets are given on an early basis
	the course and the needs specified by the instructor for the successful delivery of the course to ensure high quality undergraduate instruction. For any available sessional instructor positions, we will continue our practice of posting these positions openly to all Ph.D. candidates in the Department and interviewing interested candidates prior to any assignment being distributed		

Ensure that TAship in the department is viewed as one of the key professional development opportunities by providing various opportunities for positions, adequate training, and constructive feedback to the students.	We agree and we will continue to offer our annual TA training session to all graduate students. We will extend these sessions to emphasize the importance of communication as key factor for professional success. We will encourage our graduate students to take advantage of the many opportunities offered by the MacPherson Institute. In the academic year of 2017-18, our Department voted and unanimously supported changing our graduate course requirements to allow one of our required graduate courses to be in a nonengineering/science field, such as courses in teaching and learning. These changes have been approved at the Senate level, after approval by the Graduate Council. As such, it will now be easier for our students to gain additional training in this area while still fulfilling program requirements.	Chair, Associate Chair (Graduate), Associate Dean (Graduate) and MacPherson Institute	Already implemented new policy to provide flexibility for students to take at least one course that is outside of engineering/science to provide additional opportunities for professional development. We need to increase student awareness of graduate coops and industrial Ph.D. We will work with the Associate Dean to better advertise this to our students – this will be done in the next year.

	The Associate Dean has been very active and is developing capacity in the Faculty to increase the opportunities for professional development, such as coop for graduate students and industrial Ph.D. options. We will continue to support these options for our students.		

Review the requirement for Master's students to give oral presentations and/or other opportunities to communicate their knowledge to a wide audience.	We agree with the reviewers on this point. During our May retreat, we already voted to require all graduate students to present (either orally or through a poster) their research work in our annual research conference called MUCEC, attended by all graduate students and professors. While this formal change requires approval by Graduate Council and thus cannot be a formal program requirement until the 2019-2020 academic year, we have already updated the graduate student handbook strongly encouraging Master's students to deliver one poster presentation at MUCEC and will remind faculty members of our decision on this point prior to the next MUCEC conference to encourage high participation rates.	Chair, Associate Chair (Graduate) and Assistant Administrator (Graduate)	Already added to graduate student handbook. The paperwork to make this a formal program requirement for the Master's degree will be submitted in September. The Assistant Administrator has been tasked with monitoring that this requirement is met.
It is recommended that the department review the course offerings, especially in light of the accelerated Master's students only having one year to take graduate courses, and some courses are only offered on alternative years.	We agree with the reviewers, and for the academic year of 2017-18 we already got Graduate Council approval to modify our graduate course requirements to allow all our graduate students to take one non-technical course selected by the student (and approved by the supervisor) to provide an additional opportunity to professional development – this	Chair, Associate Chair (Graduate)	Already got Graduate Council and Senate approval to provide more flexibility in course selection and cross-listed many graduate courses. We will identify any essential graduate courses

	will open up a large number of potential courses that can be taken by the students. In addition, we cross-listed a large number of graduate courses to increase the available courses to all students. Finally, between 2015 till 2019, we hired 6 new professors, each bringing new graduate courses to the Department to significantly expand our range of course offerings. Most of these new courses will be coming on to the books in the next 2-3 years as these new professors become established, starting this year with a new course in Bacteriophage Biotechnology. In terms of allowing Accelerated Master's students more access to courses offered only in alternate years, we will review the course calendar and ensure that any graduate course that would be considered essential to success in a given project is offered with a frequency suitable for the Accelerated Master's program timing. We have already done this with our advanced statistics course (CHEM ENG 765), which was offered twice last year alone.		for Accelerated Master's students within the next year and will offer those courses on an annual instead of alternate year basis.
The department may wish to discuss how it will support the new internship and industrially based programs.	We did not yet have any students opting for this path, and this is a Faculty-wide initiative. The Chairs of all the Departments meet formally and informally at least once per month and bestpractices will be shared. The Department was polled when this initiative was first presented by the Dean and Associate	Chair/Associate Chair (Graduate)/ Associate Dean (Graduate)/	Already started and current parameters will be revisited and adjusted as students make it through the program.

	Dean and there was unanimous support. There is a long history of department-industry		

	collaboration which makes internships a natural process.		
The committee would suggest that the department specifically update the program learning objectives to reflect the new graduate programming specifically the work experience.	We agree with this recommendation.	Chair/Associate Chair (Graduate) in consultation with the Associate Dean (Graduate)/	This exercise will be started in 2018 and to be completed by 2020.

The Faculty of Engineering should encourage all graduate programs in the Faculty to address the matter of language proficiency requirements.	The Faculty of Engineering is aware of differences in language requirements. The Department of Chemical Engineering has already the highest language requirements in the Faculty and, at our May retreat, we voted to further increase the program requirements to a 91 minimum TOEFL score (minimum 20/category) and a 7.0 minimum IELTS score (minimum 6.5/category). The changes to the minima per category are particularly noteworthy in terms of ensuring that incoming graduate students have a complete set of language skills relevant to their success. These are now the second highest language requirements in Canada for Chemical Engineering – only second to the University of Toronto. This change needs to be approved by Graduate Council and will be submitted for approval for the 2019-2020 admission cycle.	Dean, Associate Deans and Chairs	The Dean has been very clear, for a couple of years, in insisting that all departments raise language requirements. Some Departments have responded positively (such as Chemical Engineering), while others have been more conservative because increasing requirements would decrease their graduate student counts. This issue is discussed at Dean's Council several times every year and there has been a gradual overall increase of the requirements thanks to the Dean and Associate Dean (Graduate)

That the Department, in consultation with the School of Graduate Studies, make information regarding the new language proficiency requirements accessible and transparent to prospective graduate students on all relevant websites.	We agree that the varying language requirement statements are confusing. We will ensure that there is consistency in all relevant webpages between the Faculty of Engineering, the School of Graduate Studies, and our department, after the new minimums are approved by Graduate Council.	Chair, Associate Chair (Graduate) and Assistant Administrator (Graduate)	Implemented and to be monitored on a yearly basis.

That the Department of Chemical Engineering admit all graduate students at a single IELTS or equivalent measure.	Our Department does not accept any students below the specified minimum and will not approve any requests for exceptions to these minima. In fact, after our Departmental Retreat in May, we voted to TOEFL/ILETS requirement to 91 (minimum 20 per category) or 7.0 (minimum 6.5 per category), making it the second highest in Canada for Chemical Engineering. We believe that the reviewers got the impression of a multitiered system, because different departments have different requirements and the Faculty does not have a common minimum.	Chair, Associate Chair (Graduate) and Assistant Administrator (Graduate) to ensure that these minimum requirements are met	Continuous monitoring and ensuring that applications not meeting the minimum requirements are not further considered, consistent with our current practice.
That Chemical Engineering develop new opportunities for graduate students, particularly Ph.D. candidates, to work in laboratories not only outside of McMaster, but also outside of Canada.	We currently have 2-7 graduate students participating in lab exchanges. We believe that this is best achieved at the supervisor/student level. Doing it at the Department level does not seem to be feasible since the Department does not have funds to support these exchanges and the supervisor/student are much better equipped to make the connections with different labs.	Graduate Students and Supervisors. Associate Chair (Graduate) to provide support to remove barriers	Already being done for many years. We will continue to accommodate these requests in terms of waiving seminar requirements, scheduling TA assignments etc. as appropriate to facilitate these opportunities.
That Chemical Engineering, in collaboration with the Faculty of Engineering	Please see response for previous item – the main issue is the same. We will certainly join with the Faculty on ongoing efforts to establish linkages	Graduate Students and Supervisors. Associate	Already being done for many years

develop key "partner" universities, particularly in institutions (e.g., in the U.S.) where strong relationships – through research collaborations already underway with faculty members – already exist.	with partner universities (most recently with Northwestern Polytechnical Institute in China and Penn State) and promote these exchange opportunities to our students.	Chair (Graduate) to provide support to remove barriers	

Dean's Response, Faculty of Engineering

The Faculty had read the reply of the program to the reviewers' recommendations and consider their approach prudent. They have identified urgent task versus long-term continuing areas for improvement. The reviewers in their assessment of Chemical Engineering found a department that has kept its attention on staffing, research output and teaching, concluding it to be a very strong and collegial department with significant research leaders at all rank levels.

The reviewers identified language proficiency standards as a minor issue to be addressed, which the program has responded that they will immediately handle through GCPC. They seem very concerned that the department and Faculty could have different minimums though it is not the philosophy in the Faculty to operating in a top-down manner; they encourage departments to aspire to the highest possible standards yet recognize that each discipline is in a much better position to set those standards provided undergraduate students encounter only high-quality TAs. The Faculty will continue to ask all of the departments to raise their minimums over time. The reviewers make a mistake though in stating an enrolled student who did not receive a TA due to their low proficiency score while applying may re-take the test to receive a TA later – that is not consistent with the Faculty internal policies.

Most of the big recommendations provided by the reviewers related to internationalization and external collaboration, giving the department some aspirational goals, though the Faculty doesn't see any links being made in the report to curriculum content or programming quality that would be relevant to this review exercise and so they don't consider these as urgent tasks.

The Faculty was gratified that the reviewers were excited by the faculty initiatives to include more workplace experiential learning in curricula and will continue to help Chemical Engineering and all other Engineering departments integrate these experiences in their programs. They greatly appreciate the hard work and effort undertaken by the reviewers and thank them for providing valuable suggestions that will help bring more visibility to the department as an international leader in research excellence.

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.