

University of Regina
Academic Unit Review
Faculty of Engineering and Applied Science

Report of the Review Committee (Research, Graduate Studies and Services)

Following a Site Visit Conducted on
May 6-7, 2019

Rehan Sadiq (Committee Chair, External)

Professor of Civil Engineering
Executive Associate Dean | School of Engineering
Faculty of Applied Science
University of British Columbia

Michele Oliver (Committee Member, External)

Professor of Biomedical Engineering
School of Engineering
College of Physical & Engineering Science
University of Guelph

Zisis Papandreou (Committee Member, Internal)

Professor of Physics
Department of Physics
Faculty of Science
University of Regina

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Executive Summary

Workload Management

- The Faculty is young, having recruited several new members in the last few years. High workloads (teaching, MEng and Capstone supervision) may have resulted in various challenges resulting in low morale. The Review Committee (RC) has made several suggestions that would ameliorate this situation and allow the Programs to carry out forward and strategic planning. These suggestions will require modest financial resources.

Graduate Students Teaching and Learning

- There is a healthy number of graduate students, well balanced across the three graduate degree programs. The relationships between students and faculty members are collegial and respectful, however, students feel that they are not empowered and need more financial support.
- Students were generally not happy with the number of course offerings. The Committee recommends that the faculty should take advantage of *Western Canada Dean's Agreement* that allows students to take approved online courses for credit.
- The graduate student population should be diversified to include more domestic, international (from more countries), Indigenous and female students. Rebranding Petroleum Systems Engineering and modifying the name of Environmental Systems and Electronics Systems Engineering could help in this respect.

Space Challenges

- Space (research labs, student offices) pressure is acute. The RC recommends creating and promoting a culture of shared/swing spaces. More graduate students could be accommodated in the GHG building. Prioritizing desk spaces for research-based students should be continued until a new building which contains adequate space is obtained.

Research Programs and Institutes

- The faculty has three research chairs, pockets of excellence, had a very successful year with NSERC Discovery grants, and puts Mitacs to very good use. A full-time Mitacs Coordinator at the UofR would enhance the latter endeavours. A business development person/fundraiser hired on a cost recovery basis could help increase research funding by facilitating relationships between faculty members and industry.
- The RC recommends that the ADR role be mandated to include "Research and Industry Partnerships". The ADR should be relieved of day-to-day management of the MEng Program and a position for a Professional Programs Coordinator (any current faculty member) created to facilitate this change.
- The university should consider creating an Advisory Board comprised of UofR CRCs to provide counsel on university research directions.
- The RC recommends the rebranding of Petroleum Systems Engineering to improve the Program's image and help with student recruitment.

Service & Staff

- The administration, faculty and staff were friendly, collegial and collaborative, both within and across programs. Communication to faculty continues to be an issue, despite very good efforts from the Dean and his group. The RC recommends mentoring of new faculty, which, over time and with retirements, should help create a more research-driven and collaborative environment in the FEAS.

Financial Resources

- The Faculty generates a healthy amount of revenue. The RC recommends increasing the proportion of revenue returned to the unit. This could be used to help with workload (teaching relief), research and new building fundraising (hiring a Business Development Officer) and Indigenization (hiring an Indigenous Program Counsellor).
- Programs have industry advisory boards, and concerted efforts should be made to engage industry partners and alumni that can help in fundraising efforts for a new engineering building.
- FEAS hosts two research institutes (Institute for Energy, Environment and Sustainable Communities and the Clean Energy Technologies Research Institute). The institutes are world leaders in environmental-related research and in carbon capture technologies bringing in significant funding and overhead to the university.
- FEAS is heavily involved in the Petroleum Technology Research Centre and through this involvement they have developed fruitful research relationships with a number of international universities.

Fit to University Strategic Plan

- The faculty aligns with the UofR's Strategic Plan in its general tenets, such as educating engineers for the future to positively impact on communities and Industries, and to engage in research that supports learning, industry and entrepreneurship. The Faculty has a laudable number of citations in the "Clean Energy" and "Environment/Ecology" sectors.
- The current FEAS strategic plan does not deal specifically with trying to increase the proportion of female faculty members. Attempts to attract Indigenous faculty members have been unsuccessful.
- Most of the FEAS programs do not align specifically with the research clusters mandated in the University Strategic Plan. An engineering faculty member should be on the UofR's Strategic Planning Facilitation Team. Each Program needs to complete their strategic plan as soon as possible.

Table of Contents

1. PREAMBLE	5
2. REPORT FORMAT	5
3. WORKLOAD MANAGEMENT.....	6
4. GRADUATE STUDENTS TEACHING & LEARNING	8
5. SPACE CHALLENGES	12
6. RESEARCH PROGRAMS & INSTITUTES	13
7. SERVICE & STAFF	14
8. FINANCIAL RESOURCES	16
9. FIT TO UNIVERSITY STRATEGIC PLAN.....	17

1. Preamble

The Review Committee (RC) for the University of Regina's Faculty of Engineering and Applied Science's (FEAS) Graduate Program consisted of two external reviewers, Rehan Sadiq, Executive Associate Dean and Professor, School of Engineering, University of British Columbia, and Michele Oliver, Professor, School of Engineering, University of Guelph, while the internal reviewer was Zisis Papandreou, Professor of Physics from University of Regina.

The RC was provided with the following documents: i) FEAS Self Study, ii) Data on Course Enrolments, Convocation through 2018, Spending, Tuition, Research Revenue and Teaching, and ii) Key University of Regina (UofR) Documents (Strategic Plan, Budget, Annual Report, Registration Statistics, Policies, etc.). The Self Study included sections on Background, Faculty Mission, University Strategic Plan and Strategic Research, Programs Offered, Staffing, Resources, Research Output, Community Service Initiatives, Unit Budget, Key Points from SWOT Analysis, Indigenization, Faculty short CVs, Enrolment of Undergraduates since 2012, Program Credit Requirement Info, and Graduate Course Descriptions. The information provided in the above documents was helpful, however, the RC found that the SWOT analysis carried out by FEAS lacked sufficient details and in-depth analysis.

The RC carried out a site visit of FEAS on May 6 and 7, 2019. The site visit included meetings with Senior Academic Administrators of the University, the Dean's Executive Group (DEG) from FEAS, with Program Chairs (on the first day) and Program Chairs plus members (on the second day), CRC Chairs, the Associate Dean of FEAS, a Mitacs representative, a representative of the Saskatchewan Research Council Petroleum Technology Research Centre, a representative of the International Mineral Innovation Institute, former and current graduate students, and had a meet and greet social with faculty and staff. The RC was given tours of the Institute for Energy, Environment and Sustainable Communities, Petroleum Systems Engineering Labs, and the Clean Energy Technologies Research Institute. The itinerary for the RC's site visit can be found in Appendix A.

The RC wishes to express its gratitude to all members of the FEAS and the UofR's senior administration for a well-organized site visit, for being forthcoming in answering the committee's queries, and explaining details of the research and graduate programs as well as the resource constraints and challenges of FEAS within the University's budget.

2. Report Format

The RC have addressed the following topics:

- Workload Management
- Graduate Students Teaching and Learning
- Space
- Research Programs and Institutes
- Service and Staffing

- Financial Resources
- FEAS Fit to the University's Strategic Plan

Each topic was addressed in a SWOT format. Within each topic, the RC followed the University of Regina's Academic Unit Reviews policy and review of the following areas where applicable.

- The priorities and aspirations of each unit and the extent to which they are being realized
- The challenges and opportunities faced by the unit
- The structure and quality of graduate programs and instruction
- The contribution of each program to related disciplines and fields of study
- The scope and significance of research being pursued
- The degree to which academic programs meet students' learning needs and goals
- The characteristics of staffing complements
- The degree to which the unit is meeting its service responsibilities
- The role the unit plays in meeting the University's vision, mission, goals and priorities
- The financial resources of the unit

Finally, the RC summarized its report in terms of observations and recommendations.

3. Workload Management

3.1 Strengths

- The Faculty is young, having recruited several new members in the last few years (faculty members increased from 37 to 45 since 2014, a year after the current Dean took office) even during tight budget years, likely because the University administration was responsive to success in student enrolment and generally well run programs.
- Faculty retention seems to be high.
- The RC was impressed with several of the young members¹ and particularly by Dr. Jia, whom the RC found quite enthusiastic and hospitable while demonstrating a strong collaborative spirit towards other faculty members.
- Teaching seems to be valued the most amongst the Electronics Systems Engineering program.

¹ It would have been interesting for the RC to meet with all young members as a group, but this was not planned. The RC advised the Provost to do so for future academic reviews.

3.2 Weaknesses

- The teaching loads for regular faculty are 4 per year (generally comprised of 3 undergraduate and 1 graduate courses) and 2 + 1 per year for the CRC's. Faculty members worked on a Teaching and Research Optimization Committee (TROC) plan in 2016, but their recommendations were not implemented. That report included references to studies by the Higher Education Quality Council of Ontario and Queen's University Engineering School, which concluded that the typical teaching load for a research active professorial position is 3 classes in total per year. Normally, this means two undergraduate and one graduate classes per year. Capstone design groups with only 2-3 members increases the teaching load unnecessarily. Also, teaching does not seem to be valued and pedagogical research is not counted towards research for tenure and promotion.
- There is a suggestion to increase the CRC teaching load from 2 courses per year to 5 courses every 2 years.
- High workloads may have resulted in differential enthusiasm levels between programs:
 - Some programs seemed to have difficulty identifying where and what they would like to be in 5 or 10 years, which greatly inhibits strategic planning efforts.
 - Petroleum and Environmental Systems Engineering members seem to be less affected and more optimistic. Petroleum Systems Engineering has well defined and sustainable plans, which might not be realistic based on available resources and the oil & gas market.
 - Electronics Systems Engineering members seem to be particularly pessimistic and demonstrate low morale mostly due to their lack of success with NSERC Discovery grants. This group was particularly hopeful that this review would help them establish a clear direction, but they are not as advanced in forward planning as the other programs.
- Each faculty member has on average of 7 graduate students which is reasonable but this includes non-research based students (i.e., MEng students) who are likely not as productive from a research output perspective.

3.3 Threats

- Faculty members' morale is low, particularly in Electronics Systems Engineering. There is a general passivity and feeling of not being in control of their own destiny, on research (direction, fit to the UofR-SP) as well as teaching (load).
- There is pressure to be successful without adequate resources (i.e., time, space, funds). This could affect faculty and staff wellness and retention adversely.

3.4 Opportunities & Recommendations

One of the major challenges identified almost uniformly by all faculty members was around the 3+1 teaching load and some service related concerns in supervising numerous Capstone projects. The RC believes that without adding too many financial resources, the morale of the research active faculty can be significantly improved by considering the following:

- **Student Numbers:** FEAS seemed to achieve the right size in terms of UG student numbers and now needs to consolidate. UG enrollment should be kept stable for the time being until new resources become available. In the meantime, increase the class size of certain courses and give double credit to instructors who teach these courses. If possible, also consider synergies and make changes to achieve 1.5 years common for UG programs, which will reduce the overall number of courses taught and can significantly impact the workload and release pressure on the system. Increase Capstone project group size from 2-3 students to 3-4 students, which is the norm at other Canadian universities offering engineering programs.
- **Provide Incentives:** Incentivize individual researchers based on number of research students supervised, high quality publications and funding success (\$) in Tri-council as well industry research contracts. Consider giving a one-class teaching relief to a top performer in each program (not including CRCs and Program Chairs) on a yearly basis. It will create a very healthy competitive environment in the Faculty and significantly boost morale. It should not be a significant financial burden as it will require allocation of 5 different courses to sessional/instructors. It is anticipated that some of this cost can be recovered through increased research overhead.
- **CRC Teaching Loads:** The teaching load puts stress on CRC renewal. Allow buy-out for one UG course to Research Chairs. Currently, FEAS has two CRCs and one industry research chair. Such measures will help highly productive researchers to do even better.
- **Marketing and Business Development:** Currently, no marketing or business development services exist in FEAS. A dedicated full-time new position in this area could be very helpful for FEAS revenue growth.
- **Electronics Systems Engineering:** It was mentioned that Electronics Systems Engineering were promised a Tier II CRC which subsequently did not materialize. This should be made the highest priority of FEAS if a CRC Chair becomes available to the Faculty, which might infuse new blood and enthusiasm (and possibly vision of what they would like to become). Investigate whether a name change for Electronics Systems Engineering might help address their perceived issue of disfavor by their NSERC Evaluation Group.
- **FEAS Strategic Planning:** Bring in a facilitator to help with FEAS strategic planning.

4. Graduate Students Teaching & Learning

4.1 Strengths

- There is a healthy number of graduate students almost equally distributed across the three programs (MEng ~86, MASC ~80, PhD ~80), which appears well-balanced to the RC. Their ranks have domestic but mostly international students. There is a mechanism for scholarships through base funding transferred from FGSR to FEAS, as is the process for all Faculties at the UofR.
- As far as student (both undergraduate and graduate) numbers are concerned, the Faculty numbers have increased substantially since 2012-13 (undergraduate course enrolments went from 16,990 to 25,432, graduate course enrolments went from 806 to 1342, graduate convocations increased from 69 in 2013 to 102 in 2018). These changes resulted in a

significant increase in FEAS revenues (tuition generated went from \$4.3M in 2014 to \$7.0M in 2018).

- Enrolments increased in all FEAS programs, from the lowest increase of x1.06 in Environmental Systems Engineering to the highest x7.2 in Software Systems Engineering and x8.8 in Process Systems Engineering.
- Over the last few years the MEng student numbers increased consistently and significantly.
- International graduate student tuition fees are low and competitive.
- The relationships between faculty members and graduate students are collegial and respectful. Supervisors generally provide financial support for conferences. Professors frequently meet with grad students to check research progress.
- Overall, the graduate students feel they receive positive help and support from ADR's office.
- The graduate student group that the RC met was reasonably well-organized. The international student group is very diverse.
- Female students feel comfortable within their ranks.
- Electronics Systems Engineering has created cross listed courses at the 400-600 level.
- Petroleum Systems Engineering has organized events like PSE week. They have also created an interesting course on carbon management.
- FGSR offers regular workshops in communications and writing. Mitacs also offers professional development workshops for graduate students and faculty. TLC offers TA workshops (two-day sessions). FGSR is planning more career services to students and an emergency bursary.
- The Engineering Graduate Student Association (EGSA) overall role is very positive. It arranges social events and workshops for the students. Professors also show up to student events. The Dean's office provides partial support; however, it was pointed that sometimes it takes a long time to process the claims.

4.2 Weaknesses

- There are no mainstream engineering programs (as far as the program titles are concerned), which makes it hard for prospective students to understand the programs that FEAS offers as compared to other engineering schools in Canada. Specifically, prospective students don't understand the "systems" approach to each of the programs.
- Some programs indicated that they are not able to attract high quality students (primarily Software and Electronics Systems Engineering).
- Office space, computer availability and ability to print hard copies of documents is limited.
- The graduate student group that met with the RC was not generally happy with quality of courses offered by the Faculty. Students noted that common program courses are too basic and generic. In addition, they felt that there are limited graduate course options, requiring some students to take Geology, Chemistry, and Mathematics courses to meet the program requirements. It was also pointed out that some graduate classes are very large.
- Most programs have very few domestic students, which is similar trend seen at other universities.

- Communications are somewhat limited within the EGSA, and between the Engineering GSA and the rest of Faculty.
- Students feel that they are not empowered and feel that they need more FGSR support.
- Student funding is on the lower side and depends primarily on faculty research grants, thus limiting the number of research-funded graduate students that can be accepted. Specifically,
 - a. Teaching assistantship values are quite low. In 2018, graduate students received a total of \$536,286 in scholarships and awards including \$340,403 provided by the FGSR in the form of Graduate Teaching Assistantships (GTAs). The faculty contributes \$236,846 in additional funding for graduate students as TAs for marking and other duties. This funding has almost doubled since 2012, which compares favorably to the national average (46% of budget on internal scholarships/TAS versus 41.5% nationally).
 - b. Funding available to graduate students has not increased lately.
 - c. There is no guaranteed graduate funding beyond one year, which creates a feeling of uncertainty among students, particularly international ones.
- There is an insufficient number of technicians to provide research support in the laboratories and their priorities are mainly around undergraduate teaching.
- There is not enough industry interaction and cooperation which makes students feel isolated. The feelings of isolation are further exacerbated by not having bus service to Saskatoon.
- FGSR has no firm mechanism to deal with student-advisor conflict, but rather deals with it on a case-by-case basis.

4.3 Threats

- No minimum funding levels for graduate students forcing many students to seek off-campus employment often resulting in increased time to completion.
- There appears to be a reliance on international graduate students from a select number of countries (China – 24%, India – 22%, Nigeria – 11%, as compared to only 12% domestic students). This is prone to large enrollment fluctuations when Canada has diplomatic squabbles with those countries (e.g., Saudi Arabia, China).
- There is a perception of a lack of ability to compete with University of Saskatchewan Engineering (UofS). As one example, the competition/threat for Environmental Systems Engineering is the UofS Civil, Geological and Environmental Engineering program.

4.4. Opportunities & Recommendations

With the growth of the undergraduate programs, FEAS has also seen an unprecedented students' increase in both research-based and professional programs. Based on the problems identified by the faculty, staff and graduate students, the following recommendations are made:

- **Graduate Course Offerings:** As the overall number of graduate students have reached approximately 250, the need for more specialized courses have been identified. UofR is a member of *Western Canada Dean's Agreement* which allows graduate students to take

courses from other universities for free. It is recommended that FGSR should coordinate and explore options for video conferencing of specific graduate courses which are high in demand but not offered at UofR. In addition, FEAS should also work with other Faculties on campus (especially Science) to jointly offer courses of common interest.

- **Graduate Student Funding:** It was observed that the number of grad students/research faculty is similar to the rest of Canada. Moreover, the funding of research students in FEAS is also close to Western Canadian Universities, but it is lower than the rest of Canada (\$11.1k versus \$16.0k per student). To be competitive in research output, an effort should be made to ensure a minimum funding model to attract and retain top quality grad students, especially at the PhD level.
- **Domestic Students:** Currently, almost 80% of the graduate students in the Faculty are international, and therefore not eligible for NSERC student scholarships. Like any other engineering school in Canada, FEAS has similar challenges in attracting domestic students for MAsC and PhD. FEAS should consider a 4+1 fast-track Masters Program to attract more domestic students to research-based degrees. Where permitted, also consider developing more mainstream academic programs to allow Regina to compete with University of Saskatchewan.
- **International Students:** Diversify countries that students are recruited from. This should be part of the international recruitment strategy. Consider a PhD partial tuition waiver for international students. To avoid ethnic segregation, FEAS should frequently organize cultural programs.
- **Graduate Student Empowerment:** Consider adding a PhD student to all hiring committees including faculty and staff. A students' representative should be invited to Faculty Council as non-voting members to improve communications.
- **Professional Masters Program:** There is a growing interest in attracting international professional Masters Students, which bring extra revenue for the University and FEAS. This should only be expanded when appropriate support is available.
- **Re-Branding of Petroleum Systems Engineering Program:** Overall, petroleum engineering programs in Canada are facing challenges in terms of low enrollment, however, this is not true in terms of research activities. The FEAS program has recently expanded to include up-mid- and downstream aspects. Nevertheless, this program should use this downturn as an opportunity to re-brand and re-market itself as "Energy Systems Engineering" to attract a wide-range of students both at UG and graduate levels. If the re-branding is done properly, it can attract many international students as well as other diverse groups including female and Indigenous students.
- **Environmental Systems Engineering Program:** This group feels that it cannot change its program name to "Environmental Engineering" citing a potential conflict with the UofS (its name is "Civil, Geological and Environmental Engineering") and that the provincial government may oppose such a change. Another possible name is "Environmental and Water Resource Engineering", based on the program's current curriculum and research.
- **Collaboration with other Faculties:** Closer cooperation between Software Systems Engineering and the Computer Science department on the 'Digital Future' cluster is recommended, particularly in Machine Learning and AI areas.

5. Space Challenges

FEAS allocated space for research graduate students' activities is on the lower side as compared to other Canadian Universities. Finding graduate student desk space as well as research space for the new faculty has been a serious challenge for the FEAS, which adds frustration and impact morale negatively for both grad students as well as faculty members.

5.1 Strengths

- There are separate undergraduate and graduate labs.
- Some research spaces have been utilized quite well albeit oversubscribed.
- There is an MEng student room with 4-6 desks with computers.

5.2 Weaknesses

- All types of space including research labs, grad student desks, social interactions, etc. are lacking. Labs and office space in terms of space/FTE student are 2.2 and 1.1 compared to the national average of 5.0 and 2.7. Students often work from home as a result. 7-8 faculty members share three labs, that includes dozens (~50) graduate students. Use of existing space does not seem to be optimized.

5.3 Threats

- Dissatisfaction and low morale of research students.
- Failure to resource growth of graduate programs adequately.

5.4 Opportunities & Recommendations

FEAS is in dire need of a new building, however, it will take at least 4-5 years to materialize. In the meantime, to meet growing needs, the following recommendations can ease the pressure:

- **GHG Building:** Explore the opportunity to accommodate more graduate students in the GHG building.
- **Swing Space:** Find and promote swing spaces for the whole Faculty, which should not be allocated permanently to a professor but rather be allocated on a project basis.
- **Graduate Student Desk Space:** Prioritize desk spaces for research-based students; MEng students should be given lower priority.
- **Shared Spaces:** Create and promote a research culture of shared spaces. The current practice employed by the DEG is a "gentle approach" in persuading faculty to share space. This could be extended by employing a productivity/merit system.

6. Research Programs & Institutes

6.1 Strengths

- There are two CRC Tier-I Chairs and a SaskPower Industrial Chair in Clean Energy, which is a reasonable number for a Faculty this size. However, the term of one CRC Chair is finishing soon. There is some alignment of the Research Chairs and Programs with the University's research clusters.
- FEAS had a good year in NSERC Discovery grants, following several years with low levels.
- Faculty members put Mitacs to very good use, having 120 Accelerate units in the last year was a significant success. Mitacs filled gaps in Discovery grants (particularly in Electronics Systems Engineering).
- FEAS is well integrated with the Centres and has potential to grow. FEAS has good contact with Industry Advising Boards. Some sharing of lab facilities and equipment takes place.
- The programs are evenly resourced with the exception of Software Systems Engineering.
- The 2 research institutes hosted by FEAS (Institute for Energy, Environment and Sustainable Communities and the Clean Energy Technologies Research Institute) are world leaders in environmental-related research and in carbon capture technologies bringing in significant funding and overhead to the university.
- FEAS is heavily involved in the Petroleum Technology Research Centre and through this involvement they have developed fruitful research relationships with several international universities.

6.2 Weaknesses

- The RC feels that the name of Petroleum Systems Engineering needs to change (rebranding). The public's perception of oil and gas industries is not generally positive. In addition, the current generation of students has been brought up with "clean energy" concepts, which do not include fossil fuels. These issues are a challenge, which will could continue to result in low undergraduate numbers.
- Research revenue is subject to large fluctuations: 2014 \$4.2M, 2015 \$1.3M, 2016 \$2.6M, 2017 \$2.1M, 2018 \$3.6M. It is hoped that recent NSERC success will continue, as this would form a core of stability in research revenue, when industry contracts fluctuate.
- There is no formal mechanism for CRCs as a group to counsel the university on future research directions

6.3 Threats

- Considering Saskatchewan is a small province, UofR faces severe competition from UofS in terms of research funding and government support.

6.4 Opportunities & Recommendations

In the past 10 years, engineering faculties all over Canada have grown and continue to grow because of rapidly changing engineering sectors including high-tech and digitalization, advanced manufacturing, biomedical engineering and clean-technology. The FEAS is experiencing a similar trend and has become the fastest growing Faculty at the UofR. Where the increased interest in FEAS at UofR have caused pressure on the system, at the same time it has created new opportunities for the Faculty to attract high quality graduate students (in some programs but not all). This has allowed them to take a lead in innovation and entrepreneurship, and research and development especially relevant to provincial resource industries. A few recommendations and suggestions have been made to help FEAS grow strategically and help UofR to meet its aspirational goals.

- **Role of ADR:** With growing aspirations of increasing research activity, it is important to have a distinct, clear role for the ADR, who is currently provides liaison with both the VPR office as well as the FGSR. However, in the current role, the ADR is also responsible for MEng student activities. The Committee recommends that the ADR role be mandated to include “Research and Industry Partnerships”. Accordingly, they should be relieved of day to day management of the MEng Program and a position for a Professional Programs Coordinator (existing faculty member) should be created to facilitate this change. The Coordinator should take care of MEng, continuing education and fee-based professional development courses.
- **Mitacs Representative:** Currently UofR does not have a full-time Mitacs representative on campus. FEAS has a huge potential to increase industry research funding through Mitacs partnerships. University Executives should consider a full-time position on campus and negotiate with Mitacs. This model has already been proven very successful in other universities across Canada (e.g., UofS, Waterloo and UBC).
- **Business Development:** A business development (BD) person who can facilitate and harness relationships between faculty members and industry partners can be helpful to increase research funding in the Faculty. This position can be based on a cost recovery model, which is also common in other universities in Canada. Proposed role of a BD can provide support to the ADR office and help aligning research activities with the VPR’s strategic research clusters. This role can also work very closely with UofR’s Advancement & Communications office to increase research-based fundraising.
- **CRC Advisory Board:** The University administration should consider creating an Advisory Board comprised of UofR CRCs to provide counsel on university research directions.

7. Service & Staff

7.1 Strengths

- Overall, the administration, faculty and staff were friendly, collegial and collaborative, both within and across programs.
- The Dean’s Executive Group (DEG) was supportive of their students and the efforts of Programs as well as individual members, and the DEG offers a hands-on leadership, with

continuity through a second term of the Dean, Dr. Hussein. The Dean sends out kudos to FEAS members on successes, and frequently takes walks around campus with new/young faculty and senior faculty in some cases. The graduate students also find the faculty members friendly.

7.2 Weaknesses

- Communication between the Dean and the faculty seems to be an issue despite the Dean trying all sorts of methods.
 - There seems to be a disconnection between the Dean's office and some of the Programs, however, it's difficult to assess this because especially newer faculty did not appear to be comfortable enough to speak freely in the company of senior faculty from their programs.
- There appears to be no formal onboarding and mentoring of new faculty within their Programs.

7.3 Threats

- The Dean mentioned that there appears to be polarization in some Programs but their members say "we have no problem". In Petroleum Systems Engineering, almost all members were hired in a narrow time window, meaning that there no senior members and therefore no natural leader.

7.4 Opportunities and Recommendations

- **Administrative Support:** The FEAS Unity Study provided a list of administrative staff that included 18 persons, although one was on leave, one retired and one position (technical writer) was eliminated. The RC was not provided with enough information to judge whether this level of support is commensurate to the Faculty's size, in terms of faculty members and students. When asked what their wishes are, graduate students mentioned that having a lab instructor in every lab would be a priority (among others).
- **Communication:** The RC recommends that the DEG focus on new faculty members since they should not have any pre-conceived notions. An official "buddy" program for newly recruited faculty could be an option. DEG group should meet with new faculty possibly by discipline in an environment where they feel they can speak freely.

8. Financial Resources

8.1 Strengths

- The FEAS operating budget went from \$5.8M in 2012-13 to \$10.8M in 2017-18. CCE, MEng and Equipment Fund revenues went from \$0 to \$304k, \$0 to \$358k, and \$73k to \$221k, respectively, over the same period.
- As a result of increased undergraduate and graduate student numbers, FEAS increased revenues from \$4.3M in 2014 to \$7.0M in 2018. A portion of this revenue is used by the University to support other faculties.
- FEAS generated other revenue from undergraduate course offerings through CCE (went from \$40k to \$400k in 6 years) and the MEng program (generates \$300k, even after an increase in its tuition fee).

8.2 Weaknesses

- Financial incentive to faculty supervising an MEng is \$400-\$600 or as high as \$800-\$1000. Most of the tuition revenue goes to the program and central revenues.
- A considerable fraction of the surplus revenue generated by FEAS is used by the University to support other faculties.

8.3 Threats

- Following the expansion of FEAS in terms of graduate (and undergraduate) students, faculty and revenue minus expenditures net and surplus contribution to Central, FEAS needs to consolidate. Further increases in student numbers without careful planning is a threat to FEAS program quality.
- A continued subsidy (at current levels) of other Faculties by the surplus in FEAS can contribute further to negative morale and, in conjunction with high workload, could adversely affect the mental and physical health of faculty and staff. This could have negative effects on the quality of research and instruction.

8.4 Opportunities & Recommendations

FEAS should try to negotiate a more favourable funding formula with UofR Central, which would help to support research activities more strongly, and support of MASc and PhD students through revenue generated by professional Masters Programs.

- **Industry Advisory Board:** FEAS and few programs in the Faculty have their own industry advisory boards. Concerted efforts should be made to engage more industry partners through these advisory boards. This may also help in fundraising efforts for a new engineering building.
- **Alumni Outreach:** Petroleum Systems Engineering has strong industry contacts and a vibrant Industry Advising Board which meet once per year. They also have contacts with influential alumni group spread across Canada.

9. Fit to University Strategic Plan

9.1 Strengths

The FEAS Unit Self Study discussed alignment with the UofR's strategic plan in educating engineers to maximize their impact on industries through research that supports learning, industry and entrepreneurship, and in serving communities. FEAS program offerings aim to meet the needs and interests of students but also to align with local and provincial needs.

Graduate student success is celebrated with a special Dean's list for students that have completed their course requirements and obtained a GPA higher than 90%. Student innovative achievements are posted on the website, the University's research magazine Discourse, and the APEGS Professional Edge magazine. Graduate students have participated in solving some First Nations' problems dealing with water treatment and energy distribution in the north.

FEAS research is connected to two thematic areas of the UofR-SP Clusters: "Water, Environment and Clean Energy" and "Digital Future". FEAS has the highest number of citations per paper in Canada in the "Clean Energy", and the third highest in "Environment/Ecology" sectors in Western Canada. The research on this cluster aligns with three core growth activities identified by the provincial government to foster economic growth, which include "clean energy, innovative oil and gas initiatives such as enhanced oil recovery, mining, life sciences, crop sciences, value-added food processing and manufacturing." Digital Future researchers are contributing to innovation and creativity in computing and digital media. The growth and expansion of the data culture provide constant opportunities to the faculty.

9.2 Weaknesses

- The current FEAS strategic plan does not specifically address the need for an increase in the proportion of female faculty members despite only having 6 female members out of 45. The word diversity comes up seven times in that SP, but no specific plans were outlined to attract female faculty members, who would serve as mentors to female students, something strongly needed in Engineering (this is also needed in the associated STEM disciplines such as Physics).
- Limited evidence of Indigenization: Attempts have been made unsuccessfully to attract Indigenous faculty members. They have invited graduates and have contacted the UofR's Indigenous Lead. There was mention to contact Indigenous students in Grade 9/10 and offer them a four-year scholarship to the UofR, but no concrete plans were presented.
- Most of the FEAS programs do not align specifically with the research clusters mandated in the University Strategic Plan.

9.3 Threats

- Schools with deeper pockets can attract and recruit Indigenous faculty members.

- Risk of losing new faculty due to issues in morale in some programs as well as a lack of future planning in others and non-alignment with UofR-SP clusters. Such losses directly impact the SP's mission on teaching and research.

9.4 Opportunities & Recommendations

- **Strategic Plan:** Each department, in consultation with the Dean needs to complete their strategic plan as soon as possible, and hopefully within the next 12 months. The faculty and University should provide facilitators to help in that process, for each program individually but also collectively. This effort should ensure alignment with the UofR-SP.
- **Indigenization:** It is critical that Indigenous students see themselves reflected in those who are teaching and mentoring them. Because many Canadian universities with deeper pockets are also looking for Indigenous engineering faculty members, consider growing your own from your population of undergraduate and graduate students. For this to be successful, FEAS need to identify talent in high school and undergraduate students. This will require that contacts be made in high schools and Indigenous communities. Put special supports in place and consider hiring an Indigenous Program Counsellor in engineering whose job it is to provide support for your Indigenous undergraduate and graduate students. Consider creating an Engineers without Borders like combined undergraduate/graduate club whereby students take on at least one major project per summer which enhances health and wellness in a Saskatchewan Indigenous Community. The club should be open to both Indigenous and non-Indigenous students. Given that you already have an Indigenous Engineer in Residence perhaps this individual could serve as the faculty mentor for the club.
- **Participation on University Wide Committees:** Should have an engineering faculty member on the Strategic Planning Facilitation Team.

Appendix A



UNIT REVIEW 2018-19

Schedule for the Faculty of Engineering and Applied Science

External Unit Review Site Visit: **Monday 6 May 2019**

Time	Who/What	Participants	Where
7:00-8:00	Opening Breakfast	Dean, Graduate Studies & Research and Associate Vice-President (Research); Review Team	Fairfield Inn and Suites <i>3915 Albert Street</i>
8:00	Hotel Pick-up	External Review Team	Fairfield Inn and Suites <i>3915 Albert Street</i> <i>(Zisis Papandreou will transport)</i>
8:30-9:10	Pre-Review Team Meeting	Review Team	ED 436.14
9:10-9:40	Dean's Executive Group	Dr deMontigny, Dr Henni, Dr Hussein, Ms Schmidt	ED 436.14
9:40-10:10	Program Chairs	Dr Azam, Mr Douglas, Dr Henni, Dr Jia, Mr Jones, Dr Laforge, Dr Maciag	ED 436.14
10:10-10:30	Break		
10:30-11:00	Canada Research Chairs	Dr Huang and Dr Chan	ED 436.14
11:00-11:30	Tour Institute for Energy, Environment and Sustainable Communities	Dr Huang	RIC
11:30-12:00	Saskatchewan Research Council, Petroleum Technology Research Centre	K Knorr and D MacLean	ED 436.14
12:00 -1:30	Lunch	Review Team	Lakeshore Restaurant <i>1350 23rd Avenue</i> <i>(Reservation under Dr Papandreou)</i>
1:30-2:30	Tour Petroleum Systems Engineering Labs	Dr Jia	PTRC
2:30-3:00	Mitacs	Dr Zsuzsa Papp	PSE Boardroom
3:00-3:30	Tour Clean Energy Technologies Research Institute	Dr Idem	GHG
3:30-4:00	Acting Dean, Graduate Studies and Research	Dr Watson	ED 436.14
4:00-4:15	Summary Caucus	Review Team	ED 436.14
4:15-5:15	Meet and Greet Social	Faculty, Support Staff, Graduate Students	ED 436.14
5:15	Transport external reviewers to the hotel		

**This agenda is subject to change, updated 6 May 2019*

Schedule for the Faculty of Engineering and Applied Science

 External Unit Review Site Visit: **Tuesday 7 May 2019**

Time	Who/ What	Participants	Where
8:30	Hotel Pick-up	External Review Team	Fairfield Inn & Suites 3915 Albert Street (Dr Amr Henni will pick-up)
9:00-9:30	Environmental Systems Engineering Program	Dr Azam, Dr Huang, Dr Jin, Mr Lichtenwald, Mr Milton, Dr Ng, Dr Sharma, Dr Veawab, Dr Wu, Dr Young	ED 436.14
9:30-10:00	Electronic Systems Engineering Program	Dr Al-Anbagi, Dr Bais, Mr Downie, Mr Duguid, Dr Laforge, Dr Paranjape, Mr Wagner, Dr Wang, Dr Zhang	ED 436.14
10:00-10:30	Break		
10:30-11:00	Industrial Systems Engineering Program	Mr Al Zubaidi, Dr Aroonwilas, Dr Dai, Dr Henni, Dr Ibrahim, Dr Idem, Mr Jones, Dr Kabir, Dr Mayorga, Dr Mehrandezh, Dr Peng, Dr Stilling, Dr Paitoon, Mr Zaidi	ED 436.14
11:00-11:30	Petroleum Systems Engineering Program	Dr Azadbakht, Dr Gu, Mr Hong, Dr Jia, Dr Shirif, Dr Torabi, Dr Yang, Dr Zhao	ED 436.14
11:30-12:00	Software Systems Engineering Program	Dr Chan, Mr Douglas, Dr El-Darieby, Dr Gelowitz, Dr Maciag, Dr Morgan, Mr Naqvi, Dr Yow	ED 436.14
12:00-1:00	Lunch	Review Team, Former and Current Graduate Students	ED 436.14
1:00-1:30	Faculty of Engineering and Applied Science Students	Former and Current Graduate Students	ED 436.14
1:30-2:00	Summary Caucus	Review Team	ED 436.14
2:00-2:10	Break		
2:10-2:40	International Mineral Innovation Institute	A Shpyth	ED 436.14
2:40-3:00	Dean's Executive Group Follow-up	Dr deMontigny, Dr Henni, Dr Hussein, Ms Schmidt	ED 436.14
3:30-4:00	Exit Interview	Provost; Dean, Graduate Studies & Research and Associate Vice-President (Research); Dean, Engineering and Applied Science; and Review Team	ED 436.14
4:00	Transport external reviewers to the hotel		

**This agenda is subject to change, Updated 6 May 2019*
Review Team consists of:

Dr Rehan Sadiq, University of British Columbia (Professor and Associate Dean, School of Engineering)

Dr Michele Oliver, University of Guelph (Professor, School of Engineering)

Dr Zisis Papandreou, University of Regina (Faculty of Science)