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MEMORANDUM

ATTENTION Senate
DATE March 10, 2022
FROM Catherine Dauvergne, Vice-President,
Academic and Provost and Chair, SCUP
PAGES 1 of 1
RE: External Review Mid-Cycle Report School of Mechatronic Systems Engineering
(SCUP 22-08)

The External Review of the School of Mechatronic Systems Engineering was conducted in March 2017. As per Senate guidelines, the Unit is required to submit a mid-cycle report describing its progress in implementing the External Review Action Plan. At its March 9th meeting SCUP reviewed the School of Mechatronic Systems Engineering's mid-cycle report.

The mid-cycle report, a summary of the Unit's assessment of its Educational Goals, and SCUTL's Feedback on the Educational Goals are attached for the information of Senate. The Canadian Engineering Accreditation Board (CEAB) report is also available upon request.

C: J. Shen

MEMORANDUM

Attention: Catherine Dauvergne, Vice-President, Academic and Provost and Chair, SCUP

From: Wade Parkhouse, Vice-Provost and Associate Vice-President, Academic



Re: External Review Mid-Cycle Report for the School of Mechatronic Systems Engineering

Date: February 23, 2022

The External Review of the School of Mechatronic Systems Engineering was undertaken in March 2017. As per the Senate guidelines, the Unit is required to submit a mid-cycle report describing its progress in implementing the External Review Action Plan and the assessment of its Educational Goals. The update on the Action Plan has been reviewed by the Faculty Dean. The Senate Committee on University Teaching and Learning (SCUTL) has provided feedback to the Unit on the assessment of its Educational Goals. In support of the assessment of Educational Goals, a 120-page report from the Canadian Engineering Accreditation Board was forwarded to SCUTL. The recommendations from SCUTL will be incorporated into the Unit's self-study report for the next external review.

The following documents are attached for the information of SCUP:

- Update on the Action Plan
- Assessment of Educational Goals
- SCUTL's Feedback on the assessment of Educational Goals

c: John Zheng Shen, Director, School of Mechatronic Systems Engineering
Eugene Fiume, Dean, Faculty of Applied Sciences



MEMORANDUM

ATTENTION Dr. Catherine Dauvergne, VP Academic DATE November 1, 2021
FROM Dr. Woo Soo Kim, Acting Director PAGES 1/1
RE: MSE External Review Mid-Cycle Report (Deferred from 2020/21)

As a part of the external review process, the School of Mechatronic Systems Engineering (MSE) would like to submit a mid-cycle report on the progress of implementing the action plan and the assessment of educational goals. MSE's executive committee members including Director, Undergraduate Curriculum Chair, Graduate Program Chair, Space Chair, Academic Manager, and Laboratory Manager participated in drafting, collecting data, and assessing the educational goals together for the completion of the attached documents. We look forward to hearing your feedback.

Please find the following documents attached:

1. MSE_Mid-cycle report 2021
2. MSE_Educational goals assessment 2021

Feel free to contact me if you need any further information please.

Best regards,

A handwritten signature in blue ink, appearing to be 'Woo Soo Kim'.

Dr. Woo Soo Kim

External Review Mid-Cycle Report for the School of Mechatronic Systems Engineering

| Action | Progress Made |
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| 1. Programming | |
| 1.1.1 Undergraduate | |
| <ul style="list-style-type: none"> To revisit the current teaching load to ensure most efficient allocation of teaching. | There are currently 20 faculty members in MSE; except five teaching-stream faculty members, 15 are active researchers. Several faculty members have partial teaching relief either due to research or administration. We set up a rolling two-year teaching plan in summer 2021 whereby the teaching load of the next two-year window was negotiated with every faculty member. Through this system, we have developed an efficient, fair, and transparent method to distribute our teaching workload. |
| <ul style="list-style-type: none"> To facilitate eight-month co-op by creating a two-stream teaching plan (staggered offering of second and third-year courses). | We designed a five-year flex plan back in 2015 which allowed students to opt for an eight-month co-op as opposed to our regular four-month co-op. This plan is augmented by multi-offering key courses in first, second and third-year courses. Also, we have established understanding with the other two schools in FAS (ENSC and SEE) so that MSE students can take equivalent courses from either school. Therefore, students who go to eight-month co-op have much more flexibility to take required or elective courses at any semester. |
| <ul style="list-style-type: none"> To increase the TA allocation. | Thanks to our Dean, the TA budget has increased in the last two years, and we have managed to address the TA allocation for all our courses. From 2019 to 2021, for two years, TA budget allocation has been increased about 25% annually. Since spring 2020 and the current pandemic, our TA allocation has increased to address the need for more TA in remote mode of teaching. |
| <ul style="list-style-type: none"> To seek additional space for the undergraduate project teams and teaching activities. | The new Surrey engineering building (SRYE) is now operational and some of our undergraduate laboratories are relocated to the new building. So, MSE teaching labs are currently running in Surrey Central as well as new SRYE buildings. We have also managed to get additional space for capstone project teams in Surrey central building (SRYC). |
| <ul style="list-style-type: none"> To develop three specialization streams in the form of options. | Whereas we have significantly increased the pool of engineering elective courses in all Mechatronics engineering areas (around 20 courses) and allow students take approved 400-level courses in other engineering |

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| | <p>schools; we arrived at a decision to provide flexibility to students to take different courses as opposed to develop specialization streams or options. The key obstacle has been the accreditation as if we develop options, then they need to meet Canadian Engineering Accreditation Board (CEAB) specific accreditation units. In addition, specialization or option implies a further increase in our engineering elective courses. At the time, our teaching bandwidth is already stretched. Finally, the exceptional situation triggered by the Covid-19 pandemic has led to a halt in hiring new faculty members. Therefore, we will consider options again when we are able to hire new faculty members and when there is more clarity to allow us plan for a longer time horizon.</p> |
| <ul style="list-style-type: none"> In light of the above, to meet its teaching obligations, MSE's requires twelve (12) more faculty members. | <p>Since the inception of the MSE program, we have had to deal with tight budget and lack of resources. To be able to provide a much better environment for our students, we have advocated for more hiring in some of the emerging areas of Mechatronics and to augment the current specializations of our faculty. However, we are aware of the current constraints and understand that we should wait – even longer. This had limited the number of Courses being offered (elective and core) and required the hiring of sessional instructors and using Overload teaching contracts. When better conditions prevail, we must hire several new faculty members to be able to meet our teaching and research obligations.</p> |
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| 1.1.2 Graduate | |
| <ul style="list-style-type: none"> To address TA shortages. | <p>As mentioned above, the TA situation is improved and graduate students who are qualified to take TA responsibilities have ample opportunities to teaching assistantship in the school. From 2019 to 2021, for two years, TA budget allocation has been increased about 25% annually. This made TA salary increase and MSE TAship became fair by comparison with other schools in FAS.</p> |
| <ul style="list-style-type: none"> To improve the quality and quantity of research space (labs/offices). | <p>The new engineering SRYE building is now operational and several of our research labs have been moved to the new building. Eight MSE research faculty members moved their core research laboratories to the entire 5th floor research labs in new SRYE building.</p> |

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| <ul style="list-style-type: none"> To coordinate with FAS for the promotion of the graduate program. | <p>Through coordination with Associate Dean – Research, we have managed to promote our graduate program nationally and internationally. We need to continue this effort specially for recruiting talents domestically.</p> |
| <ul style="list-style-type: none"> To plan on offering more 800-level graduate courses (through the hiring of additional faculty members). | <p>We have added two new 800 level courses to MSE, which are required for MSE graduate students: 1) MSE802 Research Methods, 2) MSE804 Research Seminar</p> <p>These courses provide a critical introduction to hypothesis driven research, safety, ethics and research communication. In addition, this core and required courses provide the opportunity to students to interact across departments and build the graduate student community in MSE.</p> <p>We have added seven new 800 level technical courses. However, our teaching bandwidth cannot sustain regular offerings of these courses without additional faculty hires. The limited course offering continues to be a shortcoming of our graduate program and needs urgent attention.</p> |
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| <p>2. Research</p> | |
| <ul style="list-style-type: none"> MSE will receive three lecturer positions to meet its teaching shortfall and additional nine tenure-track faculty members as described in the MSE Self-Study document. | <p>The need for reinforcement of our faculty members has been well documented and discussed in the last few years. We managed to hire three Lecturers, one in electrical engineering and the two in the mechanical entering area, in the last two years. However, we had no chance to hire any tenure-track assistant professor after 2017. But two senior tenured research stream faculty members were added to MSE in 2019 and 2022, respectively. It should be noted that we lost one tenured faculty member and one lecturer 2021 Spring. So, the continuing faculty lines in MSE have increased from 18 FTE in 2016/17 to 22 FTE in 2021/22. We need to increase it close to 25 FTE in a few years to keep rolling our program initiatives such as new Industry 4.0 Professional Master program, and Agritech program etc.</p> |
| <ul style="list-style-type: none"> MSE will receive additional space through internal allocation (FAS) and the new SEE building. | <p>We have acquired additional teaching and research space in the SRYE building as detailed above. Specially, addition of research spaces on 3rd floor of new Surrey Engineering building (SRYE) made majority of research space requirement of MSE faculty members.</p> |

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| <ul style="list-style-type: none"> According to the original building plan, it is expected that MSE will receive the 5th floor or equivalent space in the new building. | <p>Six research areas with eight research faculty members in MSE completed moving to 3rd floor of SRYE building. Research laboratories in SRYE includes Advanced Manufacturing, Bio-mechatronics, Micro/Nano Fabrication & Characterization, Power Electronics, and Smart Control Research labs.</p> |
| <ul style="list-style-type: none"> Three of MSE faculty members have received research lab space at the PowerTech facilities. | <p>Research space in Powertech is spacious and equipped with required fume hoods in the industrial environment. From 2017 to 2020, three MSE faculty members deployed their students and postdocs to Powertech labs. Unfortunately, there are issues such as 1) student safety issue for commuting in the remote industrial area, 2) student mental problem issue because of detachment from the main campus, 3) work safety issue due to frequent explosion and chemical experiments in Powertech etc. Therefore, FAS and MSE administration decided to bring back those labs to SRYE building, and only the industrial scale experiment-related research activities remained in the Powertech facility currently.</p> |
| <ul style="list-style-type: none"> MSE will receive the Neurotech lab at Surrey Memorial Hospital. Space was promised to a faculty member with a Research Chair who is recently recruited by MSE. | <p>This has happened as planned with the support of MSE.</p> |
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| <p>3. Administration</p> | |
| <ul style="list-style-type: none"> The School agrees with the salary concerns raised in the ER. However, those should be addressed separately through the FAS Dean. | <p>This will be discussed and addressed separately through the FAS Dean's office.</p> |
| <ul style="list-style-type: none"> MSE requires hiring twelve tenure-track faculty members as described in the MSE Self-Study document. | <p>Currently, there are 20 faculty members in MSE. Two more faculty members will be added in Spring 2022 (new Director and new Lecturer). Based on self-study, we require at least three more research faculty members urgently to reach self-sustaining critical mass for teaching and research portfolio such as new Professional Master program and Agritech program, etc. As mentioned above, However, we are aware of the current constraints and understand that we should wait. When better conditions prevail, we must hire several new faculty members to be able to meet our teaching and research obligations.</p> |

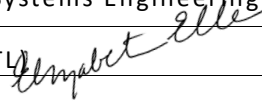
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| <ul style="list-style-type: none"> Resource & Financial Clerk (AS) – Budget, purchasing, assists faculty in grants monitoring (A limited term position already in place). | <p>FAS helped to hire MSE new staff members such as new grad admin and new front desk clerk through 2021-2022. However, there's no progress for hiring the dedicated staff assisting research faculty on financial administration. As a temporary fix, a limited term clerk was hired for 12 months in 2018.</p> <p>We require to pursue with hiring one continuing Clerk position with main function concentrated to the assistance in financial administration of research projects and departmental accounts. Also, we need to hire one continuing CUPE Secretary/Clerk position to assist in the administration of the new Professional Master Program (Industry 4.0).</p> |
| <ul style="list-style-type: none"> Mechanical and Electrical Laboratory (Instructional Labs) – addressing the mechanical and electrical teaching laboratories and machine shop teaching activities (two limited term positions have been approved). | <p>The job description of the full-time lab engineer position is prepared to add more duties and it is currently under review by HR.</p> |
| <ul style="list-style-type: none"> Electronics Technician (TS) – addressing the PCB manufacturing lab, the electrical and electronics teaching labs (already approved). | <p>Electronics Technician has been appointed and he is currently working full time.</p> |
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| <p>4. Working Environment</p> | |
| <ul style="list-style-type: none"> Providing proper space (bio-safety certified) for three faculty members who had to move some of their equipment to Burnaby campus. Also, the current biomedical research space will be appropriated to the Fraser Library. MSE needs 4250 sq. ft. of suitable space for its biomedical research, which is expected to take place after internal FAS space reallocation. | <p>Room SRYE 2024 (800 sq ft) is certified for biosafety for use by those members who dedicate themselves to bio-mechatronics (managed by FAS) as well as others on a need-to-use basis.</p> <p>Also, those members with bio-mechatronics specialty have relocated their research equipment that does not require bio-safety certification to SRYE 3046 (1400 sq ft).</p> <p>We have addressed the immediate space needs for biomedical research in Surrey.</p> |
| <ul style="list-style-type: none"> Providing adequate space for two research chairs. One CRC chair is in short of 1400 sq. ft. research space, and the other one currently has no research space. | <p>There are two Canada Research Chairs in MSE. Both members have spacious research labs in SRYC (2000 sq ft) and SRYE (1400 sq ft), respectively.</p> |

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| <ul style="list-style-type: none"> • Providing proper office space for MSE faculty members. Currently, the MSE faculty member offices are scattered on the 4th floor of the Surrey campus building. The total office spaces required for the current number of faculty members and staff is around 2700 sq. ft. The school's office space needs should be addressed after the internal space re-allocation, and through the SEE building. | <p>Nearly all existing MSE Faculty are to be moved to the east corridor of SRYC building in offices that were used by CS. We will have adequate space for existing faculty after the renovations in this area are completed.</p> |
| <ul style="list-style-type: none"> • MSE Capstone lab space is shared with 5 of our undergraduate design courses. Moreover, the space for the capstone lab is small and has to be scaled up by 1.5 of the current space. The current space is 1270 sq. ft. We are targeting for 1905 sq. ft. for the new capstone lab. The current space can be fully allocated to the undergraduate design courses. • Mechatronic Design II space is currently shared with two other undergraduate control courses. That course has open labs and is constantly occupied by students. MSE needs to double the space to separate the other two courses from the Mechatronic Design II. That means MSE needs additional 1106 sq. ft. | <p>We have moved the Capstone lab to a new room in SRYC with an area of 1200 sq ft. This space is shared between Capstone, and Mech Design I course. Ideally, we want to separate the two from each other, potentially having a dedicated large space for Mech Design I course.</p> <p>Mech Design II lab has been moved and we have increased the number of benches from 20 to 22. However, we are still sharing this lab with other courses that only require the computers. We need to schedule those labs in other rooms or computer labs across the two buildings (SRYC and SRYE).</p> |
| <ul style="list-style-type: none"> • Siemens certification program has no dedicated space for equipment. MSE needs minimum 1300 sq. ft. to run the program. | <p>We have assigned a 900 sq ft room currently to the Siemens program although the program needs minimum 1300 sq. ft. So, currently, it has no dedicated space for equipment. we are still short of space as the room does not accommodate all the equipment and additional space will be needed. Therefore, we are planning to provide additional space by combining the current space with the lab adjacent to it during the upcoming renovations.</p> |
| <ul style="list-style-type: none"> • Mechatronic Design I shares a lab with three other courses. This lab is occupied almost full time by Mechatronic Design I students since it is an open lab. It is difficult to run the other courses concurrently in that space, and it affected the quality of teaching at those labs. MSE needs 900 sq. ft. additional space to separate these labs. | <p>We have increased the number of benches from 16 to 26 by sharing resources between Capstone and Mech Design I lab. The current arrangement is not ideal as in the falls we are scheduling Capstone 1 and Mech Design I at the same time. Moreover, a minimum of 2 TAs is needed to supervise the labs in two rooms.</p> |

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| <ul style="list-style-type: none"> Electric and Electronic Circuits lab is currently used by eight courses. The room capacity is inadequate and has to be expanded. For some of the courses such as Digital Logic and Real-Time Embedded Systems, we have open labs. We need to separate the labs for some of these courses. The current lab is 900 sq. ft., and it should be increased to 1350 sq. ft. The new lab should also have the same 1350 sq. ft. | <p>This lab is now moved to SRYE and uses shared space with some courses in SEE. The number of benches is the same (18 benches). Four courses use this new lab (instead of the former 8).</p> |
| <ul style="list-style-type: none"> Thermodynamics and Heat Transfer lab is very small (470 sq. ft.) and we cannot allow more than 12 students during each session. This has created a lot of problems for managing the labs, and it also added to our TA problems since the labs cannot run without TAs. The other issue is safety, due to the running of a diesel engine in an enclosed space. MSE needs this lab to be entirely moved to a proper location and expanded to 1,000 sq. ft. to accommodate more students. | <p>This lab is now moved to SRYE 1056 (thermo-fluidics lab) and SRYE 1046 (Energy lab). We can accommodate additional students between these two new labs.</p> |
| <ul style="list-style-type: none"> MSE originally had a computer lab, which had to be dismantled to address other critical teaching needs of the program. Currently, we are using the campus computer labs, which have half the capacity of our original computer lab. Therefore, we need to book two computer labs at the same time at two different locations of the Surrey campus. This has created many problems for our Instructors and TAs because they have to teach students in the computer labs and cannot be at two rooms at the same time. The other issue is booking those labs. We have to book these rooms one or two semesters before the course begins. MSE requires 2,200 sq. ft for having a computer lab. | <p>MSE presently does not have its own computer lab. We presently use shared computer labs in SRYC and SRYE that are managed by the university to meet our computing needs.</p> |
| <ul style="list-style-type: none"> The MSE Instructional and Teaching Machine Shop (IRMS) is currently shut down by WorkSafeBC because of improper ventilation, exhaust, and dust filtration. Also, the lab is too small | <p>The equipment that used exhaust and dust filtration has been moved out of this shop to SRYE (another Engineering building where the lab infrastructure can accommodate such an equipment. In addition, the shop is moved to another space for now. A bigger space (1,500 sq. ft) is planned</p> |

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| and cannot accommodate more than six people. MSE requires a 600 sq. ft proper space to run this lab again. | to be the new space for this shop where it can accommodate larger number of students than the older space. |
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| 5. Co-op | |
| <ul style="list-style-type: none"> Require better support from Co-op (Both grad and undergrad). | We have a good working relationship with the co-op office. Although, as a school with more than 500 students and mandated co-op program, we require dedicated co-op staff who work exclusively with the MSE in order to make sure various co-op services are provided to MSE students. |
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MEMORANDUM

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| ATTENTION: | Woo Soo Kim, Associate Director, School of Mechatronic Systems Engineering |
| FROM: | Elizabeth Elle, Vice-Provost, Learning & Teaching (for SCUTL)  |
| RE: | MSE Mid-cycle Educational Goals Assessment |
| DATE: | February 24, 2022 |

The Senate Committee for University Teaching and Learning has recently been charged with providing feedback to units in their mid-cycle assessment of Educational Goals. As the School of Mechatronic Systems Engineering (MSE) is accredited with the Canadian Engineering Accreditation Board (CEAB), you already have high standards to meet. We therefore asked you only to provide some context to the large report you had previously prepared for CEAB (attached for the benefit of the Office of Academic Planning and Quality Assurance).

The graduate attributes you have adopted from CEAB are excellent choices to use as educational goals. You have clearly done a significant amount of work to collect appropriate data to assess them. You have also identified some gaps; some graduate attributes are being regularly assessed and others are not. We look forward to learning more about how you will expand your assessment efforts to include all attributes. If allowed through the CEAB process, we encourage you to explore assessment methods beyond grades attained, which are only a very rough indicator of achievement of your specific graduate attributes. If you plan to do so, the [Learning Experiences Assessment and Planning](#) (LEAP) Office can assist you. For example, you may want to develop specific rubrics to use within courses to better understand how course assignments link to attributes, as it's not very likely that an entire course maps neatly onto a specific graduate attribute. You may also wish to add some indirect measures of assessment such as surveys—have your students tell you what they have achieved, relative to your graduate attributes.

Additional items for you to consider as you approach your next accreditation deadline, and your next external review, include the following. For the internal SFU audience, explaining your “measureable indicators” and how you have modified your assessment tool will be key. It would additionally be useful to provide a brief overview (a few sentences) on which attributes your students were relatively stronger or weaker in and your interpretation of next steps. Including more specific information about what you've learned through the required CEAB assessments how this has led to improvements in your program will be incredibly useful for CEAB, MSE, and for SFU. Essentially, a narrative approach will help explain the large amount of data you've compiled will help the university better understand and celebrate your successes.

Thank you again for expanding on your mid-cycle assessment progress and please reach out if we can support your further efforts.



MEMO

Date: February 22, 2022
To: Dr. Elizabeth Elle, Vice-Provost and Associate Vice-President, Learning & Teaching
From: Dr. Woo Soo Kim, Associate Director, School of Mechatronic Systems Engineering
Re: CEAB result as an assessment of MSE's Educational Goals

As a part of the external review process, School of Mechatronic Systems Engineering (MSE) submitted this memo summarizing MSE's Educational Goals assessment with twelve student outcomes (*See Figure 1.1.3 in page 6 of the attached pdf*), prepared for the Canadian Engineering Accreditation Board (CEAB)'s accreditation. MSE's accreditation document was prepared through collective efforts of all faculty members in the school together with MSE's academic manager and lab manager.

MSE has been very successful in generating research and providing high-caliber education to students whose resultant knowledge is in high demand within a variety of engineering fields. MSE program was designed on the premise that the industry of the twenty-first century demands engineers with distinctive attributes. It trains engineers who have a solid background in mathematics and natural sciences and have had core courses in the two main engineering disciplines of electrical and mechanical engineering. Students are further trained to think systematically as problem solvers and designers with sound project management training, aware of safety, ethics of the profession, and knowledge into coherent system/product design. This is demonstrated by recent employment of our graduates to those innovative companies such as Apple and TESLA.

MSE's curriculum was redesigned in accordance with the outcome-based pedagogy since fall 2015. We adopted CEAB's Graduate Attributes, which meet the quantitative curriculum content based on accreditation unit (AU) covering five categories of MATH (M), Natural Sciences (NS), Engineering Science (ES), Engineering Design (ED), and Complementary studies (CS). It also follows outcome-based format to address CEAB graduate attributes (*See Figure 1.1.3 in page 6 of the attached pdf*). We have ensured a sensible integration between the quantitative and content-based curriculum with CEAB graduate attributes (*See Figure 1.14.1 and 1.14.2 in page 108 and 109 of the attached pdf*). We focus on graduate attributes and developing measurable indicators to ensure meeting CEAB requirements.

MSE program is accredited by the CEAB until 2026. As with any engineering program in Canada, MSE is required to adhere to the CEAB guidelines strictly, to maintain its accreditation. The CEAB visits all engineering programs in Canada once every three years. The CEAB Team visited MSE in 2011, 2014, and 2019 respectively. At its inaugural visit by the CEAB Team, the program was accredited until 2014. The second visit was in 2014 and led to the extension of the accreditation for three years. In their last visit in 2019, CEAB decided accreditation for 6 years. In the decision letter dated June 25, 2020, the CEAB extended the program accreditation to 2026 without a need for a visit. MSE Program is one of the few programs in Canada that was granted a six-year accreditation during the time that CEAB requires a transformation of all engineering programs to Outcome-based pedagogy. The renewal of MSE accreditation without a visit to the unit is a demonstration that CEAB views that MSE program complies fully with its academic accreditation criteria. CEAB recommended us a few things. For example, they recommended to improve the assessment tool which requires to be developed by assessing each attribute with a single assessment instead of aggregate of several attributes. MSE is intending to review those areas of weakness that were raised and to ensure the quality of our program and future Accreditation.

Thank you.

Woo Soo Kim