FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

CHEMICAL ENGINEERING (UG) PROGRAM

Date of Review: March 28 – 29, 2023

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 undergraduate program delivered by the Chemical Engineering program. 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 Faculty of Engineering submitted a self-study in January 2023 to the Vice-Provost (Teaching and Learning) to initiate the cyclical program review of the Chemical Engineering undergraduate program. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean, Faculty of Engineering and selected by the Vice-Provost (Teaching and Learning). The review team reviewed the self-study documentation and then conducted a virtual site visit on March 28 – 29, 2023. The visit included interviews with the Vice-Provost (Teaching and Learning), Deputy Provost, Dean of the Faculty of Engineering, Chair of the Department of Chemical Engineering, Director of Engineering & Society and Engineering & Management programs, and Acting Associate Dean (Academic) and meetings with groups of current students, full-time faculty, and support staff.

The Dean of the Faculty of Engineering, Chair of the Department of Chemical Engineering, and Associate Chair (Undergraduate) submitted responses to the Reviewers' Report. The initial response was prepared by the program in June 2023, and finalized by the Dean in March 2024. Specific recommendations were

discussed, and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

We are very pleased with the feedback given by the reviewers. The report accurately captures our strong commitment to undergraduate education. The following statements were directly taken from the report prepared by the reviewers.
"Easily the most distinguishing feature of the Chemical Engineering program is the strong sense of community that is forged between faculty, students and staff. There are multiple layers to this shared sense of identity and purpose: students feel supported by faculty in addition to feeling connected to their peers. The department is involved and invested in student run-initiatives. Staff are well-resourced and encouraged to pursue career advancement opportunities. Moreover, technical staff are highly engaged in the delivery of laboratory components. Finally, faculty report a culture of openness to seek guidance from colleagues. This constructive working and learning environment clearly emanates from the top down with departmental leadership that values inclusivity. Another outstanding component of the program is the integration of undergraduate students into the research endeavor. There are ample opportunities for students to become immersed in research as early as first-year, and the department boosts an impressive number of summer student hires."

Opportunities for Improvement and Enhancement, Including Appropriateness of Resources

The reviewers stated:
"There are no significant concerns noted by the reviewers. There are some areas for potential opportunities and enhancement, particularly as it relates to the recruitment of students into the department from Level 1, refinements to new interdisciplinary faculty wide courses, and evaluating the role and integration of teaching stream faculty into the delivery of educational programs.

Minor recommendations are suggested for Admissions, Curriculum, and Resources to Meet Program Requirements. More specifically:

Admissions:
• An increase in the curricular exposure of Level 1 students to Chemical Engineering topics.
• Outreach events, where possible, should continue to incorporate and expand devices and displays to emphasize the practical applications of Chemical Engineering.

Curriculum:
• Further refinement of ENGINEER 2PX3 is warranted.
• Investigate opportunities in current curricular offerings to incorporate experimental design.

Resources to Meet Program Requirements:

• Define a clear framework for the teaching stream faculty allowing them to thrive in their career and continue to contribute significantly to the success of the Chemical Engineering program.

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

Recommendation #1: Admissions: • An increase in the curricular exposure of Level 1 students to Chemical Engineering topics. • Outreach events, where possible, should continue to incorporate and expand devices and displays to emphasize the practical applications of Chemical Engineering.
Department Response and Actions to be Taken: We had our departmental retreat on June 7 of 2023 and we discussed this topic extensively discussed as a group. We agreed to: 1. Increase the number of faculty members involved in recruiting events, to provide a wider perspective of what Chemical Engineering is as a discipline. 2. Revisit the offerings we have for streams to capture additional areas of interest for first-year students, such as environmental engineering and sustainability. 3. Work with ELO to increase the visibility of our department through projects.
Dean's Response: I agree the department's proposed actions will impact the department's ability to recruit level 2 students. Reviewing offerings to include additional areas of interest reflects a forward-thinking approach to curriculum development. You could consider co-hosting a workshop with the ELO to revamp at least one project that highlights an area of chemical engineering that has been identified as being of interest to prospective students (e.g., sustainable energy). When you have identified an area, consider including another department with synergistic expertise.

Recommendation #2: Curriculum: • Further refinement of ENGINEER 2PX3 is warranted. • Investigate opportunities in current curricular offerings to incorporate experimental design.
Department's Response and Actions to be Taken: The Associate Dean has created a group to totally redesign 2PX3. Our department has been invited to provide input as they develop a new course. There is a clear commitment from the Associate Dean to make this course much better. Our department is happy to provide ideas and share what we thought were the best aspects of CHE2G03 – the course that was replaced with ENG2PX3. We believe that experimental design is well covered in our curriculum through the following courses: CHE 3I03, 3L03 and 4L03.

Dean's Response:
To date, all indications are that the redesign of 2PX3 has resulted in significant improvements. A mid- course review was conducted recently, and students evaluated the course at 7 (out of 10), which is a significant improvement over last year (3 out of 10). Additionally, attendance has increased from near 0 in class to ~40% (design studio attendance has always been mandatory and remains at close to 100%).

I agree that experimental design is currently well covered in the Chem Eng. undergraduate curriculum.

Recommendation #3:
Resources to Meet Program Requirements:

- Define a clear framework for the teachings stream faculty allowing them to thrive in their career and continue to contribute significantly to the success of the Chemical Engineering program.

Department's Response and Actions to be Taken:
The following steps were taken to address this important issue and will be continued for the future:

1. The teaching loads for our teaching-track faculty members have decreased from last year by at least 3 units. Under no circumstances teaching loads should be above 18 units and a more reasonable long-term target is 15 units.
2. The Chair has started a yearly meeting with the teaching-track faculty to discuss the overall teaching loads and assignments for the entire department. This brings transparency to teaching assignments and it is good governance. The departmental administrator is also part of the yearly meetings.
3. The teaching loads for two of our teaching-track faculty members are assigned between our department and the ELO. The department has decreased the teaching loads and the chair of chemical engineering will work closely with the ELO to ensure that the loads assigned from that unit are also decreased. This should provide enough time for these faculty members to work on pedagogical research, or other activities that enrich their experience as educators.

Dean's Response:
This is an area that I have been paying close attention to as the Dean of the Faculty and Chair of the Faculty's Tenure and Promotion committee. I am pleased to see the proactive steps taken by Chemical Engineering to ensure reasonable teaching loads for teaching track faculty. Additionally, to facilitate the promotion of teaching stream faculty, I have supported the development of a pedagogical research community within the ELO. This community serves as a platform for collaboration and professional development, bolstered by the inclusion of two post-doctoral fellows (PDFs). These PDFs are dedicated to supporting teaching track faculty in their pedagogical research endeavours, helping with ethics applications, data collection and analysis, or manuscript preparation. I will continue to monitor the career progress of our teaching stream faculty and provide support and
resources as warranted.

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Implementation Plan

In the chart below, please outline the recommendations made by reviewers, briefly outline the actions you plan to take, who will be responsible for leading the action, and a timeline for completion.

Recommendation	**Action(s) to be Taken**	**Responsibility for Leading Action** (specify the role(s) that will be responsible for each action item e.g. Program Chair.)	**Timeline for Completing Action** (indicate specific timelines (e.g. not 'ongoing') for action)
Admissions and outreach	1. Increase the number of faculty members involved in recruiting events, to provide a wider perspective of what Chemical Engineering is as a discipline. 2. Revisit the offerings we have for streams to capture additional areas of interest for first-year students, such as environmental engineering and sustainability. 3. Work with ELO to increase the visibility of our department through projects.	Chair and Associate Chair (Undergraduate) of Chemical Engineering	Start in September 2023 and complete in September 2024

Curriculum	Associate Dean and their team has already started to redevelop 2PX03 and the updated course will be offered in the 2023/24 academic year	Associate Dean and followed up by Chair and Associate Chair (Undergraduate)	Started in May 2023, updated course to be offered in the 2023/24 academic year.

Teaching stream	1. Decrease teaching loads for teaching-track faculty members. 2. Chair meets yearly with teaching track faculty members to assign teaching loads for the entire department. 3. Coordinate teaching loads with ELO	Chair of Chemical Engineering	Items 1 and 2 have been already implemented and will be continued. Item 3 to be addressed in the 2023/24 academic year, when a new permanent director of ELO has been selected – this role is being currently filled in an acting basis.

Quality Assurance Committee Recommendation:

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation at the April 2024, meeting. The committee recommends that the **Chemical Engineering** program should follow the regular course of action with an 18-month progress report and subsequent full external cyclical review to be conducted no later than eight years after the start of the last review.