

## FINAL ASSESSMENT REPORT

### Institutional Quality Assurance Program (IQAP) Review

#### Mechanical Engineering (M.A.Sc. and Ph.D.)

**Date of Review: February 26 and 27, 2019**

*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 Mechanical 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 Department of Mechanical Engineering program submitted a self-study in January 2019 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 February 26<sup>th</sup> and 27<sup>th</sup>, 2019. 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 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 (April 2019). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

## Strengths

The Reviewers determined that there were three areas of strength in the Mechanical Engineering graduate program: (i) Quality of the Faculty and Training, (ii) Learning Environment and (iii) Institutional Support. Most faculty have active research programs with healthy funding and productive research dissemination. The research facilities were found to be excellent and conducive for performing leading edge research in a broad range of areas in mechanical engineering. One point of note was that the research environment was collaborative, which fostered multidisciplinary research projects, many of which are supported by industry. The students were found to be satisfied with the quality of their training and pleased with their choice of institution for their graduate program. The reviewers found a high level of institutional support for the graduate program, including continuous improvements to student welfare, including seating and quiet spaces for study. The department has been successful in hiring several female faculty members in the last five years which has significantly improved the gender balance of the faculty.

## Areas for Enhancement or Improvement

While the Review Team concluded that “there were no major challenges to the success of this unit”, six areas for enhancement were identified: (i) Graduate Courses, (ii) PhD Comprehensive Examination, (iii) Student Space, (iv) TA duties, (v) Domestic Graduate Student Recruitment and (vi) International Focus. The availability of relevant courses, especially for doctoral students who have completed their MASc at McMaster was found to be limited. The PhD comprehensive exam was found to be a point of contention with graduate students, especially the assignment of the subject areas for examination. While graduate students expressed overall satisfaction with their Teaching Assistant experience, the lack of feedback on their performance was a concern. The difficulty of recruiting domestic students to the PhD program was of particular concern.

## 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
<b>PhD Comprehensive Exam:</b> (i) Re-examine objectives and ensure current examination format is meeting objectives and (ii) Split examination into two parts, taken at end of Year 1 and half way through Year II.	The department will re-examine the objectives of the PhD Comprehensive Exam. The exam format of other Engineering Departments at McMaster and Mechanical Engineering units in other universities will be reviewed. Potential revised formats are: <b>(i)</b>	Associate Chair (Graduate Studies)	These proposals will be discussed at the departmental retreat in May 2019 for faculty feedback. The graduate curriculum committee will re-examine the PhD comprehensive exam and develop any necessary changes over the academic year 2019/20 for approval

	<p>Develop a set of core subject areas from which student will pick two (relevant to their research and approved by their supervisor) to be examined for Part A. Complete Part A between 8 to 12 months of start of program. Complete Part B (Research Proposal) between 18 to 24 months of start of program. <b>(ii)</b> Remove Part A of the comprehensive exam and keep only Part B. Expand Part B to include two topic areas related to the research that the student will be orally examined on.</p>		<p>by the department and implemented in 2020/2021.</p>
<p><b>Course Offerings:</b> Examine ways to offer more flexibility to Ph.D. students in terms of course selection.</p>	<p>Current regulations require that 50 percent of the courses must be from the home department. Unfortunately, this cannot be waived by School of Graduate Studies. To alleviate this, and provide more flexibility in courses, the department has recently (2018/19) cross listed several courses from ECE, Chem Eng, SEPT, and Materials as Mech Eng Courses. Additional courses from other departments have been identified to be useful to our students,</p>	<p>Associate Chair (Graduate Studies/Graduate Administrator)</p>	<p>Additional relevant graduate courses from other departments for cross listing as MECH ENG courses will be submitted to GCPC for approval in the academic year 2019/2020. This will provide a wider range of courses for PhD students, especially those working in multidisciplinary areas, and will address the 50 percent home department course rule.</p>

	and will be cross-listed in the next academic year.		
<b>Department Weekly Seminar Course (ME758):</b> (i) Revisit format to increase number of presentations on general topics and (ii) Re-evaluate attendance criteria for fulfilling course requirements.	Students are provided with the option of presenting their own research or on a general topic in engineering. The department will solicit input from the graduate student body on the format of the presentations. The procedure for missing a seminar is announced at the beginning of each semester, posted on the department website, on the A2L course site and on the weekly announcements that are also posted on the course site and circulated by email to all graduate students.	Associate Chair (Graduate Studies)/Graduate Administrator	The procedure for missing a seminar will continue to be announced at the beginning of each term, highlighted on the department website and in both the weekly email to the students and on the A2L announcements. Graduate student and faculty feedback on the seminar format will be solicited over summer 2019. This is also an agenda item at the Department Retreat in 2019. Any changes resulting from this review will be implemented in the academic year 2019/2020.
<b>Incoming Students in Winter and Spring Semesters:</b> Provide better orientation information to incoming students starting in January and May of each academic year.	Currently, the Graduate Administrative Assistant provides individual orientations to incoming January and May Grad students, upon arrival. The process will be formalized with a scheduled orientation session for all incoming students in January and May of each year. This will not supersede the orientation events organized by the Department and	Associate Chair (Graduate Studies)/Graduate Administrator	A formal spring orientation will be held for incoming students in May 2019. This will be continued in January and May of each year. Students attending this orientation will also be invited to attend all orientation events that are held in September of each year.

	University in September of each year.		
<b>Student Space:</b> Continue survey of student space usage and plans for room renovations and expansion of student space into new Engineering tower and determine equitable solution.	JHE313 was completely refurbished in 2018 with seating for 19, hotel style. In addition, JHE326 was refurbished and repurposed as a computational graduate room with assigned desks for 12 grad students. JHE311 will be refurbished in summer 2019. Graduate student input on the layout for JHE311 will be incorporated into the design. Evaluation of student space will be an on-going activity to meet anticipated increase in graduate student enrolment.	Ms. Leslie Kocis, Administrator	Consultation with Graduate Students, coordinated through the Grad Student Representative, is underway. The design of the room layout will be finalized and refurbishment of JHE311 will done over Summer 2019.
<b>TA Duties:</b> Provide feedback on TA performance.	Currently, the Course Instructor meets with each TA at the beginning of each semester to complete the TA Hours of Work form and a Department implemented "TA Expectations" form. The latter outlines the responsibilities and expectations of the TA and the Course Instructor. An exit meeting between the Instructor and the TA will be formalized at the end of the course (after the course	Associate Chair (Graduate Studies)/Graduate Administrator	The TA exit meeting form will be developed during the summer 2019. The exit meeting between the Course Instructor and the TA will be implemented in the academic year 2019/2020.

	evaluations are received) to complete the loop. A TA evaluation form will be developed to facilitate feedback on the TA performance. Any specific comments from the students pertaining to the TA in the course evaluation form will be conveyed to the TA.		
<b>Domestic PhD Graduate Student Recruitment:</b> Consider recruitment of PhD domestic students by way of a five-year combined Bachelor-Master program.	An ad hoc department committee will be formed to determine the feasibility of a five-year combined Bachelor-Master program. The committee will also, additionally, develop other strategies on improving domestic PhD student recruitment.	Chair	The committee will be formed in Spring 2019, and perform the study in the academic year 2019/2020. The committee will present their findings at the Departmental retreat in 2020 for action.

**Dean’s Response, Faculty of Engineering**

The reviewers in their assessment of the Department of Mechanical Engineering found it to be a research powerhouse, well-structured in its curriculum and well run. Its strengths include its innovative and excellence in research, its multidisciplinary collaborative projects, good student morale, recruitment strength, and healthy gender balance. The Dean was pleased to see such a complementary assessment and aimed to help the Department with the helpful recommendations provided.

In the series of recommendations made in the report, the majority are seen as minor changes (in the words of the reviewers) and will be beneficial to the student experience. Re-evaluating comprehensive examination procedures is valuable every few years. The Dean noted the need to see better incorporation of the principles of equity and inclusion throughout the academic landscape, and comprehensive examinations are repeatedly becoming a point where issues arise frequently. The department may find their procedures are adequate, but the Faculty is very supportive of them taking a fresh look at its layout. Flexibility in course selection is a challenging issue in the face of Graduate Studies regulations that the Faculty understands well and is continually looking for creative solutions.

The Dean is highly supportive of an interdisciplinary curriculum and recognize the strength of the Department of Mechanical Engineering in this area. This is a point where the Associate Dean may be helpful and will be able to assist the Associate Chair, Graduate of the Department in addressing the program's vision. Student space is a continual issue with the Faculty's ever-growing graduate population, but with new available space in a soon-to-open engineering building, some of this stress should be alleviated and the Faculty will continually try to allocate funds over time to re-fresh their current spaces. The Faculty sees opportunities to support and help the Department in fostering international collaborations/exchanges so long as domestic recruitment remains the priority for the Department's graduate programs. The accelerated Master's degree that the Department is considering is already in use in several departments within the School of Engineering and Applied Sciences and the Faculty can link the leadership in the Department of Mechanical Engineering with the other programs to gain advice on how to effectively implement. The Dean pledged to continually work with the Department on these aspiring changes.

### **Quality Assurance Committee Recommendations**

**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 an 18-month progress report and a subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.**