



FINAL ASSESSMENT REPORT
Executive Summary
May 2018
Bachelor of Engineering in Mechanical Engineering
Program Review
Dean: Dr. Tarlochan Sidhu

Under UOIT's Quality Assurance Framework, all degree programs are subject to a comprehensive review every eight years to ensure that they continue to meet provincial quality assurance requirements and to support their ongoing rigour and coherence.

On the completion of the program review, the self-study brief together with the reviewers' report and the assessment team's response are reviewed by the appropriate standing committee of Academic Council, and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In academic year 2016-2017 a program review was scheduled for the Bachelor of Engineering in Mechanical Engineering.

This is the second program review for this program and the internal assessment team is to be commended for undertaking this assignment in addition to an already challenging workload and within a very tight timeline. The following pages provide a summary of the outcomes and action plans resulting from the review. A report from the program outlining the progress that has been made in implementing the recommendations will also be put forward in eighteen months' time.

External Reviewers: Dr. Alidad Amirfazli (York University) & Dr. Kamran Bahdinan (University of Toronto)

Site Visit: 13 – 14 November, 2017

Mechanical engineering is one of the broadest engineering disciplines, overlapping with electrical, chemical, civil, computer and software engineering. Students in the program can choose to specialize in Energy Engineering or follow the comprehensive program. It provides graduates with the knowledge and skills required for engineering in all industrial sectors.

Developed in consultation with industry and experts at other universities, the Mechanical Engineering curriculum provides a solid foundation in science and mathematics fundamentals, with significant content in engineering sciences and engineering design.

In the first year, students study mathematics, sciences, computing and technical communications — courses that represent the foundation building blocks of most engineering programs. The second year

covers basic engineering courses like thermodynamics, fluid mechanics, materials properties, electrical circuits, and the mechanics of solids.

In third and fourth years, students study a range of applied and advanced mechanical engineering courses including kinematics and dynamics, control systems, manufacturing and production processes, machine design, mechatronics, vibrations, robotics and automation, advanced solid mechanics, etc. In addition, the final year students undertake capstone design projects (over two terms) which show the cumulative knowledge that they have acquired during their studies at UOIT.

State-of-the-art laboratories and facilities have been developed to support the program, including laboratories for a wide range of mechanical and manufacturing technologies.

Significant Strengths of the Program

- All the faculty members in Mechanical Engineering have strong research and industry background.
- Many of the faculty members in the Mechanical stream have NSERC funding and/or industrial funding.
- Having a laptop loaded with any software that the students need for their study.
- Hands-on experience through state-of-the-art laboratories.
- Valuable co-op and internship opportunities for students.

Opportunities for Program Improvement and Enhancement

- Examining the use of more technical elective courses in the program for students.
- Lack of machine shop labs especially in the 1st and 2nd years of study, which delays the exposure of Mechanical students to the application of real life equipment.
- The currently available infrastructures (equipment and facilities) are not fully utilized.
- Lack of space for undergraduate students to work on their capstone projects, participate in social activities and space for study.
- Lack of space for storage of Capstone Design projects.
- Student to faculty ratio is high.

The External Review

The site visit took place on November 14 and 147, 2017. Drs. Alidad Amirfazli (York University) and Kamran Bahdinan (University of Toronto) met with members of the Faculty as well as key stakeholders at the University, including the Dean, Associate Dean in FEAS, Department Chair, Associate Dean of Quality Enhancement, and a number of faculty, staff, and students.

Summary of Reviewer Recommendations and Faculty Responses

Recommendation 1

In the view of the recent growth in enrollment and in-line with the UOIT objectives, multiple needs related to physical infrastructure may be addressed to ensure sustainable quality program offering and excellence in student learning and experience. Some examples include:

- (a) Availability of more classroom space that can mitigate suboptimal scheduling experienced by the students and faculty members.*

- (b) In order to maintain a reasonable student to faculty ratio, the Faculty has endeavored in hiring new staff and planning further hiring. This requires additional office/lab space to ensure new and future hires can build a fulfilling career at UOIT which will directly reflect on student learning.*
- (c) The above mentioned growth has had consequence for availability of suitable space for students to study and in general have a rich “campus experience”. As such, it is suggested that steps shall be taken to mitigate the negative impact on students learning experience.*
- (d) It is also beneficial to provide additional space for students’ activities including student clubs, capstone project work and storage space, as well as expanding (or making available) workshop capacities.*

Response

- (a) The faculty notes that the university is aware of the space issue and the increased need for classrooms, study space, TA space, and student space.*
- (b) The Faculty notes that in the recent academic plan and budget submission, a request has been put forth to hire an additional six faculty members over the coming two years to bring the student to faculty ratio in line with the national average.*
- (c) The faculty strongly agrees with this statement.*
- (d) The Design and Innovation Studio has recently been developed to provide students space to work on their projects, specifically Capstone Design Projects, however more space is required to ensure that the students have the best possible experience.*

Recommendation 2

Administration

To ensure sustainable quality program offering and excellence in student learning and experience, the following provides with some examples related to curriculum, and program delivery and services.

- (a) Stability, delivery as well as coordination for Natural Science (NS) courses require attention to ensure the quality of learning experience for students in the first two years of their program. The churn in the instructors for the NS courses seems to be too frequent to provide stability and continuity from a programmatic perspective. This has resulted in negative learning experience for students’ such as high failure rates at times, and on other occasions a lack of sensitivity to the engineering context in the subjects taught. To remedy this issue, the two Faculties are encouraged to embark on closer coordination for delivery of such courses.*
- (b) The students’ preparation for the course “Advanced Solid Mechanics” seems either inadequate or the design of this course is incongruent with the students’ background. As such, it requires a detailed examination by the program curriculum committee to improve students’ learning experience. Furthermore, we encourage the curriculum committee to embark on a detailed examination of the course content in the program to examine for any drift in the course contents, and possible perceived or actual overlap between various course (e.g. structure and properties of material, and thermomechanical processing of materials).*
- (c) Enhancement of experiential Learning: There has been a feeling that aside from capstone design course, there is little hands on opportunities for majority of students to build/interact with various machineries and lab equipment prior to their 4th year. It is highly recommended to:

 - a. In laboratory courses the student provided opportunities to interact with equipment that goes beyond data acquisition;*
 - b. faculty members to be more actively involved in delivery of the labs;**

- c. *Provide further hands on opportunities (e.g. small built) in courses such as “introduction to Engineering”, “Concurrent Engineering and Design”, ‘Computer Aided design” or “Manufacturing and Production processes” that will help with hands-on experience throughout the program.*
- (d) *Streamlining of course offering and organization of various options: An analysis of probable causes for declining enrollment in the management option (or determination whether or not this is a temporary phenomenon, or its rationalization). Consideration of a possible reorganization of the energy option. This may include reducing the number of required courses to align graduation requirements in terms of number of courses with the comprehensive program option. Given the strategy of the University to deliver “Market Responsive” programs, thematic groupings of courses in the energy option may be considered using elective courses as follows:*
 - a. *Wind energy*
 - b. *Solar thermal energy*
 - c. *Conventional energy productions (e.g. gas turbine, combustions, ...)*
 - d. *Energy efficiency, and storage systems (e.g. in the context of buildings), or such similar thematic areas as seen fit.*

Areas such as renewable energy and environmental aspects of energy as described above can have an added benefit of providing options that promotes gender balance within the student population.

- (e) *Administrative and Support Resources: To address the needs of the students and in response to recent expansion of enrollment, the following areas requires attention:*
 - a. *the number technical staff may need to be increased;*
 - b. *consideration for increasing the number of administrative support staff within the program should be given priority;*
 - c. *utilizing “student life” services can be better optimized, for instance, by initiating a more direct communication links to allow better understanding of roles and constraints of each of faculty and Student Life support staff. Other initiative for this matter can be inviting them to:*
 - i. *provide training for faculty regarding “early intervention” for various student issues such as health;*
 - ii. *sexual violence;*
 - iii. *career and internship counselling.*

Response

- (a) The faculty is striking a first year committee along with instructors from the Faculty of Science to address the issues noted above.
- (b) This issue has been addressed by undergoing a full solid mechanics stream review, changing the arrangement and adding an intermediate solid mechanics course.
- (c) The Faculty believes that the Design and Innovation Studio should increase opportunities for experiential learning for the students. The Faculty will also work with ACE to make the existing machine shop readily accessible to undergraduate students along with providing proper safety training. Similar to many other engineering Faculties across the country we need a dedicated space for students to work on their projects using small tools.
- (d) The Program Curriculum Committee and related faculty members in the program will seriously look into this idea and revise the curriculum if needed.
- (e) The Faculty agrees that more support is needed. They note that there is one Administrative Assistant in the Faculty, however substantial growth in recent years necessitates further administrative support.

Plan of Action

The table below presents a timeline of the actions planned to address the recommendations from the external report.

Proposed Action	Timeline	Person/Area Responsible
Introduce departmental research and teaching awards.	Fall 2019	FEAS
Addition of six faculty members to the Faculty of Engineering to help increase the faculty to student ratio.	Fall 2020	Provost's Office/FEAS
Move the Mechanical Engineering program into newly created, smaller department.	Fall 2020	FEAS Faculty Council/Provost Office/Academic Council
Define the Departmental Chair role and responsibilities.	Fall 2019	Provost's Office/Faculty Association
Develop more online content for courses, being careful to prioritize quality over speed and quantity.	Fall 2020	FEAS
Form a First Year Curriculum Committee with instructors from the Faculty of Science to coordinate the delivery of Natural Science courses to Engineering students.	Fall 2019	FEAS/FSci
Make ACE's machine shop available to undergraduate students and provide the appropriate safety training.	Fall 2019	ACE/FEAS
Increase the number of administrative and technical support resources.	Fall 2019	Provost's Office/FEAS

Due Date for 18-Month Follow-up on Plan of Action: May 2019

Date of Next Cyclical Review: 2023-2025