McMaster University **School of Graduate Studies**

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To : Members of Graduate Council

From : Christina Bryce
Assistant Graduate Secretary

The next meeting of Graduate Council will be held on **Tuesday December 5th at 9:30 am in Council Chambers (GH-111)**

Listed below are the agenda items for discussion.

Please email *cbryce@mcmaster.ca* if you are unable to attend the meeting.

A G E N D A

I. Minutes of the meeting of November 14th, 2017

II. Business arising

III. Report from the Vice-Provost and Dean of Graduate Studies

IV. Report from the Graduate Associate Deans

V. Report from the Associate Registrar and Graduate Secretary

VI. Report from the Assistant Dean, Graduate Student Life and Research Training

VII. New Program Proposal: M.Sc. in Psychotherapy

VIII. New Program Proposal: M.Eng and G.Dip in Systems and Technology

IX. New Program Proposal: Ph.D. in Statistics

X. Faculty of Engineering Graduate Curriculum and Policy Committee Report

XI. Faculty of Science Graduate Curriculum and Policy Committee Report

XII. Faculty of Health Science Graduate Policy and Curriculum Committee Report

XIII. Scholarships Committee of Graduate Council Update

XIV. Final Assessment Reports

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Graduate Council
November 14th 9:30 am
GH 111

Present: Dr. M. Thompson, Ms. C. Bryce, Ms. S. Baschiera, Dr. K. Hassanein, Dr. S. Corner, Dr. S. Pope, Dr. L. Kapiriri, Dr. W. Farmer, Dr. B. Doble, Ms. M. Badv, Mr. R. Narro Perez, Ms. S. Ramsammy, Ms. L. Yousefi, Dr. A. Sills, Mr. K. White, Mr. T. Baldeh, Ms. J. Dawdy, Dr. E. Badone, Ms. A. Devitt, Dr. P. Mhaskar, Dr. E. Grodek, Dr. S. Raha

Regrets: Dr. M. Verma, Dr. A. Kitai, Dr. L. Thabane, Dr. S. O'Brien, Dr. S. Feng, Dr. I. Marwah

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A G E N D A

I. Minutes of the meeting of October 17th, 2017

The minutes of the meeting of October 17th 2017 were approved with a minor correction on a motion by Dr. Hassanein, seconded by Dr. Pope.

II. Business arising

There was no business arising.

III. Report from the Vice-Provost and Dean of Graduate Studies

Dr. Welch reported that the brand new Provost, Dr. David Farrar officially became sole provost on November 1st. He said he thought Dr. Farrar was an excellent choice and intended to invite him to attend one of the upcoming Graduate Council meetings.

He also reported that there were three convocations this week and that this is the biggest season for graduate students.

Dr. Welch noted that over the last couple of years there has been a lot of talk about SMA 2, which McMaster has now signed. This will ultimately become a public document but the ministry doesn't want them released yet. He said there are already all sorts of activities under way with respect to next SMA. SMA 3 will start at the end of the SMA 2 cycle, which is only three years long. Given that it took a long time to get agreement, efforts are already underway for SMA 3. One of the items relevant to Graduate Council is that SMA 3 will be very concerned with experiential learning opportunities at university. He said that there are obviously more of

those available at graduate level but at the same time there is no listing of which programs/courses offer experiential learning as defined by province. All universities will now be asked to identify which courses do what kind of experiential learning and it will be one of the items the institution is measured on for SMA 3.

He also reported that there has been an increase in the number of international students in Ph.D. programs that are allowed to be counted as domestic students. These students are charged domestic tuition and McMaster receives grant money from the province for those students. He noted that this change did not affect all international students but that there had been an increase by a factor of three in the number McMaster has been able to count this year compared with the past few years. The province has also committed to this level of international funding at the domestic level for three years. He noted that a discussion would take place with the Deans and Provost about how McMaster will deal with this situation and said that it was promising that the province has recognized that international Ph.D. students play an important role and that they have made a change to make that a longer term commitment.

Dr. Welch also reported on the recent CAGS conference. He said that McMaster had fielded a good contingent including the available associate deans, Dr. Welch, two GSA exec members and two students who had produced a SPICES project regarding connecting students with industry. Among the items discussed was the concept of an individual development plan; they are keen on making this part of graduate work. There was also a discussion on the report of the Truth and Reconciliation Commission and how this will impact scholarship distribution to make sure that the intent of the TRC can be realized and that scholarships are accessible. He also noted that the Tri-Council folks were all present and that there was a big move afoot for them to harmonize so that as many of their competitions are as similar as possible in terms of paperwork and requirements.

IV. Report from the Graduate Associate Deans

Dr. Gupta reported that the Faculty of Science had been focused on recruitment. He had had a discussion with all science programs about steps to take to improve that area. He noted that one idea was an open house intended to engage students at earlier stages rather than just those in their fourth year. He said they're also working on social media strategies and looking at specific graduate program webpages that need updating. They plan to include information about current students, awards that they've won and alumni. He said that the Faculty of Science is also working on matters related to the student-supervisor relationship and noted that they were encouraging students and supervisors to use and review the document that had been developed centrally to assist with this. He also reported that the Faculty is looking into building more alumni connections. To that end, a list of recent graduates had been sent to programs to have the jobs and industries they've gone in to. They hope to engage some alumni in a more meaningful way and learn from them as to what kind of skills are needed in the job market. The final item he reported is that the Faculty of Science is also focusing on experiential learning to ensure students are competitive after graduation.

Drs. Corner, Hassanein, and Thompson had no report. Dr. Kapiriri had no report on behalf of Dr. Gillett.

V. Report from the Associate Registrar and Graduate Secretary

There was no report.

VI. Report from the Assistant Dean, Graduate Student Life and Research Training

There was no report.

VII. Faculty of Health Sciences Graduate Policy And Curriculum Committee Report

Dr. Bradley Doble presented the items on behalf of Dr. Hayward. He noted that the FHS committee had approved a number of changes from Global Health. These included a change to calendar copy with respect to two fields in Global Health intended to ensure that fields of study are more reflective of the current state of the discipline. The program also made a change to their course requirement switching one of their course requirements from HRM 771 to NURS 715. He noted that as the program has grown and developed a lot over the years they have expanded the number of elective offerings and adjusted their calendar copy to reflect this. Dr. Doble said that the Global Health students participated in a pilot exchange in Norway and now the program is listing the fields available through exchange at their partner institutions (Norway and Maastricht).

He noted there were a couple of items for information: two new courses (Innovation by Design and one from Global Health), two change to course titles for Health Management and Child Life and Pediatric Psychosocial Care changed the prerequisite of one of their courses.

Dr. Welch explained that there was some overlap between the reports because the curriculum business involves interdisciplinary programs from different faculties. The faculties have approved the same things. He said Graduate Council will not approve the same items repeatedly and will note if it's the subsequent faculty's curriculum and policy report.

Dr. Mhaskar moved and Dr. Sills seconded, 'that Graduate council approve the changes proposed by the Faculty of Health Sciences as described in the documents.'

The motion was carried.

VIII. Faculty of Social Sciences Graduate Curriculum and Policy Committee Report

There was some discussion of the items to be presented as part of the report. Dr. Welch clarified that all that Graduate Council was being asked to approve was the degree name change for the Ph.D. as the other for-approval items were included in the previous report.

Dr. Mhaskar moved and Dr. Badone seconded, 'that Graduate council approve the changes proposed by the Faculty of Social Sciences as described in the documents.'

The motion was carried.

IX. Faculty of Business Graduate Curriculum and Policy Committee Report

Dr. Hassanein noted that Business GCPC approved the changes from Global Health already described in the Faculty of Health Sciences report. Dr. Welch noted that no vote was required in this case.

A council member asked about the changes Dr. Welch mentioned for international students moving to domestic Ph.D. and asked what the policy was behind having international students pay domestic fees. Dr. Welch responded that the net benefit to the university was that instead of receiving no provincial funding, they would receive domestic student-level funding in the case of these students. In previous years, 15 students could be counted and receive provincial funding. The university had decided that fees should match provincial funding level. These changes had to be instituted by the November 1st count. As students were already set up with international support they had to convert students without disadvantaging them in terms of their support packages.

The council member noted that international students receive larger amount of funding in the beginning but that they also pay international fees and asked if they would receive the same amount of funding but pay domestic fees. Dr. Welch responded that their funding was rearranged.

The council member asked how the student were picked. Dr. Welch responded that in past years it had been fourth year students and that associate deans were asked to seek out students who were doing well but hadn't yet got a Trillium or the like. Since in the past there were fewer students selecting them was less complicated. This year the associate deans were asked to decide what group of students would be appropriate for this.

Dr. Thompson noted that in the Faculty of Engineering because they had so many more spots this year that they chose first year students who had different funding packages. They were looking for an easy way to adjust the money without harming their pay. So they chose first term people across departments and in the case of their Faculty it wasn't really merit based. At the time they weren't sure how many they were getting and had to choose very quickly. The important consideration was that they wouldn't be harmed in any way by the change. The council member asked if students were chosen based on admission package. Dr. Thompson responded that they were because they had different admission packages than students in their later years.

Dr. Welch explained the different areas students receive funding from and noted that part of the task was to figure out how to reallocate support. Ms. Baschiera noted that in SGS there was a good effort made

with the participating partner office. They ensured that when letters went out they were given the opportunity to come in and enquire. Based on what they've heard it's been positively received.

The council member asked a student has an option to deny the changes. Dr. Welch responded that they hadn't encountered that. The council member said they weren't sure what the student ended up getting out of it at the end. Dr. Welch noted that all obligations were met in terms of total support and that they have wording in the letters to clarify the situation for students.

A council member asked if there was a way students could be picked earlier, noting that if students are picked in their fourth year they've already missed the opportunity to bring in very good students from abroad with the additional funding. Dr. Welch responded that with this announcement McMaster now has the ability to use this strategically since the institution know it's coming again next year and the year after. Now that the institution has this commitment for the coming years there needs to be a discussion to see how it will be used to strengthen programs. He noted that this would be a Faculty Dean/Provost decision.

A council member noted that the deadlines from the government are a complicating factor. Dr. Welch responded that the ministry likes October a lot and that the timing means that students are already here and all financial arrangements have been made. So in the past when the information had been passed along by the ministry it had been a bit of a scramble to make use of it quickly. The multi-year commitment changes that going forward.

A council member asked if next year and the follow year there would be an allocation to each faculty so visa students can count as domestics. Dr. Welch responded that there would be a decision about that and that that's what the Deans and Provost would be talking about. He said there are a number of ways to use it and noted that there could be capacity built into programs who have not in the past been able to offered attractive packages to international students.

Dr. Hassanein noted that the instruction given was very clear that no student would be receiving lower package, had to be the same or more and that nobody rejected the package that was the same or better. He said that in his faculty (Business) everyone was better off. A council member asked why they were better off, wondering if this was a type of scholarship.

Dr. Hassanein noted that some students in Business were not getting a tuition bursary waver, so they decided to give it to them. Dr. Welch noted that they didn't want to cut this too finely in terms of getting down to the dime but they did want to ensure that there wasn't anybody who got less and there were some that got this one-time benefit.

A council member asked if they had a sense of how many students were affected. Dr. Welch responded that this year it was 41 international students which was a big change from last year's 15.

McMaster University

NEW PROGRAM PROPOSAL FOR MASTER OF SCIENCE IN PSYCHOTHERAPY

DATE: November 2017

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1 PROGRAM

1.1 PROGRAM DESCRIPTION

This is a proposal for a Master of Science (MSc) in Psychotherapy to be offered by Clinical Behavioural Studies (CBS) in the Department of Psychiatry and Behavioural Neurosciences, Faculty of Health Sciences, McMaster University.

The MSc in Psychotherapy will be a professional, course-based degree that will include several experiential training opportunities to prepare students for a career as psychotherapy practitioner. The focus of the MSc will be to provide students with a solid understanding of and competency in the delivery of evidence-based psychotherapies for a range of mental health disorders and related problems. During the completion of coursework and clinical practicum placements, students will also be exposed to opportunities to acquire and demonstrate effective communication, critical thinking and problem-solving skills. **Overall, the aim of the MSc in Psychotherapy Program is to offer students an academic and clinical learning experience that includes theoretical knowledge of mental health disorders and evidence-based psychotherapies and applied clinical skill development with direct supervision, in order to prepare them for a career as an independent psychotherapy practitioner.**

The MSc in Psychotherapy will be 20-months in duration and it is anticipated that most students will complete the program full-time. All students in the MSc in Psychotherapy will complete 11 courses, including 7 core required courses, 2 elective courses and 2 clinical practicum courses. Courses in the first year of the MSc will offer students an introduction to theoretical models for understanding mental illness and to various evidence-based psychotherapies. In advanced courses and while on clinical practica, students will be exposed to higher-level concepts and applied training opportunities to develop greater clinical competency in specific psychotherapies. It is expected that the majority of graduates from the program will register with the College of Registered Psychotherapists of Ontario (CRPO), as it is required that all practitioners performing the controlled act of psychotherapy be regulated through the CRPO (if not already a member of another regulated health profession).

The required core courses will cover introductory concepts as well as advanced training in psychotherapy theory, research, and applied clinical skills. The elective courses will offer students with depth and breadth of training opportunities. Finally, the practicum courses will provide students with the opportunity to apply and demonstrate their skills in a clinical setting and receive ongoing support from a clinical practicum supervisor who: is a member of a regulated health profession; has extensive clinical experience in the practice of psychotherapy; and is competent to provide clinical supervision (as per the clinical supervision requirements set by the CRPO). Students will also be enrolled in a small-group, tutorial-based, Applied Psychotherapy Skills course that will focus on experiential clinical skills training. Throughout the program, students will be encouraged to identify self-directed learning opportunities (through leading class discussions, reflection papers, written assignments, practicum placements) that will offer them greater depth in an area of interest. In addition, a component of the practicum courses will be the completion of an integrative paper, which will require students to complete a theoretical paper on a topic related to their current clinical practicum experience. Thus, the goal is for students to develop a solid theoretical foundation that will form the base of their evidence-based clinical practice.

It is the ideal time for the development of the MSc in Psychotherapy. First, there is a significant need for well-trained practitioners who are competent to provide evidence-based psychotherapies. Over 2 million Ontarians are affected by mental illness each year, and over a third of these individuals report receiving insufficient support (Canadian Community Health Survey, Ministry of Health and Long-Term Care, Statistics Canada, 2012). In the 2017 budget, the Ontario Government included funding of $73 million over three years to provide greater access to publicly-funded structured psychotherapy for individual suffering with mental illness (Section A: Strengthening Health Care, Ontario Budget, 2017). Students completing the MSc in Psychotherapy will have the specialized training required to provide structured, evidence-based psychotherapy, which is in high demand.

Secondly, legislative changes have increased the education and regulatory requirements for practitioners performing psychotherapy. The *Psychotherapy Act, 2007*[1] requires that all individuals practicing psychotherapy within the province of Ontario, and who are not members of a regulated profession (e.g., nurse, psychologist, social worker, occupational therapist, physician), register with the newly formed CRPO and use the designation of *Psychotherapist*. The CRPO has specific education requirements, including the completion of Master's-degree level training. In addition, under the *Regulated Health Professions Act, 1991*[2], Psychotherapy was identified as a "controlled act," which may only be performed by regulated health professionals who are members of a health college whose members are permitted to perform psychotherapy. This section of the *Regulated Health Professions Act (RHPA)* is anticipated to be proclaimed in December 2017. Once proclaimed, it is proposed that only five regulated health-related professions, including *psychotherapists*, will be able to provide the controlled act of psychotherapy[3].Thus, the MSc in Psychotherapy has been designed to provide students with the necessary training to meet the education requirements set by the CRPO (http://www.crpo.ca), and by two additional competency bodies in Canada: the Canadian Counselling and Psychotherapy Association (CCPA; https://www.ccpa-accp.ca) and the Canadian Association of Cognitive and Behavioural Therapies (CACBT; http://www.cacbt.ca/en/index.htm).

Moreover, under the new legislation, clinicians who currently practice psychotherapy (as defined by the RHPA), but do not have the training requirements needed to become registered with the CRPO, will be required to complete additional education and/or supervised practice. In addition, psychotherapy is not an entry-to-practice competency for all of the regulated health professions (e.g., nursing, social worker, occupational therapy, physicians); therefore, unless offered in during their post-professional education, these professionals will require additional education, training and supervision should they wish to perform the controlled act of psychotherapy. Thus, the MSc in Psychotherapy may also meet the training needs of these individuals.

Thirdly, the MSc in Psychotherapy will meet a training demand that is not currently offered by McMaster University and or met by existing CBS Graduate Diploma Program provided by the Department of Psychiatry & Behavioural Neurosciences. The CBS Graduate Diploma provides post-professional education to persons who have completed basic training in healthcare or health-related disciplines (e.g., nursing, social work, occupational therapy) and who are looking for additional mental health-related training. The aim of the Graduate Diploma is to offer a brief, specialized training experience (e.g., a specialized focus in cognitive behavioural therapy) to professionals in a health-related profession. Therefore, the aims of the Graduate Diploma are distinct from the MSc in Psychotherapy. It is anticipated

[1] https://www.ontario.ca/laws/statute/07p10
[2] https://www.ontario.ca/laws/statute/91r18
[3] http://www.crpo.ca/controlled-act-of-psychotherapy/

that the demand for the Graduate Diploma will remain once the MSc in Psychotherapy commences, as many healthcare professionals who may be interested in additional training in evidence-based psychotherapies may not wish to or be required to complete a Master's degree. As the MSc is developed, the curriculum for the Graduate Diploma will also be updated to better align with the MSc in Psychotherapy curriculum. The alignment of the courses across the two programs, will allow students who complete courses in the Graduate Diploma Program to use credits from the Diploma program towards fulfillment of the MSc in Psychotherapy Program should they wish to apply to transfer to the MSc program.

The proposed MSc in Psychotherapy will build upon foundation courses in the CBS Graduate Diploma and its existing resources, infrastructure and faculty to provide graduate-level training in psychotherapy. It is anticipated that the majority of students enrolled in the MSc will have no formal healthcare training or professional designation. However, the program will also be open to students who have a healthcare qualification and who wish to complete an MSc in psychotherapy, which will offer greater depth and breadth of training, and more clinical practice experience than the Graduate Diploma.

In summary, the MSc in Psychotherapy Program will be structured as a course-based, professional degree that includes in-class lectures, tutorials and experiential training components. It is anticipated that the program will offer a unique training experience that will help to fill the ever-increasing need in our community for well-trained and knowledgeable professionals who are skilled in the delivery of evidence-based psychotherapies for serious mental health disorders and related problems.

1.2 PROPOSAL PREPARATION AND CONSULTATION PROCESS

Internal Collaborators

A proposal committee was established during the initial stages of the program development that consisted of the Chair and Associate Chair Education of the Department of Psychiatry and Behavioural Neurosciences and the CBS Director and CBS Program Coordinator.

During a retreat in September 2016, key members of the CBS Program (CBS Graduate Diploma Study Area Leads, Instructors, former CBS Director, members of the CBS Graduate Diploma Steering Committee) met with the Planning Group to discuss the development of the MSc in Psychotherapy. Objectives and aims for the degree were established and used to guide the MSc Program's development. After an initial draft of the proposal was completed, the proposal was sent to members of the steering committee for review and comments.

External Collaborators

The proposal committee consulted with members of the McMaster community who are involved in other health-related Master's programs, including the Associate Deans and Program Directors from the Schools of Nursing and Rehabilitation Sciences and the Child Life and Pediatric Psychosocial Care Program. In addition, the committee consulted with program leads at St. Joseph's Healthcare Hamilton and Hamilton Health Sciences regarding the degree requirements as well as opportunities for practicum placements for students in the MSc.

To ensure that the MSc in Psychotherapy program will meet professional accreditation standards and that graduates will be able to become registered with a regulatory body in Ontario, we referred to the CRPO's Evaluation Criteria for Psychotherapy Education and Training Programs.

Finally, we sought feedback from current students and recent graduates of the CBS Graduate Diploma Program to determine the level of demand for an MSc in Psychotherapy.

1.3 CONSISTENCY WITH MCMASTER'S MISSION AND ACADEMIC PLAN

i. McMaster's Strategic Mandate Agreement:

Existing Strengths

✓	Medical Education and Research
✓	Health and Society
	Engineering and Sustainability
✓	Science and Discovery
	Digital Economy
	Materials and Manufacturing
	Business and Economics
	Policy and Ethics in a Globalized World
✓	Human Behaviour, Culture and Society
	The Arts and Creative Expression

The MSc in Psychotherapy aligns strongly with several areas of McMaster's mission and academic plan and existing strengths, including (i) Medical Education and Research, (ii) Health and Society, (iii) Science and Discovery, and (iv) Human Behaviour, Culture and Society.

The MSc in Psychotherapy is designed to educate students in empirically-supported therapy as a part of their professional practice, which maps onto existing strengths in the Strategic Mandate Agreement (i.e., medical education and research; health and society). Students in this MSc program will develop specialized skills and knowledge that will prepare them for success in health professions.

In addition, the MSc in Psychotherapy Program closely aligns with McMaster's goal of providing professional and practice-focused graduate degrees that prepare graduates for professional licensure and to assume clinical positions that meet the needs of the community. The program offers students' significant opportunities for experiential learning via course work and clinical practicum placements, which is consistent with the Ministry's support of experiential learning opportunities for students. Thus, the MSc in Psychotherapy Program will provide graduate students with advanced skills and competency in the theory and practice of psychotherapy via coursework and clinical training to better meet societal and healthcare needs.

Consistent with the university's strength in Science and Discovery, the MSc in Psychotherapy Program emphasizes the need for its graduates to gain expertise in consuming health-related literature and critically appraising the quality of the research as this will inform their evidence-based practice during clinical practica and future clinical work. Although there is not a formal research component to the program, all students will be required to demonstrate their knowledge of clinical research methods across various course requirements, such as in the writing of case studies, which requires the inclusion of relevant

research and theory to inform their case conceptualizations; in the use of validated self-report questionnaires to measure treatment outcomes; and in their ability to conduct a program evaluation. Moreover, across their courses and during clinical work, students will have multiple opportunities to demonstrate and apply their theoretical and research knowledge when completing written assignments and selecting appropriate therapeutic skills in clinical practice.

Priorities for Growth

✓	Health Sciences and the Broad Determinants of Health
✓	Fostering Robust Societies
	Business and Economics
	Science and Engineering
✓	Communications and Culture

Regarding the priorities for areas of growth as outlined by McMaster's Strategy Mandate Agreement, the MSc in Psychotherapy will foster growth in the following areas: (i) Health Sciences and the broad determinants of health, (ii) Fostering robust societies, and (iii) Communications and culture.

Related to *Health Sciences and the Broad Determinants of Health*, the MSc in Psychotherapy will help students gain an interdisciplinary perspective on contemporary issues in health and society from coursework and clinical practice. Collaboration across health-related disciplines and awareness of interdisciplinary perspectives on contemporary issues in health and society will be a fundamental component of the MSc program.

The MSc program will also encourage growth in the area of *Fostering Robust Societies.* One in 5 Canadians experience mental health problems or illness, which is associated with an economic burden of 50 billion dollars[4]. Currently, there are significant wait times for effective mental health treatment creating a significant societal need for well-trained mental health practitioners. An MSc in Psychotherapy Program will help Ontario meet current and future needs for appropriately trained practitioners by providing students with the necessary training for regulated professional practice.

Finally, in the priority area of *Communications and Culture*, the MSc in Psychotherapy Program will teach students advanced communication skills to enable them to communicate effectively with their clients and coworkers, which will be essential in their professional careers. In addition, students will have the opportunity to work with individuals from diverse cultural, social and ethnic backgrounds.

ii. McMaster's current priorities:

Alignment with Forward with Integrity

The MSc in Psychotherapy will offer a professional and practice-focused degree that aligns well with each of the four priorities outlined in the *Forward with Integrity* letter, including The Student Experience, Community Engagement, Research, and Internationalization. The primary objective of the MSc in Psychotherapy Program is to provide students with advanced skills and competencies in the theory and practice of psychotherapy via coursework and applied training experiences.

[4] Smetanin, P., Stiff, D., Briante, C., Adair, C., Ahmad, S. & Khan, M. (2011*). The life and economic impact of major mental illnesses in Canada: 2011 to 2041.* RiskAnalytica, on behalf of the Mental Health Commission of Canada.

First, related to *The Student Experience*, the MSc in Psychotherapy Program is committed to fostering competency in clinical skills through integrated theoretical and applied learning. The philosophy of the MSc in Psychotherapy Program emphasizes:

- Development of a theoretical knowledge in the assessment and treatment of mental health issues
- Opportunities to apply theoretical knowledge developed from course work in clinical settings

The problem-based learning format is foundational to the coursework and promotes the development of skills in critical thinking, problem solving, self-directed learning, communication and team participation. The course structure is designed to match the needs of students; introductory courses provide foundational skills that can then be applied to practical experiences in clinical settings. The students entering the program will come from diverse backgrounds with a range of perspectives, which will make for an enriched learning experience, while appreciating different viewpoints also prepares students for work as a member of an inter-professional team.

Second, there is a strong emphasis on *Community Engagement* in the program, which will develop strong relationships with community agencies that offer mental health treatments. Students in the MSc in Psychotherapy Program will complete practicum placements within community settings (e.g., hospital clinics, family health teams, student counselling clinics). In this way, the students will also be providing ongoing support to the community during their graduate studies. Additionally, the MSc program's graduate students and graduates will bring knowledge to community organizations and will provide evidence-based therapy within our communities.

Third, the MSc program will help the students to become self-directed learners and reflective practitioners. Students will learn to appraise the quality of research findings and they will also learn how to integrate evidence-based strategies into their clinical practice. Students will also learn to measure and evaluate the impact and outcome of their therapeutic approaches to optimize treatment gains experienced by their clients as a component of their evidence-based practice. Many of the faculty have expertise in clinical research and will incorporate contemporary empirical findings in their course material.

Finally, the MSc program will encourage the incorporation of *Internationalization* in course work and practical training experiences. Students will receive training in cultural competency, which is a necessity for treating diverse patient groups. For example, in course work, students will discuss the role of diversity in mental health, which they can then apply when working with individuals from diverse cultural, social, and ethnic backgrounds in their practical training experiences.

1.4 PROGRAM LEARNING OUTCOMES

The MSc in Psychotherapy Program Learning Outcomes (PLOs) encompass the main competencies that successful graduates from the program will acquire via course work and clinical practicum. By the end of the program, students will be able to:

Theoretical Knowledge

1. Demonstrate and apply knowledge of key theoretical models of mental illness and wellness, including understanding the role of human development, physical health, and sociocultural factors, in their professional practice.

2. Demonstrate knowledge of the theory and research support for evidence-based psychotherapies in the treatment of mental health disorders.

Therapeutic Skills

3. Demonstrate the competency to conduct clinical assessments, formulate case conceptualizations and develop treatment plans for a range of clinical presentations.

4. Engage in effective and competent clinical practice, which is demonstrated through the proficient use of evidence-based psychotherapies, ability to form therapeutic rapport, and effective communication with patients or clients.

Self-Awareness and Professional Standards of Conduct and Ethics

5. Demonstrate and integrate knowledge of professional standards of practice and ethical conduct in clinical practice.

6. Accurately appraise personal levels of clinical competence and identify areas for professional growth and self-directed learning.

Critical Thinking and Problem-Solving Skills

7. Use critical thinking skills to identify and solve complex problems and to appraise the success of the solutions employed.

8. Exhibit the ability to identify and make improvements in the delivery of patient or client care.

Communication Skills

9. Engage in effective written and oral communication skills with patients and other healthcare providers.

Research Knowledge and Skills

10. Demonstrate an understanding of clinical research methods, including the ability to critically evaluate the validity of clinical theories and research findings and the ability to conceptualize and develop a research study.

11. Integrate and apply knowledge of clinically-relevant research findings in clinical practice, including the selection of appropriate evidence-based therapies, and measuring and evaluating clinical outcomes.

1.5 CONSISTENCY WITH DEGREE LEVEL EXPECTATIONS

Graduate Degree Level Expectations

1. Depth and Breadth of Knowledge
2. Research and Scholarship
3. Application of Knowledge
4. Communication Skills
5. Awareness of Limits of Knowledge
6. Autonomy and Professional Capacity

The table below indicates how the Program Learning Outcomes align with the Degree Level Expectations:

	Degree Level Expectations					
Program Learning Outcome	1. Depth and Breadth of Knowledge	2. Research and Scholarship	3. Application of Knowledge	4. Communi-cation skills	5. Awareness of Limits of Knowledge	6. Autonomy and Professional Capacity
1	✓	✓	✓			
2	✓	✓	✓			
3			✓	✓	✓	✓
4			✓	✓	✓	✓
5			✓		✓	✓
6	✓	✓	✓		✓	✓
7	✓		✓			✓
8	✓		✓		✓	✓
9				✓		
10	✓	✓	✓			
11	✓	✓	✓			✓

1.6 DEMAND FOR PROGRAM

1.6.1 EVIDENCE OF SOCIETAL / LABOUR MARKET NEED

There is a significant need for training programs that assist in the development of well-trained and effective mental healthcare workers with psychotherapy skills for a number of reasons:

i. The level of demand for mental health services provincially and nationally is outpacing the capacity of available services to meet it.

ii. There is interest from the Government of Canada – as part of the proposed new Health Accord – and from the Government of Ontario to increase access to evidence-based psychotherapy for people with mental health problems being seen in medical and other community settings. In addition, representatives of the newly established CRPO and of the CACBT have identified the need for greater training programs that adequately prepare practitioners to meet the demands of practice and their registration and credentialing requirements. In addition, the Ontario Ministry of Health and Long Term care has recently established a working group to make recommendations for the Implementation of a Structured Psychotherapy Program in Ontario, and the Chair of the Department, who is also part of the CBS Faculty, is a member of this working group.

iii. Finally, there is an increasing expectation that all health care professionals gain a working knowledge of mental health-related problems that they can integrate with other aspects of their clinical work. For some, comprehensive training provided by a Master's degree program is needed to adequately prepare for clinical practice that includes psychotherapy. We therefore anticipate that some health care professionals, such as nurses, social workers, physicians, and occupational therapists, will be interested in completing the MSc in Psychotherapy Program for additional competencies to enhance their practice.

The MSc in Psychotherapy Program aims to address these needs by providing students with advanced training in evidenced-based therapies that can be utilized in many different clinical settings and with various populations including individuals with serious mental health disorders and related problems.

1.6.2 EVIDENCE OF STUDENT DEMAND

The student demand for courses where clinical skills are being developed and where some level of expertise is acquired in a theoretical treatment modality has traditionally been high. Specifically, demand for Master's-level training in counselling and psychotherapy is strong. For example, the Master of Education in Counselling and Psychotherapy offered by the University of Toronto/OISE reported that in 2015 it received 362[5] applicants for 32 spots in the program. As the Department has received several inquiries about the development of a MSc in Psychotherapy, we anticipate equivalent demand for the Master's Degree.

Moreover, evidence from our contacts with key stakeholders, including other Master's programs at McMaster University, and Community partners who support their employees' participation in CBS Graduate Diploma Program suggests that there will also be strong demand for the MSc in Psychotherapy Program once it is established. The agencies and organizations report that they are keen to see their employees gain this level of training. In a recent survey of students in the CBS Graduate Diploma Program, many identified an interest in obtaining Master's-level education in Psychotherapy (see Appendix A). Given the duration and training requirements of the MSc, it is anticipated that the Graduate Diploma will be in continued demand for those students who do not require the depth of training offered by the MSc.

[5] http://www.ro.oise.utoronto.ca/R_AppStat1.pdf

In addition, although psychotherapy can be practiced by individuals registered with the CRPO, or one of the other 4 recognized colleges (i.e., psychologists, nurses, occupational therapists, and physicians), it is only those with demonstrated competency to provide psychotherapy who will be able to perform the controlled act of psychotherapy once proclaimed. Therefore, individuals who have not received formal training in psychotherapy may be interested in completing the MSc in Psychotherapy to gain this required competency. It is anticipated that a significant number of community practitioners will look for additional opportunities to complete the required level of training and may register with the program. MSc courses will be open as post-degree courses; however, this will be limited to two courses per person. If an individual wishes to take additional courses they will be required to register in the CBS Graduate Diploma or in the MSc in Psychotherapy.

1.6.3 JUSTIFIABLE DUPLICATION

The proposed MSc in Psychotherapy is a unique graduate degree offering. There are 5 programs in Ontario that offer Master's of Arts, Education or Divinity in Counselling Psychology and are recognized by the CRPO (see Table 1). The content of the MSc in Psychotherapy will be distinct from that of a Master's in Counselling Psychology, as often the focus is on vocational counselling and wellness. The proposed MSc in Psychotherapy will provide students with foundational knowledge in evidence-based psychotherapy for the treatment of mental illness and in the practical clinical skills that are needed to become an independent clinical practitioner that provides psychotherapy. Moreover, it will also be the only psychotherapy-related program based in a Faculty of Health Sciences.

Table 1. Master's Degree Programs Recognized by the CRPO

University	Degree	Area of Specialization
Tyndale University College and Seminary, Graduate School of Theology	Master of Divinity	Clinical Counselling
University of Guelph, Department of Family Relations & Applied Nutrition	Master of Science in Couples and Family Therapy	Couples and Family Therapy
University of Toronto/ Ontario Institute for Studies In Education	Master of Education in Counselling and Psychotherapy	Counselling Psychology
Western University, Faculty of Education	Master of Arts in Counselling Psychology	Counselling Psychology
Yorkville University	Master of Arts in Counselling Psychology	Counselling Psychology (online course offerings)

In addition, there are 5 training programs that offer either a Diploma or Certificate of Completion in a field related to psychotherapy and are recognized by the CRPO. Most of these training programs offer a specific in-depth training experience in a specific type of psychotherapy (i.e., psychodynamic psychotherapy), which will not be the main focus of the MSc in Psychotherapy program. Therefore, none

of these training programs will significantly overlap with the content of the MSc in Psychotherapy. The programs include:

- Canadian Institute for Child and Adolescent Psychoanalytic Psychotherapy – Diploma for Child and Adolescent Psychoanalytic Psychotherapist
- Gestalt Institute of Toronto (5 year training program)
- Ontario Psychotherapy and Counselling Program – Diploma in Psychotherapy with focus on Psychodynamic Therapy
- Toronto Institute of Psychoanalysis – Certificate of Graduation as a Psychoanalyst
- Toronto Institute for Relational Psychotherapy – Diploma, Toronto Institute for Relational Psychotherapy

Within McMaster University, none of the current graduate programs overlap significantly with the curriculum for the MSc in Psychotherapy. The closest comparison to the MSc in Psychotherapy is the Research and Clinical Training (RCT) Stream offered by Psychology Graduate Program in the Department of Psychology, Neuroscience & Behaviour. The RCT Stream only offers a 4-year Doctorate of Philosophy (PhD) degree and does not offer terminal Master's-level training. Unlike the MSc in Psychotherapy, which is a course-based Master's degree, the PhD in Clinical Psychology has a significant research component, including the completion of a dissertation. In addition, graduates from the RCT Program would ultimately register with the College of Psychologists of Ontario.

The Master of Social Work (MSW) program has limited overlap with the MSc in Psychotherapy given that the content of the courses is distinct. The MSW is focused on social work practices and social policies and does not include formal training in mental health-related topics or psychotherapy. Moreover, it is anticipated that students enrolled in the MSW may be interested in taking courses in the MSc to fulfill their training in mental health-related topics. Currently, there is one student enrolled in a CBS Gradate Diploma course to fulfill an elective course requirement for their MSW. In addition, there are several Registered Social Workers currently enrolled in the CBS Graduate Diploma Program to obtain additional training in mental health-related topics.

The CBS Graduate Diploma Program has also received requests from other health-related Master's programs at McMaster University, including nursing, for their students to take one or more CBS Graduate Diploma courses. Thus, students who wish to complete courses on a mental health topic or evidence-based psychotherapy that are not offered by their program of study may be interested in completing courses through the MSc in Psychotherapy.

1.7 DEGREE NOMENCLATURE

Master of Science (MSc) in Psychotherapy is the most appropriate degree nomenclature for a graduate program that provides the opportunity for students to acquire theoretical knowledge and advanced skills in the provision of therapy to individuals with a range of mental health disorders and related problems. The MSc program requires that students become proficient in evidence-based psychotherapies, including cognitive behavioural therapy. Students will also be required to understand and critically evaluate psychotherapy research and select and apply specific clinical skills based on their theoretical understanding and case formulation. The educational plans for the MSc in Psychotherapy have the rigor required to meet the degree level expectations of a Master's program.

The inclusion of the identifier Psychotherapy in the name implicitly explains the overall content and learning objectives. That is, the program and its courses are rooted in the theories of mental health-related conditions and associated evidence-based psychotherapies.

2 ADMISSION & ENROLLMENT

2.1 ADMISSION REQUIREMENTS

Admission selections will be based on academic achievement as well as personal qualities and experiences that are evaluated during the Admissions Interview. The admissions criteria include:

a. Honours Bachelor's degree in Psychology, Social Sciences or Health Sciences from a recognized university with at least a B+ average (equivalent to a McMaster 8.5 GPA out of 12) in the final year of study. This requirement is consistent with the Faculty of Graduate Studies' admissions requirements.

b. For applicants whose first language is not English and who did not attend an English-speaking University for their undergraduate degree, a test of English language proficiency is required. Minimal scores on the Test of English as a Foreign Language (TOEFL) are: written score (600) or computer (250), or internet-based test (iBT = 92; reading = 22, speaking = 24, listening = 24 and writing = 22).

c. Applicants will also be asked to submit the following documents with their application
   i. Curriculum Vitae.
   ii. A letter of application outlining their reasons for wishing to join the program.
   iii. Two letters of reference: At least one from academic referee (i.e., professors or research supervisors). One letter may be from a professional referee (i.e., employer who can provide a professional reference).
   iv. Official transcripts from every degree-granting institution attended.

Admissions Interview

The admissions committee will review every application to the program to ensure that prospective students have the necessary academic background, proficiency in English, and relevant experience to enroll in the Psychotherapy Program. Those students who are short-listed based on this review will be offered an interview. Interviews will be conducted in person or over the telephone.

2.2 ENROLMENT PLANNING AND ALLOCATIONS

Program Year	2019-20	2020-21	2021-22	Maturity
Year 1	30	32	35	35
Year 2		30	32	35
Total Enrolment	30	62	64	70

2.3 ALTERNATIVE REQUIREMENTS

As stated in the School of Graduate Studies Calendar, some potential applicants may not satisfy the admission requirements for a 4-year honours undergraduate degree with a B+ average in the final year. However, work experience and/or completed course work beyond the Bachelor's degree, may have some bearing on the applicant's ability to complete a graduate program.

Admission to graduate studies for a student with related work experience will be based on the following criteria, as well as the standard admissions requirements, including the submission of a Curriculum Vitae and Official transcripts from every degree-granting institution attended:

1. At least 2 professional references (i.e., employer who can provide a professional reference).
2. 4-year undergraduate degree or equivalent completed more than 4 years ago, and any other course work taken since that time.
3. Work experience that has relevance to the MSc in Psychotherapy Program.

Should students meet these admissions requirements and be short-listed during the review of applications, they will also be required to attend an interview.

In addition, as the program is interested in recruiting a full spectrum of students, the program will follow the Faculty of Health Science's Facilitated Indigenous Admissions Policy.

3 STRUCTURE

3.1 ADMINISTRATIVE, GOVERNANCE AND COMMUNICATION

The MSc in Psychotherapy will be offered through the Department of Psychiatry and Behavioural Neurosciences. The MSc in Psychotherapy Program will have a Program Director (i.e., equivalent to the Assistant Deans in other FHS programs). The Program Director will be responsible for activities related to the delivery of the program (e.g., recruiting and monitoring faculty performance, assessing student eligibility at the entry level, monitoring student progress, and providing operating support). The Program Director will report to the Department Chair and to the Associate Dean of Graduate Studies for the Faculty of Health Sciences. Within the FHS, the Program Director will be a voting member of the Health Sciences Education Council and the Graduate Programs Curriculum Committee, which is a committee that manages matters related to policies and curriculum affecting graduate programs in the Faculty of Health Sciences.

The MSc in Psychotherapy **Academic Study Committee** will formulate and recommend policies and will oversee student progress in the program. The Director of the MSc in Psychotherapy Program will serve as the Chair of the Academic Study Committee. The Committee will include Health Sciences faculty members and a current student from the MSc in Psychotherapy Program. The Academic Study Committee will meet a minimum of four times a year to manage the business of the program. New members of the Committee are nominated by the existing Committee and appointed for three-year terms, with the option to renew. It is likely that the structure of the Academic Study Committee will change as the program evolves. The responsibilities of the Academic Study Committee include:

- Strategic planning for future directions for the program
- Assisting the Director in the formulation of all policies and procedures for the program

- Identifying changing community needs and expectations
- Identifying new course areas to meet student needs and assisting in their development and evaluation
- Recommending faculty for vacant teaching roles
- Preparing publicity and calendar material when needed
- Developing and monitoring the use of course evaluation forms
- Recommending and evaluating changes to the program
- Conducting regular formal evaluations of the program
- Assigning faculty advisors to program students
- Developing an integrative curriculum and ensuring ongoing alignment of the courses for the MSc in Psychotherapy and CBS Graduate Diploma Programs
- Supporting special workshops/presentations for faculty development, students and target agencies

There will also be two sub-committees of the Academic Study Committee: Admissions Committee and Curriculum Committee. For terms of reference for both sub-committees see Appendix B).

3.2 STRUCTURE AND REGULATION

The MSc in Psychotherapy will be a 20-month full-time, course-based program. The curriculum is designed to align with the principles of problem-based, self-directed and experiential learning. The courses are structured so that students are required to complete a set of 7 core courses that offer the necessary competencies in psychotherapy. In addition, students will choose 2 elective courses from available offerings. The elective courses will cover advanced psychotherapy topics, such as psychodynamic psychotherapy, mindfulness-based therapy, group therapy, and will provide students with a wider breadth of training. All courses will be designed to ensure that the content is consistent with the Program Learning Outcomes and Degree Level Expectations.

Students in the Psychotherapy Program are required to complete 7 core courses (i.e., 6 courses that are 3 units each and 1 course that is 6 units), 2 practicum courses (each practicum is a minimum of 400 hours and 3 units) and 2 elective courses (3 units each). Students will have up to 3 years to complete all of the degree requirements.

3.3 GRADUATE PROGRAMS - PROGRAM LENGTH

The MSc in Psychotherapy will be a full-time 20-month professional, course-based program. The length of the program is consistent with Master's programs in health-related disciplines, including psychology, counselling, and social work, and is designed to meet the necessary education requirements set by regulatory bodies. We anticipate that majority of students will complete the program full-time, however, with special permission students will also have the option to complete the program part-time (i.e., 1 or 2 courses per term) within 4 years.

The 20-month duration of the program was chosen to provide students with sufficient time to complete the necessary courses for foundational knowledge as well as time to practice their skills in an applied setting.

4 CURRICULUM AND TEACHING

4.1 PROGRAM CONTENT

The program will require students to complete seven core courses, two elective courses and two clinical practicum placements.

- Total course hours: 360 (36 units)
- Total clinical hours across 2 practicum placements: approximately 800

Example timeline for completing the MSc in Psychotherapy

Year 1

	TERM 1	TERM 2	TERM 3
	September – December	**January – April**	**May - August**
Courses (Required)	▪ Principles of Evidence-Based Psychotherapy (3 units) ▪ Introduction to Mental Health and Wellness (3 units) ▪ Assessment and Case Formulation (3 units)	▪ Cognitive Behavioural Therapy (3 units) ▪ Ethical Standards and Professional Practice (3 units) ▪ Elective (3 units) *****	
Practicum			**Practicum I** (4 days/week)

Year 2

	TERM 4	TERM 5
	September – December	**January – April**
Courses (Required)	▪ Clinical Research Methods (3 units)	▪ Elective (3 units) *****
	▪ Applied Psychotherapy Skills (6 units)	
Practicum	**Practicum II** (2 days/week)	

****** Suggested term for Elective Courses, however, students can take the electives during any term of either year 1 or 2.*

The following are descriptions of the courses offered by the Psychotherapy Program. Students will complete 7 core courses, 2 practicum courses, and 2 elective courses.

DESCRIPTIONS OF CORE AND PRACTICUM COURSES

The students will complete the lecture and clinical practicum courses in the following sequence. During any of the following terms students can also complete their elective courses.

Term 1 (Fall Semester - September to December)

Principles of Evidence-Based Psychotherapy (3 units)
The course will explore the theory and research related to evidence-based psychotherapies, including cognitive-behavioural therapies, psychodynamic psychotherapy, interpersonal psychotherapy, experiential and humanistic psychotherapies. Different therapeutic modalities, including individual therapy, group therapy, family therapy and couples therapy, will also be discussed. The course will also discuss the common factors that influence the effectiveness of therapy, including therapeutic alliance, specific therapist and client factors, as well as culture and diversity.

Introduction to Mental Health and Wellness (3 units)
This is a foundational course that will provide students with a theoretical overview of topics related to mental illness and health/wellness. Topics will include fundamental models for conceptualizing mental health, including the Biopsychosocial model and the Diathesis Stress Theory. Course topics will also include an introduction to health disorders and their etiology, prognosis, and epidemiology. Finally, students will explore transdiagnostic factors that influence mental health.

Assessment and Case Formulation (3 units)
The course will offer students theoretical and applied skills in the assessment of mental illness and the development of evidence-based case conceptualizations. Students will learn skills to obtain information related to individuals' mental illness via clinical interviewing and to develop an individualized formation and treatment plan based on the data gathered. In addition, students will learn how to assess and monitor treatment outcomes.

Term 2 (Winter Semester - January to April)

Cognitive Behavioural Therapy (3 units)
The course will offer students focused training in cognitive behavioural therapy (CBT) theory and skills. The course will provide students with an overview of CBT theory, core CBT principles, and an introduction to specific CBT-based treatments for various mental health disorders and related problems.

Ethical Standards and Professional Practice (3 units)
The course will focus on providing students with an introduction to the ethical and professional issues in the practice of psychotherapy, such as professional competency, privacy and confidentiality, client-therapist boundaries. The aim is for students to learn ethical guidelines and decision making for managing ethical dilemmas. The course will cover content related to the legal requirements and ethical conduct for registered health professionals.

***Term 3* (Spring/Summer – May to August)**

Practicum I (3 units)
Students will complete an external clinical practicum placement in the community under the supervision of regulated health professional. It is anticipated that the student will attend their practicum placement 4 days per week for a minimum of 400 hours and complete over a single term. While completing the practicum, students will also be working on an integration paper (e.g., case study, literature review) which will be due at the end of the practicum. Clinical practicum supervisors will provide feedback on students' clinical performance during the practicum placement.

Term 4 (Fall Semester - September to December)

Clinical Research Methods (3 units)
The aim of the course is to provide students with the knowledge and skill to review and evaluate research relevant to the field of psychotherapy. Topics will include basic research method designs, ethical issues in research, selection of appropriate assessment tools, data collection and analysis, and manuscript writing. In addition, the course will provide students with practical skills on how to evaluate psychotherapy programs.

Term 4 AND Term 5 (Fall and Winter Semesters – September to April)

Applied Psychotherapy Skills (6 units)
The course will provide training in advanced psychotherapy skills via tutorial-based classes. Students will practice a range of skills including clinical interviewing, specific strategies from evidence-based psychotherapies, managing and troubleshooting challenges to the therapeutic alliance. Skill development exercises will include reviewing audio recordings of therapy tapes, role playing in pairs and small groups, as well as reviewing treatment protocols. Students will be required to lead class discussions on psychotherapy skills. Students will be encouraged to select a topic that is relevant to their current practicum placement or is an area of interest related to their self-directed learning plan. To ensure students receive adequate supervision and assessment, the student cohort will be split into smaller sections. This course will be completed at the same time as the Clinical Practicum II course.

Clinical Practicum II (3 units)
Students will complete an external clinical practicum placement in the community under the supervision of a regulated health professional. The practicum will be completed over 2 terms for approximately 8 months. It is anticipated that the student will attend their practicum placement 2 days per week for a minimum of 400 hours. While completing the practicum students will also be working on an integration paper (e.g., case study, literature review) which will be due at the end of the practicum. Clinical practicum supervisors will provide feedback on students' clinical performance during their practicum placement.

DESCRIPTIONS OF THE ELECTIVE COURSES

In addition to the 7 core courses and 2 practicum courses, students are required to complete 2 elective courses from those listed below. The elective courses will be offered on a rotating basis and therefore, not all elective courses will be offered each year. Students will be able to complete their elective courses during any term.

Group Therapy (3 units)
Group work has been demonstrated to be an effective way of providing service to clients. This course examines group work practice by exploring a range of theoretical concept, frameworks and skills. The course will focus on the development and practice of group leadership skills through lectures and the provision of opportunities for in-class, experiential learning. Students will participate in small groups to develop specific skills for effective group leadership.

Psychodynamic Psychotherapy (3 units)
This is an introductory course to key concepts in Psychodynamic Psychotherapy and the Psychotherapeutic relationship. The overall objective is for students to gain a basic understanding of key concepts and clinical techniques of psychodynamic psychotherapy, which includes the examination of the effects that early experience has in shaping who we are and impacting our interpersonal relationships. Students will become familiar with the features of conducting a psychodynamic assessment with an emphasis on the centrality of the therapeutic relationship.

Mindfulness-Based Cognitive Therapy (3 units)
Mindfulness is a non-judgmental way of paying attention in the present moment. It may reduce emotional reactivity and negative thinking, increasing resilience and enhancing the ability to choose how to respond to difficult situations. This course will focus on developing an understanding of the application of mindfulness interventions for health care populations. The emphasis will be on developing familiarity with leading and facilitating mindfulness practices. Based on Mindfulness-Based Cognitive Therapy traditions, participants will first participate in the mindfulness intervention, followed by discussion of the practice and the methodology for teaching the practice.

Motivational Interviewing (3 units)
This course will focus on understanding the theoretical underpinnings and evidence supporting the use of this integrated set of interviewing skills for clients who are ambivalent about change. Students will participate in pairs and small groups to develop and practice beginning and advanced motivational interviewing skills through discussion, case studies and practice in class.

CBT for Specific Populations (3 units)
This course will have rotating topics that vary depending on the instructor and topics of interest to the students. For example, it may focus on CBT for chronic pain, addictions, psychosis, or trauma.

Interpersonal Therapy (3 units)
Interpersonal Therapy (IPT) is a short-term contractual "here and now" focused psychotherapy that focuses the relief of depressive symptoms and the individual's adaptation to the social and interpersonal circumstances associated with the onset of the depression. The emphasis of IPT is to facilitate restoration of the client's previous level of functioning.

Family and Couples Therapy (3 units)
This course will offer students an introduction to theories and evidence-based interventions that emphasize improvements in couple and family functioning.

Emotion-Focused Therapy (3 units)
The aim of this course is to offer students an opportunity to gain skills in working directly with emotions in psychotherapy. The course will cover topics including emotion theory and emotion-focused strategies.

Seniors Mental Health (3 units)
This course is designed to enhance the students' skills to communicate with and support seniors with mental health issues including emotional distress and behavioural challenges. Students will enhance their assessment skills related to seniors' mental health conditions including symptoms, risk and treatment options and communication skills with clients and other health care providers. Students will gain

knowledge and skills related to interpersonal communication including self-awareness, therapeutic relationships, and the essential of skilled helping.

Child and Adolescent Psychotherapy (3 units)
The course will offer students a theoretical and clinical foundation in evidence-based interventions for children and adolescents for a range of mental health issues and presenting problems. The course will also incorporate topics related to development, diversity, and individual differences.

Positive Psychology (3 units)
The course will focus on the theories and principles of positive psychology. Students will learn clinical strategies related to the study and assessment of individuals' strengths which can be incorporated into their treatment plans.

Research Practicum (3 units)
As an elective, students have the opportunity to become involved in a research project that is currently underway in the Department of Psychiatry and Behavioural Neurosciences.

Special Topics in Evidence-Based Psychotherapies (3 units)
This course will be designed to address current issues and emerging trends in psychotherapy literature. The topic will be chosen in response to needs identified by the instructor and/or students.

4.2 PROGRAM INNOVATION

The MSc in Psychotherapy's curriculum will integrate and reflect McMaster's three key educational principles of *Problem-Based Learning, Self-Directed Learning, and Small Group Learning*.

Problem-Based Learning
McMaster's Problem-Based Learning Model is the basis for much of the instruction in the program. Given that this model emphasizes interaction with real-life clinical issues for experiential learning, the program is designed to emphasize learning that involves interacting with others, as well as encouraging students to engage in self-reflection to promote learning, integration, and the mastery of therapeutic skills. While completing clinical practicum placements, students will have the opportunity to directly apply their skills in clinical settings to optimize their experiential learning experiences.

The courses are designed to best meet the Program Learning Outcomes, which includes challenging students to enhance their current skill sets. Given the wide range of clinical modalities addressed in the course work, students may develop an understanding and basic introduction to several different areas or may choose to specialize by focusing on one area and delving into it in-depth, including getting supervision of their clinical work with clients/patients in a specific therapeutic modality.

Self-Directed Learning
Students will have the opportunity to explore their own personal learning needs while completing all components of the program. Although all students are required to complete a set of core courses, they will have ample opportunity to incorporate self-directed learning in these courses. For example, students will be required to select topics of interest when leading class discussions and when completing written assignments and final papers. Moreover, the clinical practicum and the Advanced Psychotherapy Skills

course offer a perfect example of the Self-Directed Learning model that was set out as a priority in the *Forward with Integrity* letter. In these learning opportunities, students will be encouraged to determine their learning needs, identify methods to meet their training need, and assess whether the need has been met. Overall, the program is designed to be iterative, such that students first develop foundational knowledge and skill in the first terms, and in subsequent courses students are encouraged to select learning opportunities based on their clinical interests and learning needs.

Small Group Learning
The classroom-based courses will provide students with small group learning opportunities. The courses incorporate group-based discussions and role plays as teaching opportunities. Students will complete different practicum placements which will offer them diverse clinical experiences, and in turn, provides a valuable learning resource as it encourages students to discuss different approaches to clinical situations.

Overall, the proposed MSc in Psychotherapy is unique in Canada and differs from existing Master's-level programs in Psychology, Counselling, and Social Work. The program is designed to meet the specific needs of individuals who are seeking advanced training and competency in the delivery of psychotherapy as an independent practitioner. The focus of the program is to provide individuals with advanced knowledge and skill in evidence-based psychotherapies, with a specific focus on developing competency in cognitive behavioural therapy (CBT). Distinct from counselling programs that focus on providing vocational counselling and advice and from the majority of psychology graduate programs that have a significant research component, the MSc in Psychotherapy will emphasize foundational training in theories of mental illness and psychotherapies. The MSc will also offer several experiential learning opportunities to practice applied skills to ensure that a student exits the program with the competency to practice independently. Finally, the self-directed learning requirements will ensure that students are able to identify and continue to direct their professional development throughout their careers.

4.3 MODE(S) OF DELIVERY

The MSc in Psychotherapy will offer students a variety of learning activities via courses and practicum learning opportunities.

Learning opportunities across the **Core and Elective Courses** include:

- Written article critiques, reflection papers
- Role play of therapy skills in pairs and small groups
- Analysis of pre-recorded therapy sessions
- Formulation of case conceptualizations/case study
- Lectures by clinical specialists
- Class discussions, including leading class discussions on selected topics
- Presentations

Learning opportunities specific to the **Applied Psychotherapy Skills Course** (small group tutorials) include:

- Role play of therapy skills in pairs and small groups
- Analysis of pre-recorded therapy sessions
- Discussion of clinical cases
- Self-reflection papers

Learning opportunities during the **Practicum Courses** include:

- Conducting individual therapy sessions with clients
- Co-leading group therapy sessions with an experienced clinician
- Supervision of therapy cases by a registered clinician
- Integration paper

The core and elective courses will be offered in a regular classroom format at McMaster University or St. Joseph's Healthcare's West 5th Campus. The Practicum placements will be completed in community-based clinical settings, including hospitals, family health teams, mental health agencies, and university counselling centres.

4.4 EXPERIENTIAL LEARNING

The MSc in Psychotherapy courses will include several experiential learning components within the course-based curriculum and clinical practicum placements.

The program is committed to providing students with various methods for learning and practicing their new learning. The courses will include role plays, analyzing and discussing pre-recorded therapy sessions, and group discussions. The focus of the Applied Psychotherapy Skill is to offer students an opportunity to learn about relevant clinical topics and practice the skill with students in the program and to receive feedback prior to using the skill or therapy method with a client in clinical practice. In addition, the Applied Psychotherapy Skills course will include opportunities for students to explore a variety of clinical and professional problems that they are likely to encounter in clinical practice (e.g., managing client relationship ruptures, ethical dilemmas).

All students will also be required to complete two clinical practicum placements. Students will be able to select clinical placements that are relevant to their training interests (and based on availability). Initial clinical placements have been established with various mental health speciality clinics (e.g., Anxiety Treatment and Research Clinic, Mood Disorders Clinic) at St. Joseph's Healthcare Hamilton. As the program develops further, additional practicum placements will be formalized. It is anticipated that students will be working with clinical patients/clients in a variety of settings including hospitals, family health teams, mental health agencies, university counselling centres and private clinical practices. Experiential clinical training will offer students a range of opportunities to practice their new skills in professional clinical settings to prepare students for the workplace.

4.5 ACCESSIBILITY

Standards set by the Accessibility for Ontarians with Disabilities (AODA) will be incorporated in the development of the course materials and resources.

For example, all materials used in the MSc in Psychotherapy will be available in alternate formats (e.g., large-print; braille). The website will conform to McMaster Accessibility guidelines. All instructors and faculty will be informed on an annual basis about the requirements to provide accommodations where needed, and how to do so. Faculty can discuss any questions they may have regarding accessibility or ways in which the course content could be modified to ensure it is relevant and sensitive to different

perspectives with the course co-ordinator or with the Program Director. Accommodations will be made on an individual basis to meet the specific needs of the learner.

4.6 RESEARCH REQUIREMENTS (IF APPLICABLE)

The MSc in Psychotherapy is a professional, course-based Master's program and therefore, does not require a research project. However, the students will learn to search for and assess evidence in order to develop their skills for promoting evidence-based practice. Additionally, there are many opportunities within McMaster's Department of Psychiatry and Behavioural Neurosciences for interested students to participate in research projects that are underway.

5 ASSESSMENT OF LEARNING

5.1 METHODS FOR ASSESSING STUDENTS

Each course will incorporate a diverse set of learning activities to teach the course content, which directly align with the principles of problem-based and self-directed learning, and provide the instructor with several opportunities for the assessment of learning. The students will be evaluated using a variety of methods, including their performance in role plays and supervision of client sessions to demonstrate the skills taught, written essays on topics covered, participation in class discussions, and class presentations.

The specific assessment methods will include:

- Evaluation of assignments, papers, quizzes, exams, learning portfolios, participation in course activities.
- Reflective papers to provide the opportunity to assess students' ability to apply the theoretical knowledge and skills taught in course material to their own clinical practice.
- Evaluation of the student's ability to perform the skills taught (in role play and in clinical practice)

5.2 CURRICULUM MAP

A curriculum map is presented below.

Program Learning Outcomes (PLOs)		Program Requirements	
By the end of the program, student graduating with a Master's degree will be able to...	**Master's Degree Level Expectations (DLEs)**	**Teaching Activities & Learning Opportunities**	**Assessments and Evidence**
	For each PLO, identify which DLE(s) it aligns with below.	For each PLO, what teaching activities and learning opportunities are students exposed to that will help them to achieve that PLO?	For each PLO, what is specifically collected from the student as evidence that they can/have achieved the PLO before they graduate?
1. Demonstrate and apply knowledge of key theoretical models of mental health illness and wellness, including understanding role of human development, physical health, and sociocultural factors, in their professional practice.	1, 2, 3	**All courses** (in class lecture, course readings, class discussion)	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions
		Practicum (Application of knowledge and skill in a clinical setting)	- Midterm and final evaluations completed by clinical supervisor regarding the student's level of competence in developing case conceptualizations that are rooted in clinical theory
		Completion of Integrative Papers (completing of literature review, preparation/integration of knowledge, writing of final paper)	- Feedback on drafts of paper - Evaluation of final written paper
2. Demonstrate knowledge of the theory and research support for evidence-based psychotherapies in the treatment of mental health disorders.	1, 2, 3	**All courses** (in class lecture, course readings, class discussion)	- Graded assessments of course requirements: Written assignments and final papers - Assessment of quality of participation in class discussions
		Practicum (Application of knowledge and skill in a clinical setting)	- Midterm and final evaluations completed by clinical supervisor regarding the student's level of competency in the delivery of an evidence-based psychotherapy
3. Demonstrate the competency to conduct clinical assessments, formulate case conceptualizations and	3, 4, 5, 6	**All courses, but predominantly in the Assessment and Case Formulation Course** (In class lectures, course readings, class discussion, role play)	- Graded assessments of course requirements: Written assignments and final papers - Assessment of quality of participation in class discussions

develop treatment plans for a range of clinical presentations.		**Practicum** (Weekly supervision with a registered therapist, conducting clinical assessments with patients/clients in clinical settings)	- Midterm and final evaluations of student's level of competence in conducting clinical assessments, developing case conceptualizations and treatment plans
4. Engage in effective and competent clinical practice, which is demonstrated through the effective application of evidence-based psychotherapies, ability to form therapeutic rapport, and effective communication with patients or clients.	3, 4, 5, 6	**Applied Psychotherapy Skills** (Didactic presentations, video vignettes, role-play, class discussion)	- Graded assessments of course requirements: written assignments, projects, final papers, - Evaluation of student's quality of participation in class discussions and role plays
		Practicum (Weekly supervision with a registered therapist, leading individual and group therapy sessions in clinical settings)	- Midterm and final evaluations of student's level of competence in conducting psychotherapy
5. Demonstrate and integrate knowledge of professional standards of practice and ethical conduct in clinical practice.	3, 5, 6	**Ethical Standards and Professional Practice (**Didactic presentations, course readings, in class discussion)	- Graded assessments of course requirements: written assignments, projects, final papers - Evaluation of student's quality of participation in in-class discussions
		Practicum (In clinical setting, Discussions with clinical supervisor)	- Midterm and final evaluations of student's level of competence in clinical ethics and professional issues
6. Accurately appraise personal levels of clinical competence and identify areas for professional growth and self-directed learning.	1, 2, 3, 5, 6	**Applied Psychotherapy Skills** (Didactic lecture, class discussions, Role plays)	- Evaluation of reflection papers and self-directed learning plans - Evaluation of student's quality of participation in in-class discussions and role-plays
		Practicum (Audio recording therapy sessions)	- Completion of goals at start of practicum and evaluation of goal completion at the end of the practicum
7. Use critical thinking skills to identify and solve complex problems and to appraise the success of the solutions employed.	1, 3, 5, 6	**All courses, but predominantly in the Clinical Research Methods Course** (in class lecture, course readings – research articles, class discussion, discussion of program evaluation)	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions
		Completion of Integrative Papers (Preparation/integration of knowledge, writing of final paper)	- Evaluation of final paper
8. Exhibit the ability to identify and make improvements in the delivery of patient or client care.	1, 3, 5, 6	**Clinical Research Methods** (In class lecture on program evaluation; Completion of written assignment)	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions

9. Engage in effective written and oral communication skills with patients and other healthcare providers.	4	**All courses, but predominantly in the Assessment and Case Formulation Course** (in class discussions, clinical writing skills, written assignments)	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions
		Practicum (Completion of written clinical assessment reports and therapy progress notes; Participate as a member of a clinical team)	- Midterm and final evaluations of student's quality of clinical writing: assessment reports and clinical progress notes
		Completion of Integrative Paper Develop draft of outline and written document	- Feedback on draft - Final evaluation of paper
10. Demonstrate an understanding of clinical research methods, including the ability to critically evaluate the validity of clinical theories and research findings and the ability to conceptualize and develop a research study.	1, 2, 3	**All courses but predominantly in the Clinical Research Methods Course** (In class lecture, class discussion, written critiques of research articles)	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions
11. Integrate and apply knowledge of clinically-relevant research findings in clinical practice, including the selection of appropriate evidence-based therapies, and engaging in the measurement and evaluation of clinical outcomes.	1, 2, 3, 6	**All courses, but predominantly in the Clinical Research Methods Course**	- Graded assessments of course requirements: written assignments, projects, final papers - Assessment of quality of participation in class discussions
		Practicum (Application of skills in a clinical setting)	- Midterm and final evaluations of student's quality of clinical writing: assessment reports and clinical progress notes
		Completion of Integrative Paper Develop draft of outline and written document	- Feedback on draft - Final evaluation of paper

5.3 DEMONSTRATING STUDENT ACHIEVEMENT

Students' achievements will be demonstrated by (i) performance in courses, (ii) evaluations from clinical practicum placements and (iii) completion of the Integrative papers.

Courses

For in-classroom courses, student achievement will be identified through class participation and assignments, quizzes, midterms and exams. Theoretical knowledge will be evaluated primarily through class participation (e.g., engagement in discussions and critical appraisal of concepts), assignments, quizzes, exams, as well as on final written projects. Achievements related to practical skill acquisition will be evaluated based on students' demonstration of clinical skills/application in role plays as well as their written description of their clinical case, which will include evaluation of their client's outcomes.

The assessment methods are outlined in the curriculum map. In addition to the traditional methods of evaluating students' performance, the emphasis on clinical application lends itself to many innovative opportunities for students to demonstrate their skills, such as role plays, case formulations, presentation of vignettes illustrating their application of new skills, reflective papers, and the discussion of videotapes that demonstrate the application of new skills acquired via clinical practice. Students' progress can also be assessed through observation of their participation in group discussions during the courses.

Clinical Practicum Placements

Clinical practicum supervisors will provide the ongoing supervision and guidance of students on clinical practicum placements. Clinical practicum supervisors will also provide feedback on the student's performance while on the practicum placement, including a formal, written evaluation of the student's clinical skill (i.e., intervention utilised, building a therapeutic alliance), communication skills, and ethics and professional standards.

The Coordinator of Clinical Education will oversee, coordinate and evaluate clinical placements. The Coordinator of Clinical Education will complete the student's formal midterm and final evaluations, with consideration of the formal, written input from the clinical practicum supervisor.

Integrative Papers

Students will complete an integrative paper (approximately 2000 words) during their clinical practicum placements. The paper will require students to identify a topic of their choice related to their practicum placement (e.g., a specific mental health problem, psychotherapy treatment protocol). Students will then discuss the theoretical knowledge that they have gained on this topic and how it can be applied in their clinical setting to best meet the needs of their patients. This paper will be evaluated by their clinical practicum supervisor and by the Coordinator of Clinical Education and will be used towards their evaluation of their Clinical Practicum Placement.

6 RESOURCES

6.1 GRADUATE PROGRAMS

6.1.1 ADMINISTRATIVE, PHYSICAL AND FINANCIAL RESOURCES

Administrative
A faculty position will be developed for the Coordinator of Clinical Education (teaching-stream position) who will oversee clinical practicum placements. Due to the commitment required for coordinating clinical practicum placements for the students, the program will require a FTE who is responsible for developing, planning, coordinating, facilitating, monitoring and evaluating the clinical practicum placements and for evaluating students on placement with input from the clinical practicum supervisor. The Coordinator of Clinical Education will also build partnerships between the MSc in Psychotherapy Program and the clinical community to secure practicum positions. Finally, the Coordinator of Clinical Education will be responsible for providing orientation and training materials for clinical practicum supervisors.

The current CBS Program Coordinator will transfer to the Master's program once approved. The Coordinator will oversee the daily functioning of the program and run the administrative office.

Physical Resources
The Psychotherapy Program will be housed within the Department of Psychiatry and Behavioural Neurosciences. The existing CBS Program has two offices, one at the Ewart Angus Centre at MUMC and one at St Joseph's Healthcare Centre - West 5th campus. There is also space for student cubicles. There is no current need for additional physical resources.

Financial Resources
The program will be funded through BIU grants from the Ministry of Training, Colleges and Universities and student tuition. Financial support for the Program Director, Coordinator of Clinical Training, Program coordinator and administrative support will be generated from program revenues.

6.1.2 LIBRARY, TECHNOLOGY, AND LABORATORY RESOURCES

The library and information technology support available from McMaster University and St. Joseph's Healthcare Hamilton will be adequate to sustain and support students' learning and scholarship, including assess to journal subscriptions, online databases, and books.

The program will utilise audiovisual materials and internet access during the class lectures. All of the classrooms have the required technology.

None of the students will be conducting independent research projects and therefore no laboratory space is required.

6.1.3 FACULTY

The existing CBS Faculty will support the Master's program and maintain the high quality of teaching and the excellence of the learning environment. Majority of the teaching faculty are members of the Department of Psychiatry and Behavioural Neurosciences, while others come from McMaster's School of

Rehabilitation Science and School of Nursing in the Faculty of Health Sciences. All faculty and course instructors are well-established in academia and clinical practice and remain up-to-date with developments in clinical and psychotherapy practice. Faculty and course instructors are experienced, respected and well-recognized in their areas of expertise. As noted in 6.1.1. ***ADMINISTRATIVE, PHYSICAL AND FINANCIAL RESOURCES***, the program will be hiring a faculty member to serve as the Coordinator of Clinical Education.

A list of faculty members can be found under Appendix C. Majority of the faculty fall into category 4 (non-tenure track core faculty members who are involved in teaching and/or supervision in other graduate program(s) in addition to being a core member of the graduate program under review). Although many of the faculty members are in category 4, the CBS program is their sole or primary teaching commitment in the Department of Psychiatry and Behavioural Neurosciences. Given the demands of the MSc Program, the department will also aim to recruit a faculty member to teach exclusively in the MSc Program. As there are no dissertations or theses to be completed in this Program, there is no supervision related to a Master's thesis.

All students will be connected with a mentor, who is a faculty member involved in the MSc in Psychotherapy, to provide advice and mentorship. The student and faculty member will meet a minimum of three times per year to provide guidance and discuss with the student his/her progress in the program.

6.1.4 STUDENT FINANCIAL SUPPORT

Consistent with professional Master's degrees at McMaster University, there is a scholarship allocation of $1000 per full-time student, per year. The scholarship will be used to provide entrance scholarships, awards of academic achievement, etc., which is consistent with other graduate programs in the Faculty of Health Sciences.

7 QUALITY AND OTHER INDICATORS

7.1 ACADEMIC QUALITY OF THE PROGRAM

The MSc in Psychotherapy will use formative assessments and feedback on a regular basis to assess the academic quality of the program.

The Psychotherapy Program will be evaluated by students in the following areas: a) the quality of the instruction (i.e., knowledge and teaching ability of instructors), and b) the usefulness of the course materials to their real work experiences. Courses are evaluated on objectives, content, format, resources used, group composition and overall ratings. The program will also seek feedback from clinical practicum supervisors.

Assessment and quality of student success during the program will be evaluated based on: time to completion data; grades and averages; and retention rates. Following completion of the MSc, students will be asked to complete a survey to provide the program with information related to current employment and status of registration with the CRPO.

Faculty members' performance will be reviewed by the Associate Chair, Education Psychiatry and Behavioural Neurosciences as part of their faculty re-appointment every three years. Instructors will be evaluated by students using the standard online survey developed by the Faculty of Health Sciences. The evaluations will also be presented to the instructors to review after the course has ended. The program will follow the Faculty of Health's Sciences guidelines for sharing evaluations: To maintain and protect students' confidentiality, feedback will only be shared with faculty once a sufficient number of have been received (i.e., 5 or more) and the information gathered will be anonymized. These evaluations will then be shared with the course co-ordinator. Should there be concerns raised by these evaluations, the course co-ordinator will meet with the Instructor to discuss the concerns and to help resolve any issues that arise. This meeting will then be reported to the Program Director. Students will also be asked to evaluate their clinical practicum supervisors and the providing of feedback to supervisors will also follow the Faculty's guidelines for sharing of evaluation information.

Department meetings will be held each semester, which will provide opportunities for faculty to exchange information on how the courses are progressing and areas for improvement. These meetings will also offer faculty the opportunity to exchange ideas or innovations that have worked well in one course or part of the program and which could be adopted in other courses.

7.2 INTELLECTUAL QUALITY OF THE STUDENT EXPERIENCE

The MSc in Psychotherapy is offered through McMaster's Department of Psychiatry and Behavioural Neurosciences. The Department has a vibrant and engaged faculty with diverse training backgrounds. There will be many opportunities for students to become involved in Department activities and to interact with a variety of faculty members. The faculty are also very invested in maintaining a high standard of intellectual quality in their course offerings and in their clinical work. We aim for the MSc in Psychotherapy to meet the students' training and learning needs to prepare them for a career as an independent psychotherapy practitioner.

CHECKLIST FOR NEW PROGRAM PROPOSALS

The following section indicates all the items that are required as part of a ***complete*** new program proposal package which includes all the necessary documents. Part I, II and III should be submitted as separate files to iqap@mcmaster.ca.

PART I: COMPLETE NEW PROGRAM PROPOSAL DOCUMENT

- ☐ **Complete New Program Proposal Template**
- ☐ **Faculty CVs** (can be submitted on CD or USB)
- ☐ **Memorandum(s) of Understanding (Letters of Support)** (if applicable)

PART II: RESOURCE IMPLICATIONS AND FINANCIAL VIABILITY TEMPLATE

- ☐ Completed
- ☐ Approved

PART III: FEES MEMO

- ☐ Completed
- ☐ Approved

TRACKING THE APPROVALS PROCESS FOR NEW GRADUATE PROGRAMS

PLEASE NOTE: This table must be appended to the New Program Proposal Document and updated as each step in the approvals process is completed.

STEP IN THE NEW PROGRAM APPROVALS PROCESS	NAME OF COMMITTEE/ INDIVIDUAL PROVIDING CONSULTATION	DATE OF DOCUMENT APPROVAL
Preparation of the Resource Implications & Financial Viability Template (Budget)	**Linda Coslovi, Executive Director, Finance & Planning (Academic)**	
University Students Fees Committee Approval of Budget		
Departmental & Faculty Approvals of Proposal		

Please note that approvals from the following internal committees is also required before the New Program Proposal can be sent to Quality Council & MTCU: *Graduate Council, University Planning Committee* and *Senate.*

Appendix A

Survey of Current and Past CBS Graduate Diploma Students

Would you have been interested in completing a Master's in Clinical Behavioural Studies if it had been available to you? Please elaborate on your answer.

Answer Choices	Responses
Yes	**100.0%**
No	**0.0%**

If you were interested in the Master's degree, which track of the program would you be interested in completing?

Answer Choices	Responses
General track (i.e., completion of courses across several study areas)	**28.57%**
Specialized track (i.e., completion of courses within a specific study area)	**71.43%**

If you were interested in the Master's degree, would you pursue a full time or part time degree?

Answer Choices	Responses
Full time (1 course per term; 3 terms per year (i.e., fall, winter, spring)	**42.86%**
Full-time (1 course per term; 2 terms per year (i.e., fall, winter)	**42.86%**
Part-time (fewer than 2 courses a year)	**14.29%**

Appendix B

Terms of Reference for Admissions Committee and Curriculum Committee

Admissions Committee - Terms of Reference

Mandate: The mandate of the Admissions Committee is to develop all policies and procedures related to admitting applicants to the MSc in Psychotherapy Program, in accordance with accreditation standards and McMaster Graduate Studies Admission criteria.

Membership:

- The Director of the MSc in Psychotherapy Program or their delegate will chair the committee, which will include a minimum of 2 additional faculty members.

Length of Term:

- Appointed members will normally serve a 3-year term, renewable once.

Specific Functions:

- Establish admissions policies and procedures, including admission criteria that complies with Graduate Studies admission criteria
- Establish application deadlines for the Psychotherapy Program
- Ensure that the qualifications of applicants seeking admission are appropriately assessed and reviewed and that fair and equitable consideration is given to each applicant
- Select applicants who are best qualified and recommend them for an interview
- In consultation with Graduate Studies, regularly review the criteria for admission and recommend changes to the admission policy
- Review, revise and recommend wording and changes of the on-line application form as required
- Review and revise admission criteria and content for the website and the university calendar on an annual basis

Meeting procedures

- Frequency and duration – Twice a term (minimum 6 meetings a year). Additional meetings will be scheduled as needed at the call of the Chair.
- Conflict of interest – members are expected to declare a conflict of interest if their real or perceived personal interest might be seen to influence their ability to assess any matter before the committee objectively
- Decision making – The Chair will aim to build consensus if possible and the final decision will be made by voting; votes may be conducted electronically if necessary.
- Evaluation – the Admission Committee will review the Terms of Reference on an annual basis and/or as required

Curriculum Committee - Terms of Reference

Mandate: The mandate of the Curriculum Committee is to ensure that the curriculum for the MSc in Psychotherapy Program is designed, managed, evaluated and revised in a coherent and coordinated fashion, consistent with accreditation and current educational standards and the programs mission and goals.

Membership:

- The Director of the Psychotherapy Program or delegate will chair the committee. Membership includes a minimum of 2 faculty members and one student.

Length of Term:

- Appointed members will normally serve a 3-year term, renewable once.

Meeting Procedures

- Frequency and duration – once a month (September through June). Additional meetings will be scheduled as needed.
- Conflict of interest – members are expected to declare a conflict of interest if their real or perceived personal interest might be seen to influence their ability to assess any matter before the committee objectively
- Decision making – the Chair will aim to build consensus if possible and the final decision will be made by voting, in the event of a tie, the Chair's decision will preside
- Evaluation – the Curriculum Committee will review the terms of reference on an annual basis and/or as required.

Specific Functions:

- Policies
- Curriculum goals
- Curriculum design and methodologies
- Evaluation and revision of curriculum content
- Identifying the need for new program components or courses
- Curriculum administration
- Faculty communication and education

Responsibilities and Duties:

- To review and evaluate curriculum proposals to ensure that they meet established educational policies and standards. Make recommendations to the GPCC for approval of curriculum in accordance with Graduate Studies Policies.
- To ensure continuity within the curriculum, including the annual calendar
- To develop and implement policies regarding hours of the curriculum, curriculum design and content, including recommendations to the GPCC
- To establish curricular content and design and sequencing; ongoing review and updating of content
- To monitor adequate vertical and horizontal for integration of content
- To oversee curricular implementation and ongoing management
- To manage the ongoing evaluation and revision of the curricular content
- To develop policies, establish curricular goals and objectives
- To manage the ongoing evaluation and revision of curriculum content
- To promote faculty communication and education
- To administer the curriculum
- To receive and analyze requests for curriculum modifications such as requests for new materials
- To respond to external audits and accreditation surveys
- To review appropriateness of course offerings

- To ensure effective management of student/tutor evaluation processes

Appendix C

Current CBS Faculty Members

Faculty Name & Category of Appointment	M/F	Home Department
CATEGORY 1		
CATEGORY 2		
Armstrong, Monique, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Cox, Linda, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Evans, Peter, Assistant Professor	M	Department of Psychiatry and Behavioural Neurosciences
Fenton, Nancy, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Fletcher, Janet, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Keeber, Kristy, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Marshall, John, Lecturer	M	Department of Psychiatry and Behavioural Neurosciences
Meister, Chuck, Assistant Professor	M	Department of Psychiatry and Behavioural Neurosciences
Ricketts, Paul, Assistant Professor	M	Department of Psychiatry and Behavioural Neurosciences
Seaton, Louise, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Tarswell, Neil, Assistant Professor	M	Department of Psychiatry and Behavioural Neurosciences
Ward, Susan, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
CATEGORY 3		
Kates, Nick, Professor	M	Department of Psychiatry and Behavioural Neurosciences
McKinnon, Margaret, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
CATEGORY 4		
Bang, Debbie, Assistant Professor	F	School of Nursing
Beiling, Peter, Professor	M	Department of Psychiatry and Behavioural Neurosciences
Bourque, Lisa, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Chudzik, Susan, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Eppel, Alan, Professor	M	Department of Psychiatry and Behavioural Neurosciences
Frederiksen, Savinna, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Green, Sheryl, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences

Goldberg, Joel, Associate Professor	M	Department of Psychiatry and Behavioural Neurosciences
Haber, Erika, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Hapidou, Eleni, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
Harris, Ruth, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Hundert, Joel, Associate Professor	M	Department of Psychiatry and Behavioural Neurosciences
Hunt, Marilyn, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Jendzio, Anna, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
King, Jelena, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Liss, Andrea Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Laliberte, Michele, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Korzekwa, Marilyn, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
McCabe, Katie, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
McCabe, Randi, Professor	F	Department of Psychiatry and Behavioural Neurosciences
McEvoy, Esther, Assistant Professor	F	School of Rehabilitation Sciences
Milosevic, Irena, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Nifakis, Debbie, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
Nowakowski, Matilda, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
O'Neill, Laura, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Pellizzari, Joseph, Associate Professor	M	Department of Psychiatry and Behavioural Neurosciences
Pires, Paulo, Assistant Professor	M	Department of Psychiatry and Behavioural Neurosciences
Pytka, Pauline, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Reynolds, Jane, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Rowa, Karen, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
Saperson, Karen, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
Sergeant, Laura, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Smith, Wanda, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Sulis, William, Associate Professor	M	Department of Psychiatry and Behavioural Neurosciences

Traficante, Marlene, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Weeraskera, Priyanthay, Professor	F	Department of Psychiatry and Behavioural Neurosciences
Wolpert, Adele, Associate Professor	F	Department of Psychiatry and Behavioural Neurosciences
Yuen, Sandy, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
CATEGORY 5		
CATEGORY 6		
Key, Brenda, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences
Hewitt, Jennifer, Assistant Professor	F	Department of Psychiatry and Behavioural Neurosciences

McMaster University

NEW PROGRAM PROPOSAL

M.Eng. in Systems and Technology

April 7, 2017

TABLE OF CONTENTS

1 PROGRAM

1.1 PROGRAM DESCRIPTION

The proposed M.Eng. program combines professional development with advanced technical competencies required for the development, implementation, monitoring and improvement of performance of 21st industrial systems which combine physical and digital components (cyber-physical systems). This M.Eng. program is the first of its kind in Canada, joining a handful of recently announced similar programs in the United States. The Program is intended as a replacement for the existing M.Eng. in Manufacturing Engineering.

In addition to M.Eng. in Systems and Technology, this proposal includes offering of three Graduate Diplomas (Type 3). Each of these Graduate Diplomas corresponds to a distinct aspect of cyber-physical systems. These Graduate Diplomas are:

- Advanced Manufacturing
- Automotive
- Automation.

Background

During the last several decades there has been a growing recognition that effective engineers combine professional capabilities (e.g. communicate, lead, assess risks, manage projects, etc.) with technical expertise to deliver solutions in the world which is becoming technically more complex. Since 1970s there have been a rapid advancements in computing hardware and software which have provided a basis for a continuing development of novel manufacturing methods, better decision making (based on models) in management of manufacturing processes and the supply chain, as well as paradigm-altering computing and communication devices which we encounter in our daily lives. This new manufacturing paradigm started with stand-alone computer applications which paved the way for the integration of manufacturing equipment with computer-based decision-making applications. Presently a vast change is underway in all aspects of the societal infrastructure and the way we live. Physical world, real space within which we reside is being increasingly augmented by its representation in digital software models, data and inferences engines which reside in various forms of computing systems. New domains of knowledge, which are being continuously discovered in this digital world, require new capabilities for engineering graduates. Cyber-physical world is becoming a reality (Fig. 1) which is comprised of a variety of cyber-physical systems (see examples in Fig. 2). Cyber-physical systems (Fig. 3) are characterized by a physical asset (e.g. machine) and its digital twin, i.e. a model which mimics the behavior of the physical asset. They are comprised of integrated, hybrid networks of cyber and engineered physical elements. They are co-designed and co-implemented to create adaptive and predictive systems which respond in real time to enhance the performance. Let us note that the Internet of Thing (IoT) is a subset of cyber-physical systems, since its prevailing definition limits it to the physical assets, not including their digital models.

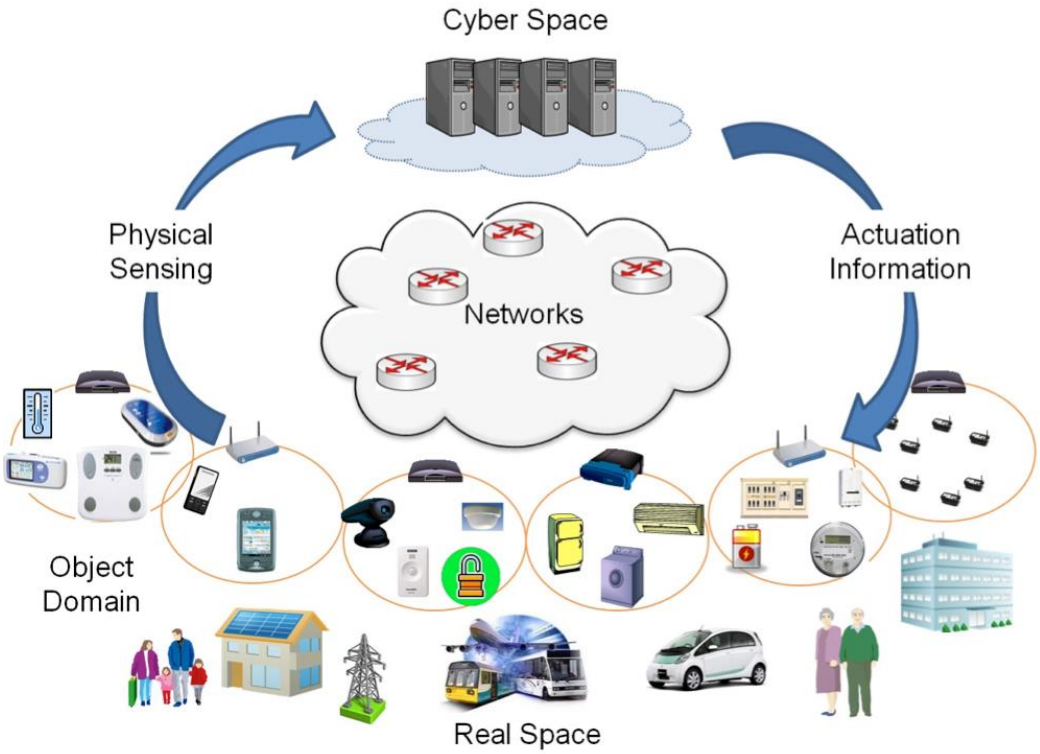


Fig. 1. Cyber physical world[1]

Fig. 2. Cyber-physical systems[2]

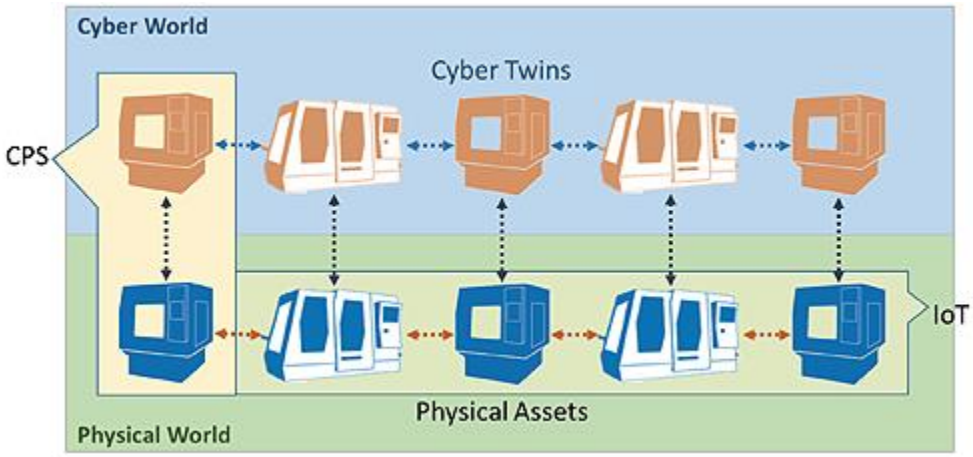


Fig. 3. A cyber physical system is comprised of a physical asset and its software model[3]

A new era of integrated cyber-physical manufacturing systems has begun, requiring engineering graduates to have professional and technical capabilities which have not been associated with the traditional engineering disciplines. In other words, an engineer ready for the 21st century needs to have the knowledge and capabilities required to understand, design, and improve systems which are comprised of humans interacting with both physical and cyber components. Terms "Industry 4.0" and "Advanced Manufacturing" have been coined to designate such manufacturing systems (Fig. 4).

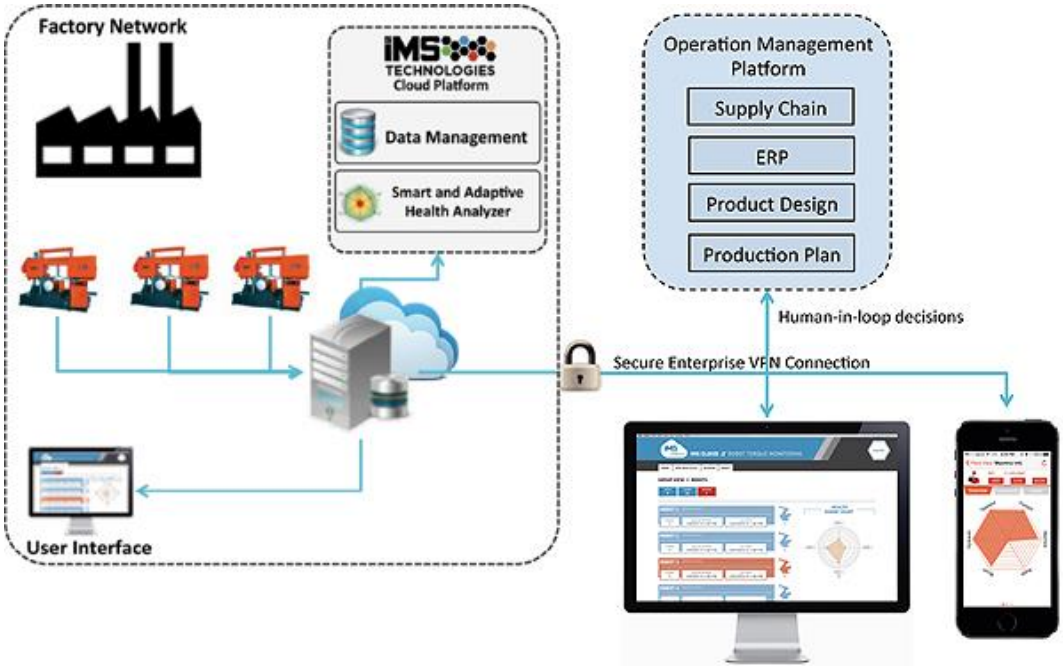


Fig. 4 Operators and manager interact with CPSs through a variety of interfaces by utilizing analytical data and models stores in the cloud.[3]

Fig. 5 Cyber-physical civic infrastructure [4]

Cyber-physical systems can be viewed from two vantage points:

1. System structure, which has a lot of characteristics common across different domains. This is reflected in modelling methodologies and algorithms for optimization of the system performance.
2. Technology required to build such systems, including the technologies specific to a given domain (e.g. internal combustion or electric engines in automotive).

Proposed M.Eng. in Systems and Technology encompasses both of these viewpoints; it will provide its graduates with capabilities to design and operate such complex systems as required to meet the societal needs. Postgraduate Diplomas will signify that its recipient has completed a specialization in specific aspects of the cyber-physical systems.

M. Eng. Program Structure and Specialization Streams

The proposed M.Eng. in Systems and Technology provide its graduates with technical and professional capabilities. In order to successfully complete the Program, the students must complete:

- Seven graduate level courses plus an M.Eng. project dealing with problems / issues related to the industrial or civic systems, e.g. manufacturing systems (power production, car manufacturing, chemical production, pharmaceuticals production, etc.), municipal or civic systems (wastewater treatment plants, district heating and cooling, water supply systems, etc.).

OR

- Complete nine graduate level courses.

The program offers full time or part time enrollment.

The program will offer specialization streams, each of them dealing with various aspects of industrial or civic systems. The common capabilities, shared among different streams, are professional capabilities as well as some of the technical capabilities related to the systems engineering methods for system design, analysis, and optimization (systems infrastructure, data analysis, operations management). This common foundation among the streams means that a large number of courses will be shared across two or more streams, leading to a cost effective delivery.

Key capabilities of the cyber-physical systems include automation of operations, modelling of the manufacturing processes and model use for system optimization, analysis of the parting data and production process improvements. Based on these core capabilities, the Program will offer the following streams:

- Automation and smart systems
- Advanced manufacturing
- Automotive

"Automation and smart systems" content is applicable equally to either manufacturing or civic systems. "Advanced manufacturing" combines elements of automation with advanced technologies to enable rapid design and delivery of goods in integrated supply chains. "Automotive" systems, while specific to the transportation domain, combine automation with parts produced via advanced manufacturing to become useful devices.

Postgraduate Diploma

Students wishing to acquire advanced capabilities in specific areas, but do not want to commit to completing the entire M.Eng. program can enroll to study towards a Postgraduate Diploma (Type III). In order to receive a Postgraduate Diploma a student will need to complete 4 graduate level courses relevant to the subject area.

The following Postgraduate Diplomas will be offered:

- Automation and smart systems
- Advanced manufacturing
- Automotive

Modes of Delivery

Both M.Eng. and Postgraduate Diploma will employ a blend of on-line and in-class or in laboratory delivery.

References:

1. WiSE Laboratory, Cyber-Physical Systems, 2017, https://www.jaist.ac.jp/is/labs/lim-lab/research.php
2. Dollham, D., NIST Cyber-Physical Systems Public Working Group: Draft CPS Framework, http://slideplayer.com/slide/9244570/
3. Bagher, B. , 2015, Big future for cyber-physical manufacturing systems, Design World, Sept. 23, http://www.designworldonline.com/big-future-for-cyber-physical-manufacturing-systems/

1.2 PROPOSAL PREPARATION AND CONSULTATION PROCESS

This proposal stems from the realization that the societal needs, as ascertained through discussions with various companies and by survey of the jobs posted in Ontario and Canada, require engineers ready to deal with a new generation of cyber-integrated industrial and civic systems. Graduates with strong capabilities in automation, networking, software development and applications, modelling, mechatronics, data analysis (all of which are addressing specific aspects of the cyber-physical systems) are sought after as witnessed by the job postings and by employment which they readily find upon graduation.

A recent article[1] published by the Boston Consulting Group calls for universities to provide a broader technical skill set that integrates IT and engineering education:

"Industry 4.0 will create many new cross-functional roles for which workers will need both IT and production knowledge. Many current educational programs at all levels provide highly siloed training and offer limited interaction among fields. To foster cross-functional knowledge and communication, universities should increase the number of interdisciplinary study programs that integrate IT and engineering, building on current programs in business informatics and business engineering." [1]

This need is most notable in the manufacturing sector; however, the broader adoption of cyber-physical systems has migrated into other industry sectors where there is an obvious synergy between technology and operations. This adoption of a cyber-physical approach to solving engineering problems creates an obvious and immediate demand for education and training.

During the preparation of the proposal, a survey of undergraduate students and alumni of McMaster Engineering were conducted in 2016 (Appendix 1A and 1B). Jobs profiles corresponding to various aspects of the proposed program were surveyed in 2016 and updated data collected in January 2017. The data show a significant demand for engineers with the capabilities which will be developed in the proposed program. In addition, consultations with a number of companies have been conducted with respect to the program content and the demands for engineers with the profiles corresponding to those proposed here.

Representatives of various industry branches have been consulted via their memberships in the Advisory Boards of the streams in BTech program, as well as the streams in the Degree Completion program. These include:

- Automotive and Vehicle Technology
- Process Automation Technology
- Manufacturing Engineering Technology

Organizations involved in the consultation process are listed in Table 1.2.1.

Table 1.2.1 Organizations Consulted During Preparation of the Proposal

Automotive and Vehicle Technology	Linamar, D&V Electronics, Tigercat, GM
Process Automation Technology	Siemens, Emerson Electric, Next Level SCADA
Manufacturing Engineering Technology	APMA, L3 Wescam, UTC Aerospace Systems, AM Dofasco

References:

1. Boston Consulting Group, Man and Machine in Industry, 2017 https://www.bcgperspectives.com/content/articles/technology-business-transformation-engineered-products-infrastructure-man-machine-industry-4/?chapter=5

1.3 CONSISTENCY WITH MCMASTER'S MISSION AND ACADEMIC PLAN

i. McMaster's Strategic Mandate Agreement:

The proposed program focuses on excellence in graduate education and training at the Master's level. It will enable its graduates to develop domain-invariant capabilities required to be a successful engineer working within the emerging new digitally integrated world.

McMaster strengths in Engineering and sustainability and Materials and manufacturing are the basis for introducing this Program.

Automotive, Automation and Smart Systems, and Advanced Manufacturing streams will utilize experimental facilities within the School of Engineering Practice and Technology (SEPT) and within McMaster Automotive Research Center (MARC) and rely on extensive expertise existing in various Engineering departments, particularly within SEPT.

Analysis of manufacturing data and their use for improvement of manufacturing operations have been a strength in the Engineering for the last 30 years, while Big Data analysis is a growing strength within Engineering. Corresponding courses in the data analysis area are suggested electives to all streams in the Program.

As a part of the growth in Science and Engineering, the Faculty of Engineering has identified an undergraduate program in Industrial and Systems Engineering as a growth area. The proposed M.Eng. in Systems and Technology will be one of the pathways towards graduate degrees for the students from all engineering departments and in particular for the students from the undergraduate program in Industrial and Systems Engineering which is being developed by the Faculty of Engineering. In addition, the proposed program is one of the pathways towards graduate degrees for the students graduating from B.Tech. program.

ii. McMaster's current priorities

Student experience

One of the goals of the proposed program is to ensure that its graduates develop strong hands-on capabilities in their respective specializations. In order to attain that goal, courses taught by the SEPT faculty will be migrated to the "inverted class" format, i.e. lecture notes will be posted as a required reading for the classes and the class time will be spent on discussions and problem solving. SEPT faculty have been experimenting with such approaches (e.g. SEP 780 Advanced Robotics course delivered in the summer of 2016) and have received very positive feedback from the students.

Since a large portion of the courses rely on software-based tools (e.g. modelling, simulations, interfacing of software components, data analysis), the primary learning mode will be the experiential learning. The courses which require physical presence in the laboratory will employ concentrated laboratory presence (e.g. 3 consecutive days), which will enable the students from distant locations to limit their presence on the campus.

Research will not be significant activity, since this is an M.Eng. program. However, the students will learn how to explore the research literature and to apply such knowledge by working on the term projects in the courses and also during their work on the M.Eng. project.

Internationalization

It is expected that 70% of the students in the Program will be from countries other than Canada.

1.4 PROGRAM LEARNING OUTCOMES

Upon completion of the M.Eng program the student will have acquire the knowledge and skills to:

PLO #1. Communicate effectively engineering content, work in teams, manage projects, assess risks, and assure quality.

PLO #2. Apply system engineering tools and methods to monitor, analyze, and improve performance of the cyber-physical systems based on data and models.

PLO #3. Integrate electro-mechanical components, IT hardware and software infrastructure and software applications into a functioning cyber-physical system and control its operation.

PLO #4. Design and improve operation of domain specific components and systems.

PLO #5. Approach holistically domain specific problems and apply system engineering methods (software/hardware, data analysis, control and optimization and others) to solve them.

1.5 CONSISTENCY WITH DEGREE LEVEL EXPECTATIONS

UNDERGRADUATE DLES	GRADUATE DLES
Depth and Breadth of Knowledge Knowledge of Methodologies Application of Knowledge Communication Skills Awareness of Limits of Knowledge Autonomy and Professional Capacity	Depth and Breadth of Knowledge Research and Scholarship Application of Knowledge Communication Skills Awareness of Limits of Knowledge Autonomy and Professional Capacity

Table 1.5.1 summarizes the relationships between the program learning outcomes and the degree level expectations.

Table 1.5.1 Relationships between PLOs and Degree Level Expectations

	Program Learning Outcomes				
Graduate DLEs	**1**	**2**	**3**	**4**	**5**
Depth and Breadth of Knowledge		X	X	X	X
Research and Scholarship					X
Application of Knowledge		X	X	X	X
Communication Skills	X				X
Awareness of Limits of Knowledge		X	X	X	X
Autonomy and Professional Capacity	X				X
PLO #1. Communicate effectively engineering content, work in teams, manage projects, assess risks, and assure quality.					
PLO #2. Apply system engineering tools and methods to monitor, analyze, and improve performance of cyber-physical systems based on data and models.					
PLO #3. Integrate electro-mechanical components, IT hardware and software infrastructure and software applications into a functioning cyber-physical system and control its operation.					
PLO #4. Design and improve operation of domain specific components and systems.					
PLO #5. Approach holistically domain specific problems and apply system engineering methods (software/hardware, data analysis, control and optimization and others) to solve them.					

Breadth of knowledge of cyber-physical systems will be attained via interdisciplinary courses dealing with system monitoring, analysis, integration, and operations improvement (**PLO #2**) and cyber-physical system integration and control of its operation (**PLO #3**)

Depth of knowledge will be achieved by enrolling in a specific stream and completing the required complement of the courses, which will enable the students to design and improve operation of domain specific systems (**PLO #4**).

Research of existing knowledge will be a part of all of the course term projects, as well as it will be a part of the work on the M.Eng. Project and alternatively the work during the Internship (**PLO #5**). Hence, even though the students will not focus on research to discover a new knowledge, they will become proficient in scholarly methods of researching the existing body of knowledge.

Application of knowledge will take place during the courses via hands-on problem solving and the term projects, thereby enabling the students to apply the knowledge on examples and case studies derived from the practice. Similarly, during the work on the M.Eng. project, the students will need to apply knowledge to solve the problems at hand. Such approach will make the program graduates to be job-

ready at the start their employment.

Communication skills proficiency will be accomplished by a combination of a formal training (the course on Engineering Communications) through term reports and presentations in the courses. Each course will require that a student prepare a term project report and make one or more presentations during the course.

Awareness of Limits of Knowledge will be gradually developed by working on ever problems of increasing complexity during each course and by including counter-examples which will readily demonstrate the limits of a given methodology. The Program will place a strong emphasis on the knowledge and capabilities which are required to succeed in designing or operating various subsystems (PLO #2, PLO #3, PLO #4, PLO #5). The students will develop competencies required to assess the trade-offs between in-depth, highly accurate solutions and approximate solutions which are good enough to meet specific needs. Such competencies will be further enhanced during the work on M.Eng. project. In other words, the students will be develop capabilities which will enable them to decide where the limitations of various methods are and how to select the best solution for a problem at hand.

Autonomy and Professional Capacity will be developed through real-life based term projects in the courses and also during the work on the M.Eng. project.

1.6 DEMAND FOR PROGRAM

I. EVIDENCE OF SOCIETAL/LABOUR MARKET NEED

From 2012 to 2016 there is a steady increase in the number of jobs in professional, scientific, and technical services in Canada, rising from 1,270,700 in to 2012 to 1,393,700 in 2016 (Statistics Canada, CANSIM, table 282-0008, last modified 2017-01-05).

As of end of 2014 almost 30% of all enterprises invested in at least one advanced technology between 2012 and 2014. Almost 18% of enterprises invested in advanced logistics technology, while about 16% invested in advanced design and fabrication technologies and about 13% invested in advanced business intelligence (Survey of Advanced Technology 2104, Statistics Canada, Dec 11 2015). Proposed M.Eng. streams focus on the latter two categories of advanced technologies

Table 1.6.1 summarize the number of job openings across Canada for some of the positions which can be expected to be filled by the graduates of the Program.

These data show high demand for capabilities in project management and system reliability. Capabilities in these areas are addressed by the interdisciplinary professional development group of courses.

More detailed breakdown of job openings in positions related to Automation and Smart Systems as well as Automotive and Advanced Manufacturing is given in Table1.6.2.

Table 6.1.1 Number of Open Job Positions Relevant to the Proposed Program
(as of Jan. 19, 2017)

Search Phrase	No. of Openings on ca/indeed.com in Canada, Jan 19 2017
Engineering Project Manager	6859
Process Control Engineer	1962
Manufacturing Engineer	2073
Manufacturing Process Engineer	1405
Reliability Manager	1463
Reliability Engineer	789
Automation Systems Engineer	1260
Automotive Engineer	606

Table 1.6.2 Manufacturing Automation, Automation Systems Engineering and Automotive Engineering

Search Phrase	Number of Jobs Openings on "indeed.com" Website						
	Openings by Location		Openings by Company		Opening by Salary range		Total
Manufacturing Automation	Toronto, ON	61	LMI Technologies	29	$50,000+	746	1247
	Windsor, ON	46	Pentair	14	$70,000+	363	
	Mississauga, ON	42	Johnson Controls	13	$90,000+	99	
	Vancouver, BC	42	Halliwell Consulting	11	$110,000+	33	
	Calgary, AB	35	ABB	9	$130,000+	6	
	Other Locations	1031	Others (Ingersoll Rand , Schneider Electric , E.B. Horsman & Son , Eclipse Automation , Gerrie Electric , etc)				
Automotive Engineering	Windsor, ON	67	Core Executive Consultants	23	$60,000+	508	***715***
	Toronto, ON	56	General Motors	18	$80,000+	170	
	Mississauga, ON	45	Creaform	16	$100,000+	31	
	London, ON	41	Aversan	11	$120,000+	6	
	Markham, ON	35	Flextronics	10			
	Others Locations	471	Others (Itec group, Powertech Labs , CORE Services , PSS, Cosma Int. , Comtech Grp, etc)				
Automation Systems Engineering	Toronto	441	AMZN CAN Fulfillment Services	45	$60K+	2005	3332
	Calgary	77	ABB	45	$80K+	981	
	Vancouver	230	JMP Engineering	21	$100K+	258	
	Montreal	198	International Civil Aviation Organization	20	120K+	79	
	Ottawa	100	RBC	18	$140+	9	
	Waterloo	63	Siemens	18			
	Other Locations	2223	Others (IBM Kenexa, Schneider Electric, Stackpole, Rockwell, Yaskawa Canada Inc, Bosch, Hatch				

Government webs sites [3] and [4] have proven to be less informative since the search engine seems to select any job opening that matches any part of the search phrase.

Producing university graduates with skills that are immediately applicable is a challenge in many industries with rapidly-changing technology. SEPT has already implemented undergraduate programs that address this challenge; namely Automotive and Vehicle Technology, Process Automation Technology, Manufacturing Engineering Technology. A new cyber-physical systems M.Eng. Program will provide students with a continuing pathway to a graduate-level program with content that is consistent with the skills that are in highest demand.

1. LinkedIn, 2015 http://www.slideshare.net/linkedin/the-25-skills-that-could-get-you-hired-in-2016/1
2. https://www.indeed.ca/
3. www.tcu.gov.on.ca/eng/labourmarket/ojf/
4. http://www.jobbank.gc.ca/home-eng.do?lang=eng

II. Evidence of Student Demand

Three opinion surveys were conducted in 2016 to assess student demand for the proposed M.Eng. Program. The surveys polled prospective M.Eng. students from three areas:

1. Current Bachelor of Technology students from both Degree/Diploma and Degree Completion Programs
2. Current Bachelor of Engineering students from all Departments within the Faculty of Engineering (includes B.Eng.Mgmt. and B.Eng. Society students)
3. Recent graduates of the Faculty of Engineering (includes both B.Eng. and B.Tech.) currently living within a 1-hr commute of McMaster University

The key takeaways from the surveys are as follows:

Bachelor of Technology student survey (348 out of ~1200 students responding)

- 68.1% (237) plan to obtain graduate degree
- Of those planning to obtain a graduate degree, 50% plan to obtain an M.Eng. degree
- 66% plan to enroll 'full time' in a graduate program

Bachelor of Engineering student survey (342 out of ~5200 students responding)

- 83% were "interested" in an M.Eng. from McMaster
- 25% or respondents planned to start a graduate degree immediately after their undergraduate degree
- Most students were interested in 'full time' study

Faculty of Engineering Alumni in GTA (within a 1-hr commute of McMaster University)

(146 out of approximately 4600 responding)

- 66% were “interested” in obtaining an M.Eng. Degree
- Most alumni were interested in ‘part-time’ study

These results indicate a strong demand for M.Eng. programs among all three populations surveyed. The complete results of three surveys are included in Appendix A.

Based on historical enrollment numbers in the existing M.Eng. programs, there is typically a large demand from international students. For instance, more than 60% of current M.Eng. students in the W Booth School of Engineering Practice and Technology are international students. It is also notable that M.Eng. programs at other Ontario Universities are popular; and in some cases even ‘over-subscribed’

Based on the results of the market research, it is evident that the demand for M.Eng. programs is strong.

III. JUSTIFIABLE DUPLICATION

The proposed M.Eng. in Systems and Technology focuses on cyber-physical systems and their applications in the world around us. The program addresses industrial cyber-physical systems (Industry 4.0). It is the first program of its kind in Canada. There are similar programs at several universities in USA (e.g. Vanderbilt, Illinois Institute of Technology, U. of California Irvine) and Europe (e.g. Switzerland). In Ontario, an NSERC CREATE grant was awarded in 2015 to Waterloo University to conduct a graduate level training program in cyber-physical systems.

A benchmark survey of competing programs at nearby Universities (summarized in Appendix 2) shows that the proposed M.Eng. Program at McMaster will have a unique focus compared to all other M.Eng. Programs currently offered at the nearby Ontario Universities.

1.7 DEGREE NOMENCLATURE

Graduates from the M.Eng. Program will be awarded Master of Engineering degree.

Graduates from the Graduate Diploma program will be awarded Graduate Diploma (Type 3).

2 ADMISSION & ENROLMENT

2.1 ADMISSION REQUIREMENTS

M. Eng. In Systems and Technology:

Students with a 4 year undergraduate degree in engineering or science with the minimum requirements with respect to GPA and English language proficiency as specified by McMaster Faculty of Engineering. In addition to these general requirements, the admitted students will need to have demonstrated foundational knowledge related to their chosen stream.

There are three typical profiles of candidates for enrollment in M.Eng. degree:

- One profile are the candidates who will have the interdisciplinary background required as a starting point for success with respect to PLO#2 and PLO #3.
- Another profile are the candidates who have a strong domain knowledge (which gives them a head start with respect to PLO #4) and the necessary background (mathematics and basic programming) to acquire capabilities corresponding to PLO #2 (monitoring, analysis, and improvement of operation) and PLO #3 (cyber-physical systems integration and control).
- The third profile are students who will have a strong desire to develop their professional capabilities and will take the maximum complement of 3 professional development courses.

Graduate Diploma (Type 3):

Applicants to Graduate Diploma (Type 3) program must meet the same entry requirements as the applicants to M.Eng. in Systems and Technology. Candidates for the Graduate Diploma will need to have the background required as a foundation to develop the expertise in the concentration area corresponding to a specific diploma.

2.2 ENROLMENT PLANNING AND ALLOCATIONS

Projected enrollment is based on the interest expressed among undergraduate McMaster students (current and alumni, see 1.6) to take a Master's degree and also based on a significant interest that the visa students have shown in M.Eng. Design program at SEPT.

It is assumed that 30% of the full time students will be domestic. This percentage is significantly higher than the enrollment in e.g. M.Eng. Design. The assumption about higher enrollment is based on the fact that the program covers a much wider range of spectrum of the job market.

Table 2.2.1 summarizes the expected enrollment in the M.Eng. in Systems and Technology.

Table 2.2.1 Expected enrollment in M.Eng. in Systems and Technology

Program Year	1	2	3	4	Maturity
New FT students, M.Eng	30	42	55	65	85
New PT students, M.Eng	5	5	10	15	15
New FT students, Grad. Diploma	5	7	10	12	15

2.3 ALTERNATIVE REQUIREMENTS

Not applicable.

3 STRUCTURE

3.1 ADMINISTRATIVE, GOVERNANCE AND COMMUNICATION

The proposed M.Eng. Program resides within the W Booth School of Engineering Practice and Technology; a School within the Faculty of Engineering. The School is led by a Director who reports to the Dean of Engineering. The Director of the School serves a 5-year term and is appointed by the Senate.

The Programs within the W Booth School are divided into Graduate and Undergraduate Programs; each is managed by an Associate Director.

Associate Director of Graduate Programs will manage the proposed new program. This includes oversight of all aspects of the program including but not limited to: marketing and promotion, curriculum, quality, managing instructors, and guiding students. The Associate Director will be supported in these activities by the current W Booth School staff, which includes personnel dedicated to marketing and promotion, student advisement, and program administration.

Each student will be assigned an Academic Advisor whose role is to help the student construct the most appropriate learning portfolio and advise with respect to the course selection.

3.2 STRUCTURE AND REGULATION

3.2.1 M.Eng. in Systems and Technology

To complete the M. Eng. Program a student must complete:

- Seven graduate level courses plus an M.Eng. project dealing with problems / issues related to the industrial or civic systems, e.g. manufacturing systems (power production, car manufacturing, chemical production, pharmaceuticals production, etc.), municipal or civic systems (wastewater treatment plants, district heating and cooling, water supply systems, etc.). The project is completed over two terms.

OR

- Nine graduate level course.

Maximum two 600 level courses can be taken (a 600 level course is an advanced version of a 4th year undergraduate course).

At least 1 and maximum 3 professional development courses (PLO#1) can be taken towards the degree for students taking option consisting of *courses plus project*. Students taking *courses only* option will take at least 1 and maximum 4 courses corresponding to PLO#1.

Since the students entering the Program will have varied technical backgrounds and also will possibly have industrial experience, the Program will enable each student to build his/her own learning portfolio in consultation with an Academic Advisor.

In order to provide as much freedom as possible to create the learning portfolio, there is only one required course: “Systems Engineering and Cyber-Physical Systems”.

Each program learning outcome has a minimum required number of courses that are to be selected from a list of courses specific to that PLO. Table 3.2.1 shows the structure of the program the minimum required number of courses for each PLO and the recommended pattern of courses of both Accelerated Full-time and for the Full-time options.

Table 3.2.1 M. Eng. Minimum required number of courses per PLO

Total number of courses	**Knowledge Area**	**Min # of Courses**
9 courses	PLO #1 Leadership, management, risk, quality assurance	Min 1, max 3
	PLO #2 Monitor, analyze, improve Performance	1
	PLO #3 Cyber-physical systems integration and control	1
	PLO #4 Design & improve domain specific competencies	1
	PLO #5 Holistic system design, integration & operation	1

Any course in the Faculty of engineering, if it is appropriate for the specific PLO, can be taken towards the degree, provided that the approval by the Associate Director for Graduate Studies of WBooth SEPT is obtained. Presented in this document are the courses which are recommended for each PLO at the time of this proposal. Since graduate level course offerings change periodically, the list of appropriate courses for each PLO will be updated as needed, in consultation with the School of Graduate Studies and with the chairs of the Departments in the Faculty of Engineering.

Tables 3.2.2a and 3.2.2b list required and recommended courses for each stream, as appropriate electives to attain the program learning objectives PLO #1, PLO #2, PLO #3, PLO #4, and PLO #5.

Tables 3.2.3a and 3.2.3b lists the professors who will teach the courses. Designation “staff” is in place for those courses which are not taught always by the same professor; corresponding Departments provide instructors for these courses as appropriate for a given year.

Table 3.2.2a Required and recommended electives by stream, PLO#1, PLO#2, PLO#3, PLO#5

Recommended courses for each stream		1=Automation &Smart Systems 2=Advanced Manufacturing 3=Automotive		
Professional development PLO #1				
Recommended electives		**1**	**2**	**3**
Project Management	SEP725	x	x	x
Engineering Communication	SEP 7xx NEW	x	x	x
Reliability, Risk, and Maintainability	SEP 730	X	x	x
Lean Thinking	SEP 6LM3	x	x	x
Leadership for Innovation	SEP 773	x	x	x
Design Thinking	SEP 760	x	x	x
Holistic analysis & design of cyber-physical systems - PLO#5				
Required		**1**	**2**	**3**
Systems Engineering and Cyber Physical Systems	SEP 7xx NEW	x	x	x
Monitor, analyze, improve system operation - PLO#2				
Recommended electives		**1**	**2**	**3**
Data mining	SEP 6DM3	x		
Systems Modelling and Optimization	SEP/CHEM ENG 753	x	x	
Operational Data Analysis and Troubleshooting	SEP/CHEM ENG 765	x	x	
Statistics for engineers (design of experiments)	SEP 6C03	x	x	x
Machine learning	SEP 7xx NEW	x		
Systems Analysis and Simulation	MANUF 771	x	x	
Operations research	COMP SCI 6TE3			
Engineering optimization	ECE 710			
Optimization of chemical processes	CHEM ENG 752			
Introduction to big data systems and applications	CAS 771	x	x	
System integration and control - PLO#3				
Recommended electives		**1**	**2**	**3**
Industrial components, networks, and interoperability	SEP 7xx NEW	x	x	x
Industrial networks and controllers	SEP 6IC3	x	x	x
Electromagnetic Sensors and Actuators	SEP783	x	x	x
Advanced robotics and Automation	SEP 780	x	x	x
Real-time systems	SEP 6ES3	x	x	
Digital computer process control	CHEM ENG 6E03	x		
The Human Computer Interface	SFWR ENG 6HC3	x	x	x
Linear Systems: Estimation and Control	CHE 702	x		
Neural networks and learning machines	ECE 772	x	x	
Computer security	SEP 6CS3	x	x	
Information privacy and security	CAS 767	x	x	
Modern Software Technology for eHealth	CAS 757			

Table 3.2.2b Recommended domain specific courses, by stream; PLO#4

Recommended courses for each stream		1=Automation &Smart Systems 2=Advanced Manufacturing 3=Automotive		
Domain specific systems design & operation - PLO #4				
Recommended electives		**1**	**2**	**3**
Advanced web programming	SEP 6WP3	x	x	
Prototyping tools and methods (mobile applications)	MECH ENG/SEP 762	x	x	x
Distributed computer systems	COMP SCI 6F03	x		
Prototyping tools and methods (solid objects)	MECH ENG/SEP 762		x	
Additive Manufacturing	SEP 735		x	x
Conceptual design of Electric and Hybrid Electric Vehicles	SEP 6AT3			x
Electri drive vehicles	MECH ENG 7xx NEW			
Polymer processing	CHE 6X03		x	
Advanced Concepts of Polymer Extrusion	CHE 773		x	
System on a chip (SOC) design and test Part I methods	ECE 744	x		
Introduction to nanotechnology	ECE 778		x	
System on a chip (SOC) design and test Part I methods	ECE 744			
Neural networks and learning machines	ECE 772	x		
3D Image processing and computer vision	ECE 736	x		
Management and Control of Electric Vehicle Batteries	MECH ENG 754			x
Manufacturing Systems	MECH ENG 729		x	
Robotics	MECH ENG 6K03		x	x
CAD/CAM/CAE	MECH ENG 6Z03		x	x
Machine tool analysis	MECH ENG 710		x	
Advanced Mechatronics	MECH ENG 743		x	x
Advanced Control on Internal Combustion Engines	MECH ENG 755			x

Table 3.2.3a Courses and the professors teaching them, PLO#1, PLO#2, PLO#3, and PLO#5

Professional dev+A3:E45elopment PLO #1		
Recommended electives	***Course Code***	***Instructor***
Project Management	SEP725	Mikhail Hanna
Engineering Communication	SEP 7xx NEW	Jennifer Long
Reliability, Risk, and Maintainability	SEP 773	Mikhail Hanna
Lean Thinking	SEP 6LM3	Louie D'Orazio
Leadership for Innovation	SEP 773	David Potter
Design Thinking	SEP 760	Robert Fleisig
Holistic analysis & design of cyber-physical systems PO#5		
Required	***Course Code***	***Instructor***
Systems Engineering and Cyber Physical Systems	SEP 7xx NEW	Vladimir Mahalec
Monitor, analyze, improve system operation - PLO#2		
Recommended electives		
Data mining	SEP 6DM3	Jeff Fortuna
Systems Modelling and Optimization	SEP 752/ CHEM ENG 753	Vladimir Mahalec
Operational Data Analysis and Troubleshooting	SEP/CHEM ENG 765	staff
Statistics for engineers (design of experiments)	SEP 6C03/CHEMENG 6C03	staff
Machine learning	SEP 7xx NEW	Jeff Fortuna
Systems Analysis and Simulation	MANUF 771	Vladimir Mahalec
Operations research	COMP SCI 6TE3	Antoine Deza
Engineering optimization	ECE 710	Tim Davidson
Optimization of chemical processes	CHEM ENG 752	Chris Swartz
Introduction to big data systems and applications	CAS 771	Wenbo He
Systems integration and control - PLO#3	***Course Code***	***Instructor***
Recommended electives		
Industrial components, networks, and interoperability	SE736 NEW	Tom Wanyama
Advanced System Components and Integration	SEP 6AS3	Tom Wanyama
Industrial networks and controllers	SEP 6IC3	Tom Wanyama
Electromagnetic Sensors and Actuators	SEP783	Moein Mehrtash
Advanced robotics and Automation	SEP 780	Zhang Gao
Real-time systems	SEP 6ES3	Jeff Fortuna
Computer security	SEP 6CS3	staff
Prototyping tools and methods (mobile applications)	SEP 762	Peter Basl
Network infrastructure and management	SEP 7xx NEW	TBN
Digital computer process control	CHEM ENG 6E03	Christopher Swartz
The Human Computer Interface	SFWR ENG 6HC3	staff
Linear Systems: Estimation and Control	CHE 702	Prashant Mhaskar
Neural networks and learning machines	ECE 772	Simon Haykin
Information privacy and security	CAS 767	Reza Samavi

Table 3.2.3b Courses and the professors teaching them, PLO#4

Design and improve operation of domain specific systems - PLO #4		
Recommended electives	***Course Code***	***Instructor***
Advanced web programming	SEP 6WP3	*staff*
Prototyping tools and methods (mobile applications)	MECH ENG/SEP 762	TBN
Additive Manufacturing	SEP 735	Ali Emamian
Conceptual design of Electric and Hybrid Electric Vehicle	SEP 6AT3	Dan Centea
Polymer processing	CHE 6X03	Michael Thompson
Advanced Concepts of Polymer Extrusion	CHE 773	Michael Thompson
Introduction to nanotechnology	ECE 778	Xun Li
System on a chip (SOC) design and test Part I methods	ECE 744	Nicola Nicolici
Neural networks and learning machines	ECE 772	Simon Haykin
3D Image processing and computer vision	ECE 736	Shahram Shirani
Management and Control of Electric Vehicle Batteries	MECH ENG 754	Ryan Ahmed
Manufacturing Systems	MECH ENG 729	Tim Nye
Robotics	MECH ENG 6K03	Fengjun Yan
CAD/CAM/CAE	MECH ENG 6Z03	Patrick Hale
Machine tool analysis	MECH ENG 710	Stephen Veldhuis
Advanced Mechatronics	MECH ENG 743	Saeid Habibi
Advanced Control on Internal Combustion Engines	MECH ENG 755	Fengjun Yan

Calendar description of all courses is provided in Appendix 3.

3.2.2 Graduate Diploma (Type 3)

Students enrolled in the Graduate Diploma (Type 3) need to complete a total of 4 graduate level courses, where maximum 1 course is at 600 level. Not more than two course can be from PLO#1. Courses appropriate for a specific diploma are those shown as appropriate courses for the stream with the same name.

3.3 GRADUATE PROGRAMS - PROGRAM LENGTH

3.3.1 M.Eng. in Systems and Technology

Expected duration of studies in the Full Time program is four terms (16 months). The length of the program has been determined by considering the fact that the complexity of the cyber-physical systems requires a breadth of knowledge which can be attained by students taking at least 7 very intensive courses plus completing a project.

Part time students enrolled in the courses-only option will require three years (3 courses every 12 months) to complete the program.

3.3.2 Graduate Diploma

Graduate Diploma is a full time two term program (8 months). Part time students can complete the Graduate Diploma in 16 months.

4 CURRICULUM AND TEACHING

4.1 PROGRAM CONTENT

M.Eng. in Systems and Technology is focused on enabling its graduates to acquire the professional competencies as well as the technical competencies in various aspects of cyber-physical systems, starting from electro-mechanical components, to the software networks and interfacing, automatic control, data analysis and operations monitoring, production and supply management. All of these are interdisciplinary, domain independent capabilities which are essential for operation of the manufacturing and civic systems of the future.

Current state and emerging trends in the cyber-physical systems will be the subject of "Systems Engineering and Cyber-Physical Systems" course. Term projects in this course will facilitate in-depth exploration of specific topics as well as a survey of the broad system aspects by the students.

Latest industry-applicable methods and standards will be addressed in the corresponding courses. Relevant infrastructure standards from different parts of the globe will be presented as needed and their impact on system design and implementation will be discussed.

Postgraduate Diplomas focus mostly on the development of competencies specific to the technical aspects of the respective areas.

4.2 PROGRAM INNOVATION

The M.Eng in Systems and Technology enables students to design their own degree. Students will select courses from the lists associated with the program learning outcomes. Students will be exposed to a blended learning environment in which on classes rely on extensive use of computer-based modelling and simulation tools combined with the theory underpinning them. An added feature of the teaching methodology includes inverted classes: these courses offered by SEPT faculty will be structured such that students will have read the lecture notes prior to class, therefore the classroom setting will become a problem-solving session.

Opportunities for professional development will be abundant. All students will also have access to the School's Practitioner's Forum; this seminar series enhances the students' experiential learning by exposing the student body to innovative thinkers and practitioners in the areas of: Engineering Entrepreneurship and Innovation, Engineering Design, Engineering and Public Policy or Technology Entrepreneurship and Innovation. It is a networking event bringing together our students, faculty and staff in a community atmosphere centered around development of innovation processes and their implementation in practice.

The program is designed to meet the needs of students who may require special needs accommodation. A large portion of the courses employ computer-based modelling, simulation, software and hardware interfacing which engenders an environment whereby students learn at their own pace. Course grading is based on the mid-term project and the final project. Students will have the option to set their own pace when completing their projects and the program is designed to relieve pressures associated with the strict timelines.

4.3 MODE(S) OF DELIVERY

The program is delivered in a blended learning environment including inverted lectures, labs, self-directed learning and hands-on applications. Students will learn both in the classroom and also while working on M.Eng. project.

4.4 EXPERIENTIAL LEARNING

The program is uniquely defined through a strong experiential learning component. Each course is specifically oriented towards problem-solving, extensive labs provide a hands-on learning experience and courses emphasize a "learn-by –doing" approach. Courses rely on computer simulation, computer-based design, data gathering and analysis. Several courses will employ electronic components (e.g. raspberry pi) for development of integration skills and operations control in order to provide experiential learning to the students.

Work on industry or civic oriented M. Eng. projects will provide further opportunities for experiential learning by solving problems encountered in real life.

4.5 ACCESSIBILITY

The program addresses accessibility through the use of computer-based courses which allow distance learning, self-paced learning and accessibility applications to read the online materials.

Technically oriented courses support an environment in which race, age and gender are irrelevant. The program is focused on helping students to attain the level of capabilities corresponding to their specialization irrespective of their abilities or disabilities.

4.6 RESEARCH REQUIREMENTS (IF APPLICABLE)

There are no requirement for a major research activity by the students in the Program. The students will learn how to research the existing literature, critically evaluate published methods and to select the most appropriate approach for solving a specific problem.

5 ASSESSMENT OF LEARNING

5.1 METHODS FOR ASSESSING STUDENTS

Student assessment during the course of the Program will be based on demonstrated learning outcomes in each course. Assessments in the courses will be based on

- Mid-term project
- Final term project
- Work in the classroom
- Homework.
- M.Eng. project

5.2 CURRICULUM MAP

Program Learning Outcomes (PLOs)		Program Requirements	
By the end of the program, student graduating with a Masters degree will...	Master's Degree Level Expectations (DLEs)	Teaching Activities & Learning Opportunities	Assessments and Evidence
	For each PLO, identify which DLE(s) it aligns with below.	For each PLO, what teaching activities and learning opportunities are students exposed to that will help them to achieve that PLO?	For each PLO, what is specifically collected from the student as evidence that they can/have achieved the PLO before they graduate?
PLO #1. Communicate effectively engineering content, work in teams and manage projects (leadership, project management, written/verbal/visual communications).	- Communication skills - Autonomy and Professional Capacity	Courses will include a very strong project-focus. Teaching will combine traditional lectures with group discussions as well as dedicated time for group-work. Project submissions will include professional quality written reports and oral presentations. Students will practice leadership and teamwork skills within these group activities. Instruction will also include workshop-based modules targeting interpersonal skills and presentation skills.	Students must submit written reports for evaluation. Student written work will be assessed based on the quality of the presentation as well as the content. They must also deliver oral presentations, which will be graded, not only on content, but also on the skill of the delivery. Peer feedback and quality of class participation will be used to assess interpersonal skills, communications and leadership qualities.
PLO #2. Apply system engineering tools and methods to monitor, analyze, and improve performance of cyber-physical systems based on data and models.	- Depth & Breadth of Knowledge - Appl. Of Knowledge - Awareness of Limits	Laboratory exercise (via computer simulations or with actual physical hardware, as appropriate)	Course mid-term and final term projects. Classroom presentations.
PLO #3. Integrate electro-mechanical components, IT hardware & software infrastructure & software applications into a functioning cyber-physical system & control its operation.	- Depth & Breadth of Knowledge - Appl. Of Knowledge - Awareness of Limits	Laboratory exercises and term projects (computer-based simulation and modelling software integrated with sources of data and computign decisions w.r.t. control targets).	Course mid-term and final term projects. Classroom presentations.
PLO #4. Design and improve operation of domain specific components and systems.	- Depth & Breadth of Knowledge - Appl. Of Knowledge - Awareness of Limits	Laboratory exercise (via computer simulations or with actual physical hardware, as appropriate)	Course mid-term and final term projects. Classroom presentations.
PLO #5. Approach holistically domain specific problems and apply system engineering methods (software/hardware, data analysis, control and optimization and others) to solve	all 6 DLEs	Design oranalyze and recommend improvements in the operation of a particular system.	Term project in "Systems Engineering and Cyber-Physical Systems" course.

5.3 DEMONSTRATING STUDENT ACHIEVEMENT

The assessment tasks will be designed to measure the achievement of program and course level learning outcomes throughout the program and will be embedded into each course.

The following assessment tools will be used to measure student achievements: assignments, midterm exams, and term projects or final exams. These will be graded using the McMaster University grading system. In addition, M.Eng. project will be graded for those students who enroll in this option.

The data collected from each of these activities will be analysed using a variety of methods that are currently used in the department.

We will be conducting a survey of students asking them to reflect on their learning experiences. A similar survey of faculty will also be conducted to assess the achievement of learning outcomes by the students and their efforts to provide activities for assessment of the learning outcomes, levels of achievement, and any associated challenges.

6 RESOURCES

6.2 GRADUATE PROGRAMS

6.2.1 ADMINISTRATIVE, PHYSICAL AND FINANCIAL RESOURCES

The Program will be hosted by the W.Booth School of Engineering Practice. The School has administrative staff of experienced in the operation of graduate and undergraduate programs. Director of the School is responsible for both undergraduate and graduate programs offered by the School. Day to day operation of the graduate programs is managed by the Associate Director for Graduate Programs who will assume the responsibility for the management of the new Program.

The Program will be funded from the tuition fees and the BIUs for domestic students. Immediately after the program is approved, the School will start implementing a marketing program which will be prepared in advance in cooperation with the marketing group in the Faculty of Engineering.

At the time of processing applications for the first generation (expected in 2018/2019) of the total of 30 accepted students, it is anticipated that 0.3FTE administrative assistant will be made available to the program (this is accounted for in the financial plan). Eventually, in year 5 a total of 1 admin support persons will be required for the program.

SEPT physical space in ETB building will be used to provide a working space for the students and the faculty or sessional instructors.

6.2.2 LIBRARY, TECHNOLOGY, AND LABORATORY RESOURCES

Library facilities in the traditional sense (books and journals on the shelves and space to sit and read them in the library) are not needed by the Program. On-line availability of the journal and books will provide the students with access to the material required for their course work and for the M.Eng. Project.

Dedicated computing laboratory for specialized engineering software programs with capacity for 20 is available at W. Booth SEPT. This facility will be sued mainly for the Eng. Study computations, since most of the software used in the courses is available to the students directly for download on their own computers.

W. Booth School of Engineering Practice and Technology has extensive laboratories which will be used to provide. In addition, the laboratories at McMaster Automotive Research Centre (MARC), as well as … are also available for use by the program. Brief description of the laboratories is provided here.

Advanced Automation, System Integration, and Networks Laboratories

Online Laboratories and Laboratories based Projects

In W. Booth School of Engineering Practice and Technology of the Faculty of Engineering at McMaster University, we have developed a series of industrial automation laboratory equipment that is accessible online through the Internet. We also have the ability to support independent technical projects carried out by students off campus.

Online Laboratory Equipment for System Integration

Figure 1 shows the network architecture of the online laboratory equipment for system integration. The equipment is design to offer a wide variety of laboratories and laboratory based projects, ranging from PLC programming and IED configuration, to horizontal and vertical industrial and business systems integration required to support manufacturing under Industry 4.0 paradigm. The equipment depicts a plant that has a process automation system, and an electrical substation system. The process automation component of the equipment has an Automation Direct CLICK micro PLC and a Productivity 3000 PLC which is also used as an Integrated Electronic Device (IED) in some of the laboratories. The electrical substation is automated using IEC61850 compliant IEDs that have Modbus communication capabilities, as well as power meters that communicate using Modbus RTU. The I/O devices of the equipment include 3-phase AC motors, vibration sensors, temperature sensors, and a set of relays that control light bulbs. In addition, the equipment is fitted with an Internet camera to allow remotely located students to see the equipment.

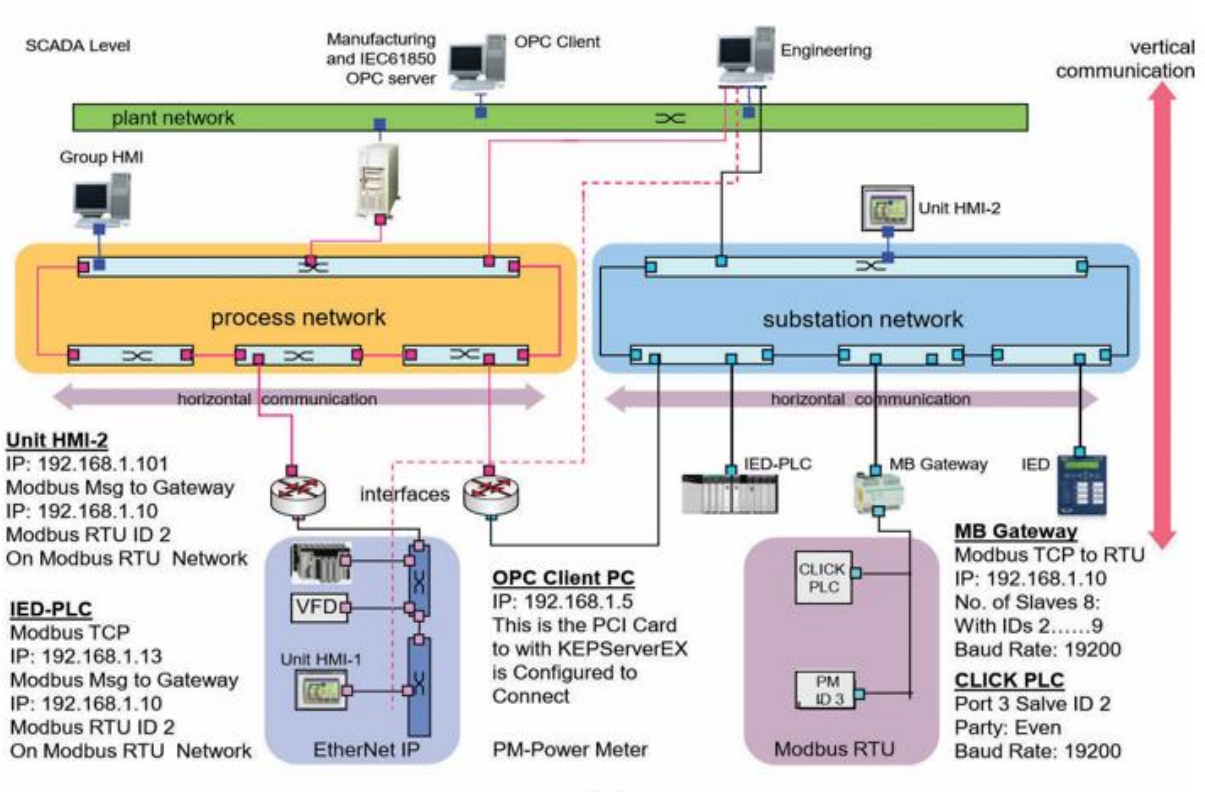


Figure 6.2.1: Industry Systems Integration Online laboratory Equipment

Open Productivity and Connectivity (OPC) Online laboratory Equipment

Figure 2 shows the architecture of the equipment used to carry out online OPC data access and system integration laboratories and projects. The process and energy data of the system is accessed using KEPServer OPC server. The server has multiple drivers including Ethernet IP and IEC61850 MMS. These drivers are configured as channels to deliver the associated data to OPC clients. This is necessary because OPC servers usually do not poses advanced data access features such as HMI, alarms and events handling, data logging and historian, and process data tunneling and bridging. It is OPC clients that are normally utilized to provide these features. Remotely located students can learn how to access data from KEPServer using OPC DataHub, Wanderware, or Ignition so as to provide Human Machine Interfaces (HMIs), carryout data logging, configure and manage alarms and events, and program macros for Dynamic Data Exchange (DDE) to Microsoft Excel files.

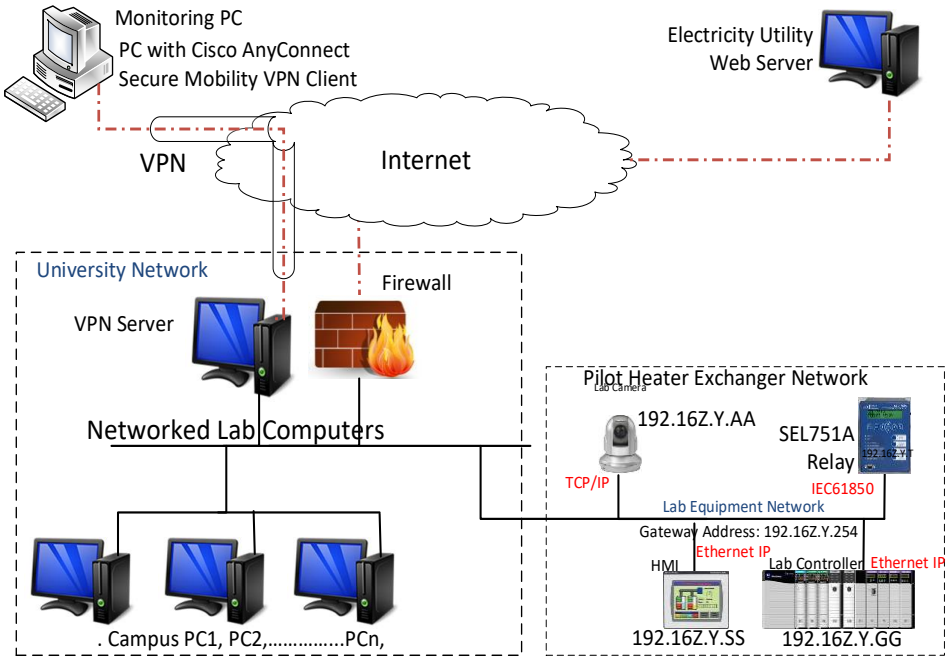


Figure 6.2.2: OPC Training System Architecture

Independent Projects

Student can carry out independent projects based on microcontrollers such as Arduino and MSP 430; and mini computers such as Raspberry Pie. Examples of such projects include the following:

- Control 3D printed robotic arm.
- Implementation of monitoring and automation systems.
- Implementation of image processing systems.
- Implementation of apps and hand held devices for machine monitoring and control.

Automotive Vehicle Technology Laboratories

The Automotive and Vehicle Technology laboratories include facilities for experiments and projects in computer aided engineering (engineering graphics, CAD, mechanical and thermal stress analyses, manufacturing, CAM, metrology, reverse engineering, computer integrated manufacturing, robotics), automotive engineering, control systems, and vehicle dynamics.

Available are automation software (PLC and Melfa), software packages for finite element analyses (ANSYS, Catia-FEA, Nastran, NX-FEA), multi-body dynamics and simulation software (Adams, Adams/Car, Matlab, Minitab, CarSim), CAD tools, and software tools for Computer Assisted Manufacturing (Edgecam and CNC programming). Physical equipment includes gasoline, electric, and hybrid cars which the students can reconfigure and modify.

In addition, students will use the facilities in McMaster Automotive Research Center (MARC) which will also provide them with the opportunities for interaction with the researchers in the Centre.

Learning Factory (Industry 4.0)

SEPT is currently creating a Learning Factory which will provide hands-on learning of systems and components which constitute Industry 4.0. Most of the required equipment is already available at SEP and we are confident that this learning facility will be ready well before 2018/2019.

The Learning Factory will provide integration from enterprise planning level to the production equipment. It will include prototyping tools, actual cyber-physical systems examples (discrete manufacturing, continuous manufacturing, smart homes/buildings, smart grid, and smart transportation).

A simplified representation of the Learning Factory is given in Fig. 6.2.3.

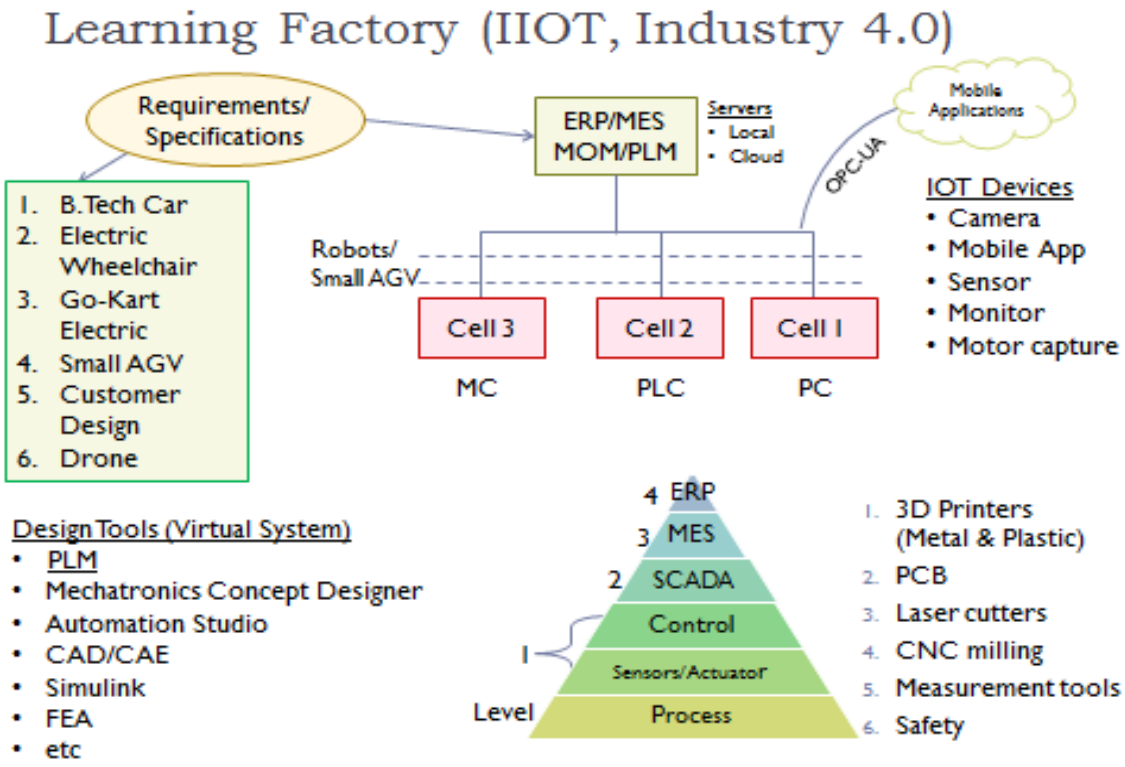


Fig. 6.2.3 Simplified representation of the Learning Factory

6.2.3 FACULTY

The proposed program will be delivered in large part by the existing Faculty members from SEPT with some incremental course enrollments across the Faculty of Engineering. Program specific courses will be taught by the faculty members from SEPT.

It is proposed that from outset the program employs (a part of) a full time teaching faculty, starting from 0.33 FTE and increasing to 0.7FTE when the program reaches approximately 80 students.

Table 6.2.1a and Table 6.2.1.b list members of Faculty members who will teach or already teach the courses which are recommended to the students in the Program.

Table 6.2.1a Faculty Members for W. Booth School of Engineering Practice and Technology who will teach courses

Name	Rank	M/F	Dept.
Mo Elbestawi	Professor	M	SEPT
Vladimir Mahalec	Professor	M	SEPT
Fleising, Robert	Associate Professor	**M**	SEPT
David Potter	Associate Professor	M	SEPT
Dan Centea	Assistant Professor	M	SEPT
Gao, Zhen	Assistant Professor	M	SEPT
Jeff Fortuna	Assistant Professor	M	SEPT
Mehrtash, Moein	Assistant Professor	M	SEPT
Tom Wanyama	Assistant Professor	M	SEPT
Yuam, Timber	Assistant Professor	M	SEPT
Long, Jennifer	Lecturer	F	SEPT
Singh, Ishwar	Adjunct Professor	M	SEPT
Mikhail Hanna	Adjunct Professor	M	SEPT

Table 6.2.1b Faculty Members from other departments in the Faculty of Engineering who teach the recommended courses who will teach courses

Name	Rank	M/F	Dept.
Stephen Veldhuis	Professor	M	MECH
Saeid Habibi	Professor	M	MECH
Tim Nye	Associate Professor	M	MECH
Tohid Didar	Assistant Professor	M	MECH
Fengjun Yan	Assistant Professor	M	MECH
Ryan Ahmed	Adjunct Professor	M	MECH
Ravi Selvagnapathy	Professor	M	EPHYS
Tim Davidson	Professor	M	ECE
Shahram Shirani	Professor	M	ECE
Nicola Nicolici	Professor	M	ECE
Xun Li	Professor	M	ECE
Simon Haykin	Professor	M	ECE
Christopher Swartz	Professor	M	CHE
Michael Thompson	Professor	M	CHE
Prashant Mhaskar	Professor	M	CHE
Antoine Deza	Professor	M	CAS
Wenbo He	Associate Professor	F	CAS
Reza Samavi	Assistant Professor	M	CAS
Borzoo Bonakdarpour	Assistant Professor	M	CAS

Faculty from W. Booth SEPT will from the beginning of the Program be responsible for delivery of the professional development courses.

6.2.4 *STUDENT FINANCIAL SUPPORT*

The program will not offer financial support to the students.

6.2.5 *FACULTY RESEARCH FUNDING* ***– NOT APPLICABLE; THIS IS NOT A RESEACH PROGRAM***

6.2.6 *SUPERVISION*

Supervisions areas for each of the listed faculty members are presented in Table 6.2.6.1 below.

Table 6.2.6.1 Supervision privileges

1=Automation&Smart Systems 2=Advanced Manufacturing 3= Automotive						
				Faculty		
Name	**Rank**	**M/F**	**Dept.**	**1**	**2**	**3**
Mo Elbestawi	Professor	M	SEPT		x	x
Vladimir Mahalec	Professor	M	SEPT	x	x	
Fleising, Robert	Associate Profes	**M**	SEPT	x	x	
David Potter	Associate Profes	M	SEPT		x	
Ng, Eugene	Associate Profes	M	SEPT		x	
Dan Centea	Assistant Profes	M	SEPT		x	x
Gao, Zhen	Assistant Profes	M	SEPT	x	x	
Jeff Fortuna	Assistant Profes	M	SEPT	x		
Mehrtash, Moein	Assistant Profes	M	SEPT			x
Tom Wanyama	Assistant Profes	M	SEPT	x	x	
Yuam, Timber	Assistant Profes	M	SEPT			x
Singh, Ishwar	Adjunct Professo	M	SEPT	x	x	
Mikhail Hanna	Adjunct Professo	M	SEPT		x	
Stephen Veldhuis	Professor	M	MECH		x	
Saeid Habibi	Professor	M	MECH	x		x
Tim Nye	Associate Profes	M	MECH		x	
Tohid Didar	Assistant Profes	M	MECH		x	
Fengjun Yan	Assistant Profes	M	MECH		x	
Ryan Ahmed	Adjunct Professo	M	MECH		x	
Tim Davidson	Professor	M	ECE	x		
Shahram Shirani	Professor	M	ECE	x		
Nicola Nicolici	Professor	M	ECE	x		
Xun Li	Professor	M	ECE	x		
Simon Haykin	Professor	M	ECE	x		
Christopher Swartz	Professor	M	CHE	x		
Michael Thompson	Professor	M	CHE		x	
Antoine Deza	Professor	M	CAS	x	x	
Wenbo He	Associate Profes	F	CAS	x	x	
Reza Samavi	Assistant Profes	M	CAS	x	x	
Borzoo Bonakdarpour	Assistant Profes	M	CAS	x	x	

7 QUALITY AND OTHER INDICATORS

7.1 ACADEMIC QUALITY OF THE PROGRAM

The most important measures of the Program quality will be the employment record of its graduates as well as the satisfaction of the graduates and their employers with the capabilities attained during the studies.

The following annual surveys will be conducted:

- Expectations of the students at the beginning of their program.
- Satisfaction with the program outcomes at the end of the studies.
- Survey of alumni with respect to:
    - Employment at the time of the survey.
    - Ranking / rating of capabilities attained during the program w.r.t. their usefulness in their career.
    - Capabilities that they wish to have.
- Survey of employers who will have had graduates from the Program in their employ.
- Survey of the Internship experience (by the students and by the host entities).

In addition, the Program will measure:

- Time to completion
- Retention rates
- Incoming GPA
- GPA during the Program.

7.2 INTELLECTUAL QUALITY OF THE STUDENT EXPERIENCE

Strong student-faculty interaction will be facilitated by inverted classes, since most of the time in the classroom will be spent on problem solving and discussions.

SEPT Faculty have been recognized as having one of the highest student ratings in the Faculty of Engineering, which is a clear indication of their ability to engage students and create an engaging working environment.

In addition to the classes, the students will be able to participate in Practitioners Forum, as well as the social activities in SEPT. Remotely located students will be able to interact with their colleagues via social media platforms (e.g. Facebook group for each class is a tradition at SEPT).

APPENDIX 1a – Results of Bachelor of Technology Student Survey

Q10-C49		
Options after Graduation		
I am interested in pursuing my P.Eng. designation		
Strongly Disagree	9	2.56%
Disagree	14	3.99%
Neutral	62	17.66%
Agree	121	34.47%
Strongly Agree	**141**	**40.17%**
N/A	4	1.14%
Total	**351**	
Mean	4.07	
Standard Dev.	0.99	
Variance	0.98	

I would pay to attend P.Eng. preparatory courses for the challenge exams required to attain my P.Eng. designation after graduation			
Strongly Disagree	18	5.11%	
Disagree	24	6.82%	
Neutral	74	21.02%	
Agree	**121**	**34.38%**	
Strongly Agree	110	31.25%	
N/A	5	1.42%	
Total	**352**		
Mean	3.81		
Standard Dev.	1.11		
Variance	1.24		

I plan to pursue management certification credentials		
Strongly Disagree	11	3.16%
Disagree	29	8.33%
Neutral	**126**	**36.21%**
Agree	110	31.61%
Strongly Agree	66	18.97%
N/A	6	1.72%
Total	**348**	
Mean	3.56	
Standard Dev.	1.00	
Variance	1.00	

I have a career plan for after graduation		
Strongly Disagree	17	4.86%
Disagree	30	8.57%
Neutral	83	23.71%
Agree	**122**	**34.86%**
Strongly Agree	88	25.14%
N/A	10	2.86%
Total	**350**	
Mean	3.69	
Standard Dev.	1.10	
Variance	1.21	

I plan to obtain a graduate degree, such as an M.Eng., MASc., MBA, or PhD.		
Yes	**237**	**66.95%**
No	117	33.05%
Total	**354**	
Mean	1.33	
Standard Dev.	0.47	
Variance	0.22	

What degree are you most interested in?		
M.Eng.	**113**	**50.00%**
M.Sc.	12	5.31%
M.A.Sc.	15	6.64%
MBA	56	24.78%
Ph.D.	16	7.08%
Other	14	6.19%
Total	**226**	
Mean	2.52	
Standard Dev.	1.71	
Variance	2.93	

Why do you want to pursue graduate studies?		
Career growth	**163**	**22.09%**
Higher pay	150	20.33%
Competitive edge (vs. those with just an underg	133	18.02%
Desire to conduct research	49	6.64%
Desire to teach at a College or University	52	7.05%
Interest in a specific field of study	92	12.47%
Eases pathway to a P.Eng. Designation	94	12.74%
Other	5	0.68%
Total	**738**	
Mean	3.48	
Standard Dev.	2.13	
Variance	4.54	

Please rank the following from highest to lowest for choosing a graduate-level degree (1-highest and 5-lowest):										
	1		2		3		4		5	
Reputation of the school	76	34.70%	35	16.06%	31	14.16%	42	19.09%	35	16.06%
Cost of the program	35	15.98%	46	21.10%	42	19.18%	26	11.82%	70	32.11%
Courses offered	46	21.00%	45	20.64%	56	25.57%	50	22.73%	23	10.55%
Quality of the instructors	28	12.79%	43	19.72%	64	29.22%	51	23.18%	32	14.68%
Ability to choose your own courses to fit your interests	34	15.53%	49	22.48%	26	11.87%	51	23.18%	58	26.61%

If you were to enroll in an M.Eng. Degree Program, which one of the following would represent your desired balance between technical and professional courses (e.g. leadership, project management, communications for engineers, basic entrepreneurship, etc.):		
10% professional 90% technical	21	9.42%
20% professional 80% technical	58	26.01%
40% professional 60% technical	**72**	**32.29%**
50% professional 50% technical	72	32.29%
Total	**223**	
Mean	2.87	
Standard Dev.	0.97	
Variance	0.95	

Would you be interested in a 1-year M.Eng. Program at McMaster?		
Yes	**201**	**89.73%**
No	23	10.27%
Total	**224**	
Mean	1.10	
Standard Dev.	0.30	
Variance	0.09	

Are you seeking to enrol in graduate studies on a full-time or part-time basis?		
Full-time	**141**	**62.39%**
Part-time	85	37.61%
Total	**226**	
Mean	1.38	
Standard Dev.	0.49	
Variance	0.24	

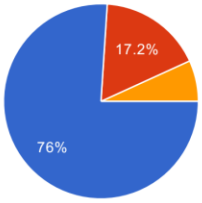
Why are you not interested in pursuing a graduate-level studies?		
Grades are not high enough	33	14.10%
Not enough interest in a specific area	29	12.39%
Eager to enter the workforce	41	17.52%
Need money!	**59**	**25.21%**
Graduate Degree doesn't seem to be worth the time and money	50	21.37%
Other	22	9.40%
Total	**234**	
Mean	3.56	
Standard Dev.	1.53	
Variance	2.34	

Under what circumstances might you consider a 1-year Master of Engineering Program?		
Would not consider it	4	1.49%
If a potential employer suggested it	**68**	**25.37%**
If the cost was not too high	58	21.64%
If there was a program focus area that I was interested in	66	24.63%
If I could find balance between work, family and studies	63	23.51%
Other	9	3.36%
Total	**268**	
Mean	3.53	
Standard Dev.	1.23	
Variance	1.52	

APPENDIX 1b – Results of Engineering Alumni Survey

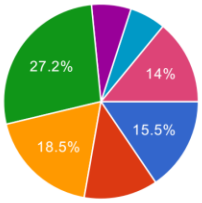
Summary

Please identify your degree.



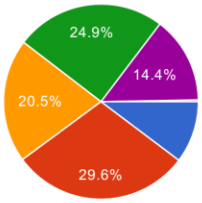
B. Eng.	**257**	76%
B. Eng. Mgmt.	**58**	17.2%
B. Eng. Society	**23**	6.8%

Please identify your primary technical discipline.



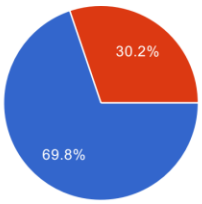
Chemical Engineering	**52**	15.5%
Civil Engineering	**41**	12.2%
Computing and Software Engineering	**62**	18.5%
Electrical and Computer Engineering	**91**	27.2%
Engineering Physics	**22**	6.6%
Materials Science and Engineering	**20**	6%
Mechanical Engineering	**47**	14%

Please identify your graduation year.



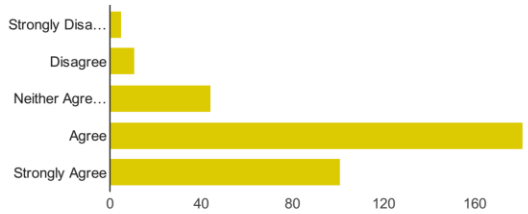
2020 +	**35**	10.3%
2019	**101**	29.6%
2018	**70**	20.5%
2017	**85**	24.9%
2016	**49**	14.4%
2015	**1**	0.3%

Have you considered pursuing a graduate degree, such as an M.Eng., MASc., MBA, or Ph.D.?



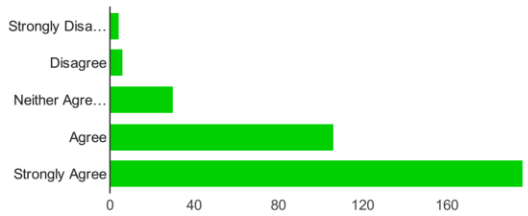
YES	**238**	69.8%
NO	**103**	30.2%

If my employer suggested it. [Under what circumstances might you consider a 1-year Master of Engineering Program?]



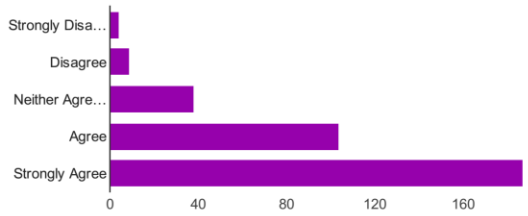
Strongly Disagree	**5**	1.5%
Disagree	**11**	3.2%
Neither Agree nor Disagree	**44**	12.9%
Agree	**181**	52.9%
Strongly Agree	**101**	29.5%

If my employer subsidized the cost. [Under what circumstances might you consider a 1-year Master of Engineering Program?]



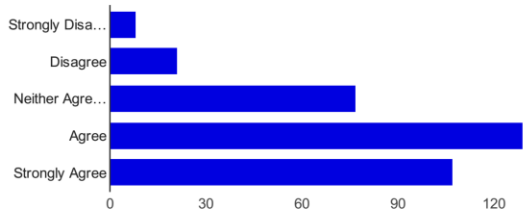
Strongly Disagree	**4**	1.2%
Disagree	**6**	1.8%
Neither Agree nor Disagree	**30**	8.8%
Agree	**106**	31%
Strongly Agree	**196**	57.3%

If there was a program focus area that I was interested in. [Under what circumstances might you consider a 1-year Master of Engineering Program?]



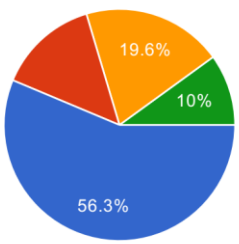
Strongly Disagree	**4**	1.2%
Disagree	**9**	2.6%
Neither Agree nor Disagree	**38**	11.1%
Agree	**104**	30.4%
Strongly Agree	**187**	54.7%

If I could reconciles between work, family and studies. [Under what circumstances might you consider a 1-year Master of Engineering Program?]



Strongly Disagree	**8**	2.3%
Disagree	**21**	6.1%
Neither Agree nor Disagree	**77**	22.5%
Agree	**129**	37.7%
Strongly Agree	**107**	31.3%

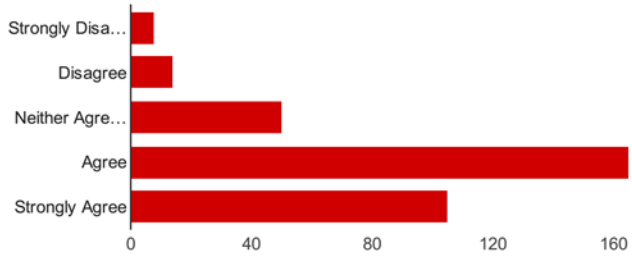
If you would consider a graduate degree, what degree would you be interested in?



M.Eng.	**192**	56.3%
MASc.	**48**	14.1%
MBA	**67**	19.6%
PhD.	**34**	10%

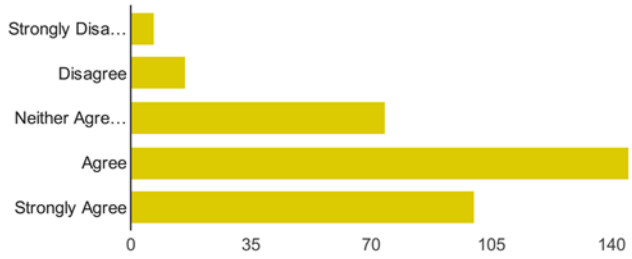
APPENDIX 1c – Results of Bachelor of Engineering Student Survey

Helps in your career-path. [Indicate your agreement with the following statements related for obtaining a graduate-level Degree.]



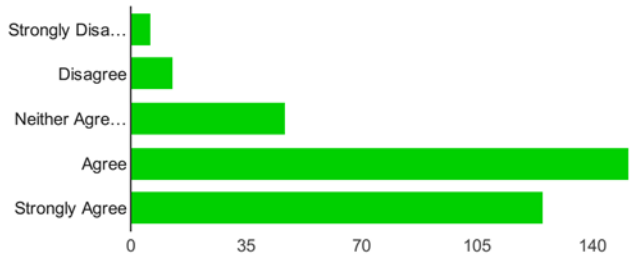
Strongly Disagree	**8**	2.3%
Disagree	**14**	4.1%
Neither Agree nor Disagree	**50**	14.6%
Agree	**165**	48.2%
Strongly Agree	**105**	30.7%

High pay. [Indicate your agreement with the following statements related for obtaining a graduate-level Degree.]



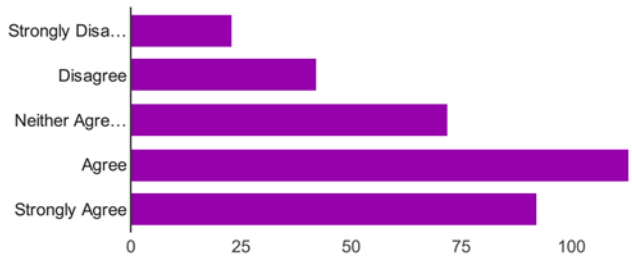
Strongly Disagree	**7**	2%
Disagree	**16**	4.7%
Neither Agree nor Disagree	**74**	21.6%
Agree	**145**	42.4%
Strongly Agree	**100**	29.2%

Sets you apart from student's with a Bachelors Degree. [Indicate your agreement with the following statements related for obtaining a graduate-level Degree.]



Strongly Disagree	**6**	1.8%
Disagree	**13**	3.8%
Neither Agree nor Disagree	**47**	13.7%
Agree	**151**	44.2%
Strongly Agree	**125**	36.5%

Desire to conduct research. [Indicate your agreement with the following statements related for obtaining a graduate-level Degree.]



Strongly Disagree	**23**	6.7%
Disagree	**42**	12.3%
Neither Agree nor Disagree	**72**	21.1%
Agree	**113**	33%
Strongly Agree	**92**	26.9%

Appendix 2

Benchmark Survey of nearby University M.Eng. Programs

University	Summary	Course No.	Project	Speciality
Windsor	Eight graduate-level courses, including five from their area of specialization plus one more engineering course (from any department) and no more than two non-engineering courses. Alternatively, a student may choose to complete all eight courses within their area of specialization.	8	Co-op Optional	• Electrical Engineering • Electrical-Computer Engineering • Mechanical Engineering • Materials Engineering • Industrial Engineering • Environmental Engineering • Civil Engineering
Guelph	• 2.5 credits from the program core and • 2.5 credits chosen from approved courses. • No more than 1.0 of these credits may be from senior undergraduate engineering courses • No more than 1.5 credits may be from courses offered outside the School of Engineering. • For the final project (1.0 credit) the student will consult with his/her advisor for an approved topic.	8	NA	• Biological Engineering • Environmental Engineering • Engineering Systems & Computing • Water Resources Engineering
Ottawa	30 credits of academic work: • 18 credits of core courses • 12 credits of optional courses (inclusive of 6-credit research project) • 50/50 split between Engineering & Management courses	10	Optional	8 Inter-disciplinary Areas in Engineering Management
Waterloo	5 of the courses for degree requirements are to be taken in Chemical Engineering.	8	NA	Chemical Engineering
Queens	• Two of the courses can be at the 400 undergraduate levels. • Students are eligible to take any course listed in the Graduate Calendar, as long as at least four of the courses are taken from their home department. • Students generally take a set of courses that fit their background and interests.	8	Optional Internship	• Chemical Engineering • Civil Engineering • Electrical and Computer Engineering • Engineering Physics • Geological Engineering • Mathematics and Engineering • Mechanical and • Materials Engineering • Mining Engineering
Western	• Three half courses per semester (fall, winter) • Two engineering professional development courses in the summer term • Project in any of the three semesters	10	Optional	• Environmental and Green Engineering • Biomaterials and Biochemical Engineering • Reaction and Process Systems Engineering • Particle Technology and Fluidization • Process Control and Safety
Toronto	The MEng program requires successful completion of ten half-courses, or seven half-courses and a MEng project (Course Code: MIE 8888Y).	10	Optional	• Computational Mechanics in Design • Energy Studies • Financial Engineering • Healthcare Engineering • Information Engineering • Robotics and Mechatronics

Appendix 3

Calendar description of courses in the program

Effective, communicative leadership – PLO #1

SEP 725 / Practical Project Management for Today's Business Environment

This course covers the basics of project management techniques and tools, as well as advanced, adaptive, and emerging approaches to improve project success. Students will learn how to apply effective project management to a variety of common business situations, including starting a company, bringing a product to market, doing primary research and development, constructing a physical facility, and developing a major piece of software, among others. Case studies, guest speakers, and hands-on exercises will be used to explore real-life examples of project management successes and failures.

SEP 7XX/ Professional Communication in Engineering

In this course, students will develop professional communication skills, written and oral, for use in engineering contexts. Using the fundamentals of communication theory, students will critically examine human connection and the effect of technology on communication. Through case study analysis and industry examples, students will learn to adapt their work for various audiences, integrate industry communication standards into their own work, and learn the art of persuasion. Students are expected to write a project proposal, assess and integrate peer and instructor feedback, prepare a report, and present their findings. Classes will include both lectures and experiential learning activities in order to develop professionalism as well as technical writing and presenting skills for the Canadian workplace.

SEP 773 / Leadership for Innovation

This course will explore leadership in an innovation context with the objective of providing a conceptual understanding of role model leadership, and an approach used to assist the development of personal leadership capacity. The student will develop an understanding of personal, interpersonal, and group skills. Personal leadership development, leadership in teams, and leadership from an organizational and societal perspective will be a focus. Leadership in driving innovation will be emphasized and practiced by application during the School of Engineering Practice's Innovation Studio.

SEP 760 / Design Thinking

This course will explore the creative design process, tools and methods that will enable students to discover, identify, and analyze opportunities and develop those opportunities into innovative design solutions. Based on a series of self-contained exercises and small projects, students will work to research a well-conceived design concept by the end of term.

SEP 6LM3/ Lean Thinking

Students will learn about and apply classical lean techniques well beyond the shop floor. Lean methods will enable students to deploy and adapt tools aimed at minimizing waste, removing non-value added activities, and pursuing incremental improvements across organizations.

Monitor, analyze, improve system operation – PLO #2

SEP 6DM3 / Data Mining

Classification, association, prediction and clustering of data through the use of machine learning algorithms - from introductory approaches to recent advances. Evaluation metrics. Meta learning. Deep Learning.

SEP 752 / SYSTEMS MODELING AND OPTIMIZATION

Architecture of simulation programs, solution algorithms, integration of simulation models from different simulators. Steady-state and dynamic simulation via sequential modular and equation-oriented algorithms. Optimization of steady-state and dynamic performance, sensitivity of the optimum, multi-objective optimization. Analysis of plant data, gross error detection, parameter estimation to match the plant performance. On-line monitoring and optimization of process performance.

CHEM ENG 765 / Multivariate Statistical Methods for Big Data Analysis and Operations Improvement

This course is based around multivariate latent variable models which assume low dimensional latent variable structures for the data. Multivariate statistical methods including Principal Component Analysis (PCA), and Partial Least Squares (PLS) are used for the efficient extraction of information from large databases typically collected by on-line process computers. These models are used for the analysis of process problems, for on-line process monitoring, and for process improvement.

SEP 7XX / Machine Learning

This course gives students both a theoretical and a practical look at the fundamental concepts upon which machine learning systems are based. These concepts include a variety of linear and non-linear approaches to the two basic machine learning problems – regression and classification. Additionally, a discussion of how these algorithms can be combined together (ensemble learning) is included. Special emphasis is placed on the connections and relationships between approaches. This enables the student to understand the behavior of an approach in the context of others, which is particularly useful when selecting the appropriate approach to solve a particular problem.

SEP 6C03 / Statistics for Engineers

Staff (cross-listed as CHEM ENG 6C03)
Linear regression analysis in matrix form, non-linear regression, multiresponse estimation, design of experiments including factorial and optimal designs. Multivariate statistics. Special emphasis on methods appropriate to engineering problems.

MANUF 710 / SYSTEM ANALYSIS SIMULATION

Computer simulation of manufacturing systems. Simulation programming languages. Applications: the analysis and design of systems for production. Model validation. Simulation output analysis. Use of software. Students enrolling in this course must obtain permission from the instructor.

COMP SCI 6TE3 / Continuous Optimization

Fundamental algorithms and general duality concepts of continuous optimization. Special attention will be paid to the applicability of the algorithms, their information requirements and computational costs. Practical engineering problems will illustrate the power of continuous optimization techniques.

ECE 710 / Engineering Optimization

Concentrates on recognizing and solving convex optimization problems that arise in engineering. Convex sets, functions, and optimization problems. Basics of convex analysis. Least-squares, linear and quadratic programs, semi-definite programming, minimax, extremal volume, and other problems. Localization methods. Optimality conditions, duality theory, theorems of alternative, and applications. Interior-point methods. Applications to signal processing, control, circuit design, computational geometry, statistics, and mechanical engineering. The prerequisites are - a good knowledge of linear algebra and willingness to program in Matlab; exposure to numerical computing, optimization, and application fields helpful but not required; the engineering applications will be kept basic and simple.

CHEM ENG 752 / Optimization of Chemical Processes

Numerical techniques for achieving optimal performance of a chemical process. Topics in numerical linear algebra; optimality conditions; algorithms for unconstrained optimization; application to solution of nonlinear equation systems and least-squares problems; linear programming; algorithms for constrained optimization; dynamic optimization; interior-point methods; mixed-integer programming; global optimization. Application to process design, control, operation and scheduling.

CAS 771 / Introduction to Big Data Systems and Applications

Nowadays, unstructured data such as multimedia data account for around 80% of Internet traffic. Meanwhile, more than 80% of potentially usable business information exists in unstructured formats (e.g., audio/video information, social network relations, users' purchasing habits, environmental data). Much of the unstructured data remains unused because the algorithms available for analyzing and understanding unstructured data usually do not scale up to handle the amount of data being generated. This course will discuss and explore the computer system design to deal with large scale unstructured data.

Systems integration and control – PLO #3

SEP XXX / Systems Engineering & Cyber Physical Systems

This course covers system thinking, system science, life cycle management (processes and activities throughout the life cycle of a system), specialty engineering, system engineering practical tools & methods, system-of-systems, and agile and iterative methods in the context of cyber physical systems.

SEP 7xx / Industrial components, networks and interoperability

This course covers advanced software and hardware components of industrial systems, as well as industrial networks used in Machine to Machine (M2M) and Business to Business (B2B) communication to integrate industrial components. The course also covers interoperability issues of industrial automation systems. Topics covered include legacy industrial networks such as Modbus serial and DeviceNet; Ethernet and TCP/IP; Ethernet based industrial networks such as Ethernet IP, Modbus TCP, ProfiNet, BACNet; as well as integration of process/manufacturing automation, building automation, environment management, energy management systems, and electricity automation systems using DDE, OPC, and SCADA systems. Moreover, the course covers use and integration of artificial intelligence in industrial systems.

SEP 783 / Electromagnetics Sensors and Actuators

Basic Electromagnetics, Magnetostatics , Reluctance method, magnetism, Theory of magnetic sensors, Hall effect and magnetoresistive sensors, Application of hall sensors, Eddy-current damping generation and model, Application of eddy-current damper in automotive active suspension, Magnetorheological fluid control, Magnetorheological fluid shock obsorber in automotive, small gap electromagnetic actuators, linear motor model and performance analysis, Optimization of Fast-acting actuators, Automotive application of solenoid actuator (fuel pump, injectors, transmission, and compressor), Magnetic-circuit analysis of motors, Magnetic valves, Large gap magnetic actuator, magnetic levitation and manipulation, Electromagneic energy harvester concept and model

SEP 780 / Advanced Robotics and Automation

This course covers the fundamental and the recent advances of robotics and automation. With the hands-on components, it builds a bridge between theoretical study and industrial applications. The students can apply what they learnt to analysis and address the real-world issues including robot programming, kinematics and control of serial and parallel robots, performance analysis and optimization, human-robot interface, and robot vision. Through the training of practical mini-projects and course project, the students are capable of constructing the automated robotic system with integration of software, hardware and user interface.

SEP 6ES3 / Real-Time Systems

Real time system characteristics, dynamic responses of physical processes, real-time system requirements, real-time operating systems, scheduling and concurrency.

CHEM ENG 6E03 / Digital Computer Process Control

This course addresses key aspects of implementing control via discrete calculations using digital computers. Topics include discrete-time dynamic models, system identification, analysis of discrete-time systems, design of digital control systems, and model predictive control.

SFWR ENG 6HC3 / The Human Computer Interface

A study of the principles of good interface design. Information overload problems and accommodating user mental models. Human input and technology insertion methods. Information and data visualization techniques. Modes and the mode awareness problem. Human factors and health issues, ergonomics. Interface design tools and Performance Support Systems.

ECE 772 / Neural Networks and Learning Machines

Statistical learning theory, including VC, regularization, and Bayesian theories. Algorithms for multilayer perceptrons, kernel-based learning machines, self-organizing maps, principal components analysis, and blind source separation. Sequential state estimation algorithms, including extended Kalman filter, unscented Kalman filter, and particle filters; applications to learning machines.

SEP 6CS3 / Computer Security

Network and software security, cryptography algorithms, firewalls, vulnerabilities, policies and best practices, attack and defense strategies.

CAS 757 / Modern Software Technology for eHealth

This course exposes the graduate students in software engineering, computer science, or related programs to the challenges in the field of electronic health (eHealth). The course introduces a collection of modern architectures and technologies that are recommended by standardization organizations to build the infrastructure that meets the emerging demands in the growing network of health care systems. Topics include: standard health care and data and service representations; clinical terminology systems; web services and service oriented architecture; decision support systems; data mining techniques on clinical data; data and knowledge interoperability; security and privacy techniques, and health care application development environments.

Design and improve operation of domain specific systems – PLO #4

SEP 6WP3 / Advanced Web Programming

Design, development and testing of database-driven web applications using modern client-side and server-side frameworks. Model-view-controller and related design patterns. User authentication and authorization. Web security. RESTful services and integrating 3rd party APIs.

SEP 762 / Prototyping Tools and Methods

This course will enhance the prototyping capabilities of students. Students will select one stream of prototyping. This will include hardware prototyping and software prototyping but will be expanded depending on the current slate of degree-required projects in the Master of Engineering Design program. Students will be expected to develop basic hands-on competency in their chosen stream of prototyping and demonstrate their ability and knowledge through a lab project that contributes to their degree-required project.

COMP SCI 6F03 / Distributed/Parallel Computer Systems

This course introduces the fundamentals of multiprocessor programming. It covers processes and threads, synchronization and communication; concurrent objects and data structires, correctness of concurrent objects, parallel programming paradigms such as MPI and GPGPU.

SEP 735 / Additive Manufacturing

Basic overview of additive manufacturing processes including powder bed fusion processes, and beam deposition processes. The course will also deal with issues related to design for additive manufacturing, applications and quality aspects.

SEP 6AT3 / Conceptual Design of Electric and Hybrid Electric Vehicles

Problem Based Learning course that allows group of students to design innovative electric or hybrid electric vehicle concepts and associated rental or car sharing services. Students are involved in topics that combine mechanical, electrical, controls, and computer engineering with business and management elements with the purpose of creating a smart vehicle associated with a smart car service.

SEP 6XX3 / Electric Drive Vehicles

The course covers topics related to electric and hybrid electric vehicles. It includes an introduction in internal combustion engines and electric machines, covers electrical and hybrid energy storage systems and chargers, and concentrate on the fundamentals of hybrid electric powertrains, hybrid electric vehicles, plug-in hybrid electric vehicles, all-electric vehicles, and range-extended electric vehicles.

CHEM ENG 6X03 / Polymer Processing

An introduction to the basic principles of polymer processing, stressing the development of models. Rheology of polymers, extrusion, molding, films, fibers, and mixing. Reactive processing.

CHEM ENG 772 / Polymer Rheology

Rheology of thermoplastic melts, conservation, and constitutive equations. Viscoelasticity. Complex flows, die swell, melt flow instability. Continuum and molecular theories including reptation. The role of rheology in processing.

ECE 744 / System-on-a-Chip (SOC) Design and Test: Part I - Methods

This course provides in-depth knowledge of the design methodologies that meet the challenge of the global shift from chip-based products to those which implement complete systems on a single chip. The course focuses on the novel intellectual property (IP)-centered design methodologies. The topics include embedded processor cores and memories, low power design, system verification and fault-tolerant computing. Understanding of application specific integrated circuits and hardware description languages is recommended.

ECE 778 / Introduction to Nanotechnology

This course provides a fundamental knowledge in nanotechnology. It focuses on the new physical phenomena due to the reduction of device dimension and the new applications as a result of these new phenomena. The topics include nano-materials, nano-processing, nanoelectronics, nano-photonics, nano-biotechnology, nano-MEMS and nano-integration. Students will learn what should be considered in the nano-world, what new applications we might be benefited from, and what precautions we need to pay attention when dealing with issues in the nano-world.

ECE 736 / 3D Image Processing and Computer Vision

Central to computer vision are the mathematical models governing image formation and methods for processing and recovering information based on the model and the image data. In this course we concentrate on statistical and geometrical models of visual data. Assuming a statistical model for the visual data, we talk about learning and inference. We cover modeling of the data densities, regression and classification methods and how we can use graphical models (e.g., Vitterbi, belief propagation) to solve learning and inference problems. In the other half of the course we take a geometrical approach to image formation and look at problems such as image blending and stitching and 3D reconstruction.

MECH ENG 754 / Management and Control of Electric Vehicle Batteries

Covers the key aspects of battery management systems in hybrid electric vehicles, plug-in hybrid electric vehicles and battery electric vehicles. Battery modeling, analysis, state-of-charge estimation, and state-of-health estimation via the application of parameter estimation, system identification, optimization, filtering, and control theory.

MECH ENG 729 / Manufacturing Systems

This course studies the organization and control of manufacturing systems. Types of production systems, the role of inventory, capacity and production control planning, scheduling, push-, CONWIP- and JIT-systems.Use of analytic, heuristic and numerical analysis and design methods.

MECH ENG 6K03 / Robotics

Fundamental theory and practical applications of robotic manipulators and mobile robots. Equations of motion, robot dynamics and statics, motion planning, introduction to machine vision, basics of robot programming.

MECH ENG 6Z03 / CAD/CAM/CAE

Solid modeling theory, part creation, assemblies and rigid bodies, mechanism simulation, BSplines, data exchange, CNC machining and inspection. Major project using computer laboratory facilities.

MECH ENG 710 / Machine Tool Analysis

Definitions and test of accuracy.Metrology using laser interferometer.Thermal deformations. Automation, numerical control: command generation, digital positional servos. Dynamics of machine tool structures, stability against chatter. Selection, specification, utilization, maintenance.

MECH ENG 743 / Advanced Mechatronics

This is a graduate course in mechatronics with an emphasis on actuation systems and control. The course begins by considering the industrial process that is followed for the design of large integrated systems. It then considers the necessity for a multidisciplinary approach to design and discusses the rational for mechatronics. Electrical and hydraulic actuation systems are considered, modeled and simulated. Electronic circuits, microcontrollers, real-time digital control, filtering, estimation and system identification are considered in the context of the control of actuation systems. The course heavily relies on experiential learning and includes a project.

MECH ENG 755 / Advanced Control on Internal Combustion Engines

The course will introduce a variety of linear and nonlinear control design techniques that are particularly useful for internal combustion engine systems. Combinations of engine system characteristics with control theory will be described through examples generated from pertinent research projects. Matlab/Simulink will be extensively used for engine control system analysis, design, and simulation studies. There will be a student self-proposed or instructor assigned term project.

McMaster University

NEW PROGRAM PROPOSAL FOR
Ph.D. in Statistics
Date: October 24, 2017

TABLE OF CONTENTS

PROGRAM

1.1 PROGRAM DESCRIPTION

The proposed Ph.D. in Statistics is a research-focused program that will train students to develop theory, methods, and tools for the analysis of increasingly diverse emerging data types. Not surprisingly, the recent explosion of interest in all things related to data has resulted in a notable increase in the number of graduate students in the Ph.D. program in Mathematics choosing to specialize in Statistics. However, the lack of a dedicated Ph.D. program in Statistics is a limiting factor in further growth (see Section 1.6.II). This proposal will remove this limiting factor and allow the growth of a unique Ph.D. program in Statistics. The proposed program is unique in that it combines a traditional Ph.D. program in Statistics, covering many areas of research, with an unusually significant research strength in computational statistics, which is a very important area of training in this data-centric era. In fact, the training in computational statistics that the proposed program will deliver is an essential component of the highly-skilled workforce for which Ontario is striving.

1.2 PROPOSAL PREPARATION AND CONSULTATION PROCESS

Dr. Paul McNicholas was assigned responsibility for taking the lead in the preparation of this proposal. As part of the process, other statistics Ph.D. programs in Canada were studied. The Faculty Dean and AVP and Dean of Graduate Studies were involved over various stages of drafting. There was broad consultation within, and beyond, the department. Notably, this includes a retreat of all concerned faculty, where the a near-final draft of the proposal was discussed and there was clear consensus on moving forward.

1.3 CONSISTENCY WITH MCMASTER'S MISSION AND ACADEMIC PLAN

i. **McMaster's Strategic Mandate Agreement:**

The proposed program directly addresses the "Science and Discovery" institutional strength, as articulated in the SMA (2014–2017). At the time of writing, SMA2 is not available; however, it is known that the institutional strengths and priorities will remain unchanged. While research in statistics is specialized, research that utilizes statistics cuts across almost every area of science and discovery. The SMA describes science and discovery as "the foundation for innovation and discovery at McMaster". Indeed, in this big data era, much of science and discovery depends on the availability of appropriate statistical techniques and expertise; the proposed program will help to deliver both. The SMA also states that:

> *Inquiry-based research programs in the sciences… inculcate the desire in McMaster students to create new knowledge and seek answers to far-reaching questions that challenge our understanding of ourselves, the*

world, and the universe.

Nowadays, seeking such answers almost inevitably entails dealing with big or otherwise complex data sets. The proposed program will train students to tackle such problems by developing and implementing cutting edge statistical methods in a wide variety of areas of expertise (cf. Section 1.1).

The area of growth addressed by the proposed program is "Science and Engineering". The SMA explains that "the Faculty [of Science] sees a tremendous opportunity to translate research outcomes into practical, advanced training for Science graduates". The proposed program aims to seize on just such an opportunity. In addition to the vibrant statistics research that is ongoing at McMaster University, there is research across campus that depends on statistics and, indeed, that drives some of the fundamental statistical research that is being carried out. Indeed, faculty listed in Section 2.6.VI are involved with several institutes across campus, e.g., the Michael G. DeGroote Institute for Infectious Disease Research (IIDR), the McMaster Autism Research Team (MacART), the McMaster Data Science Institute (MacData), the Physical Activity Centre for Excellence (PACE), and the Genetic and Molecular Epidemiology Laboratory (GMEL).

ii. **McMaster's current priorities:**

The proposed program will address all four of McMaster's identified priorities:

- *The Student Experience*
  The proposed program will foster academic and intellectual growth, as well as interactions between graduate students, faculty, the university, and the wider research community. Experiential learning is an important component in the proposed program (see Section 4.4). In keeping with the current tradition for students studying Statistics within the Probability and Statistics specialization of the Mathematics Ph.D. program, students in the proposed program will have the opportunity to be involved in collaborations between their supervisor and researchers in other departments across campus. Accordingly, there will be a clear element of interdisciplinarity in the proposed program. Finally, in carrying out the research required for the thesis, students will be engaging in self-directed learning.
- *Community Engagement*
  As already mentioned, the proposed program will foster interactions with the wider research community – within Ontario, Canada, and abroad. Work will be disseminated to the community both by presentations at conferences, publication of preprints in open access venues (e.g., www.arXiv.org), publication of papers in peer-reviewed journals, and publication of the thesis.

- *Research*
  As part of a research-intensive program, students will be immersed in a vibrant research environment, comprising fellow students, postdoctoral researchers, and faculty.
- *Internationalization*
  Student participation in seminars on campus will help to imbue a sense of the importance of their work on an international level. As is currently the case for students studying Statistics within the Probability and Statistics specialization of the Mathematics Ph.D. program, there will also be the opportunity to travel to international conferences and meetings, supported by supervisor funding and/or the various travel grants that are available.

1.4 PROGRAM LEARNING OUTCOMES

The proposed program will:

- **PLO1** Provide graduates with advanced education, knowledge, and technical expertise in the broad area of statistics.
- **PLO2** Produce graduates with both a broad understanding of the discipline of Statistics as well as in-depth knowledge of the literature surrounding the sub-discipline that forms the topic of the thesis.
- **PLO3** Ensure that, at completion, students can effectively communicate their knowledge of the discipline, and results of their research, both orally and in writing.
- **PLO4** Foster academic and intellectual growth, as well as interactions between graduate students, faculty, the university, and the wider research community – within Ontario, Canada, and abroad.
- **PLO5** Develop highly competent, independent, and creative statisticians who will provide leadership in academic institutions and in research and development within industry or government agencies.
- **PLO6** Help address the acute shortage of highly qualified statisticians, especially those trained to the doctoral level, who understand theory and can develop computational and statistical tools for the analysis of diverse emerging data types.

Note that, while our master's program, as well as programs offered at other institutions, have helped to address the problem highlighted in PLO6, a dearth of such expertise at the doctoral level remains. A continuing failure to address this shortage will result in lost opportunities in every area of the economy as well as in areas of notable societal importance such as the healthcare industry. In particular, the computational statistics research focus in the proposed program will help to address this failure.

1.5 CONSISTENCY WITH DEGREE LEVEL EXPECTATIONS

UNDERGRADUATE DLES	GRADUATE DLES
Depth and Breadth of Knowledge	Depth and Breadth of Knowledge
Knowledge of Methodologies	Research and Scholarship
Application of Knowledge	Application of Knowledge
Communication Skills	Communication Skills
Awareness of Limits of Knowledge	Awareness of Limits of Knowledge
Autonomy and Professional Capacity	Autonomy and Professional Capacity

Graduate DLE	By the end of this program, students will…
Depth and Breadth of Knowledge	…have gained advanced education, knowledge, and technical expertise in the broad area of Statistics (PLO1).
Research and Scholarship	… have undergone academic and intellectual growth, and interacted with other graduate students and faculty within the university and the wider research community (PLO 4). …be highly competent, independent, and creative statisticians (PLO5). …be highly qualified statisticians who have been trained to understand theory and develop computational and statistical tools for the analysis of the increasingly diverse emerging data types (PLO6).
Application of Knowledge	…have been trained to understand theory and develop computational and statistical tools for the analysis of the increasingly diverse types of emerging data types (PLO6).
Communication Skills	…be able to effectively communicate their knowledge of the discipline, and results of their research, both orally and in writing (PLO3).
Awareness of Limits of Knowledge	…have a broad understanding of the discipline of Statistics as well as in-depth knowledge of the literature surrounding the sub-discipline that forms the topic of the thesis (PLO2).
Autonomy and Professional Capacity	…be highly competent, independent, and creative statisticians who will provide leadership in academic institutions and in research and development within industry or government agencies (PLO5).

1.6 DEMAND FOR PROGRAM

I. Evidence of Societal/Labour Market Need

The Ontario Ministry of Advanced Education and Skills Development collect and publish labour market information; this is available at https://www.app.tcu.gov.on.ca/eng/labourmarket/ojf/findoccupation.asp. The classifications used are based on the National Occupational Classification system; cf. http://www.statcan.gc.ca/eng/subjects/standard/noc/2011/index. Unfortunately, the NOC does not have a separate category for “Statisticians”, including them under “Mathematicians, statisticians and actuaries” (2161). Worse still, the Labour Market Information published by the province, i.e., at https://www.app.tcu.gov.on.ca/eng/labourmarket/ojf/findoccupation.asp, does not include this occupation classification. There are, however, two

occupations that statisticians can be considered part of: Information systems analysts and consultants (2171) and Computer and Information Systems managers (0213). Demand for 2171 and 0213 is listed as Above Average for the periods 2009-2013 and 2013-2017; however, both occupational classifications are too broad to facilitate an accurate assessment of the labour market for statisticians.

Borrowing information from south of the border leads to a much better assessment of demand for statisticians, as follows. The United States Department of Labor, Bureau of Labor Statistics is a little ahead of their Provincial and Federal counterparts in Canada in using a specific category "Statisticians". The relevant section of their Occupational Outlook Handbook (http://www.bls.gov/ooh/math/statisticians.htm) gives projections for the period 2014-2024, stating, inter alia, that:

> *Employment of statisticians is projected to grow 34 percent from 2014 to 2024, much faster than the average for all occupations. Growth is expected to result from more widespread use of statistical analysis to make informed business and healthcare decisions.*

Given the similarities between the labour market in Southern Ontario and much of the United States, it is reasonable to assume similar robust growth in demand for statisticians on this side of the border. Furthermore, there is strong anecdotal evidence of demand for graduates form the master's in Statistics program as well as from the Probability and Statistics specialization of the Mathematics Ph.D. program. This includes recent graduates taking jobs with large financial institutions, medical research companies, and other private organizations. Some concrete examples, for graduates from the Probability and Statistics specialization of the Mathematics Ph.D. program, are given in the appendix.

In addition to providing highly trained researchers in statistics, the proposed program is unique in that it combines a traditional Ph.D. program in Statistics, covering many areas of research, with an unusually significant research strength in computational statistics. In this data-centric era, computational statistics is a crucially important area of training. In fact, the training in computational statistics that the proposed program will deliver is an essential component of the highly-skilled workforce for which Ontario is striving.

II. Evidence of Student Demand

The last few years has seen a notable increase in the number of students studying Statistics within the Probability and Statistics specialization of the Mathematics Ph.D. program rising from 9 in 2011 to 17 in 2016. This growth in Ph.D. level studies in statistics is encouraging; however, further growth is limited by the absence of a Ph.D. program in Statistics. For one, the inability

to explicitly advertise Ph.D. studies in statistics at McMaster University is a significant disadvantage; some students interested in studying statistics may not even look at a program entitled Mathematics. For those who do consider it, the actual structure of the Mathematics Ph.D. program may be unattractive to students who wish to study statistics, e.g., the first part of the comprehensive exam focuses on topics in mathematics (including probability) but not on statistics.

A major reason for the development of the present proposal is that there would be more applicants to study statistics at the Ph.D. level at McMaster University if such studies could be formalized and advertised as a Ph.D. in Statistics. The rationale is that a Ph.D. in Statistics would be more attractive than a Ph.D. in Mathematics with a specialization in Probability and Statistics. To test this theory, a short survey was administered to the STATS 780 (Data Science) class on November 30, 2016. This class was chosen because, in addition to all the new master's students in Statistics, the class contained some Mathematics Ph.D. students in the Probability and Statistics specialization as well as more than ten graduate students from other programs. Participation in the survey was voluntary (26 students responded), students did not have advance notice that it would take place, nothing about the proposed program had been previously discussed during the class, and completed surveys are anonymous.

The key question posed was "Compared to a Ph.D. in Mathematics with a specialization in Probability and Statistics, a Ph.D. in Statistics is:" and students were asked to circle one of five options: much more attractive; more attractive; neither more nor less attractive; less attractive; much less attractive. Notably, no student selected either of the latter two options and 24 of the 26 students responded that a Ph.D. in Statistics is (much) more attractive. All three of the students currently enrolled in the Probability and Statistics specialization of the Mathematics Ph.D. indicated that a Ph.D. in Statistics is much more attractive, as did 10 of the 13 master's students in Statistics. The responses are summarized, by student group, in Figures 1-3.

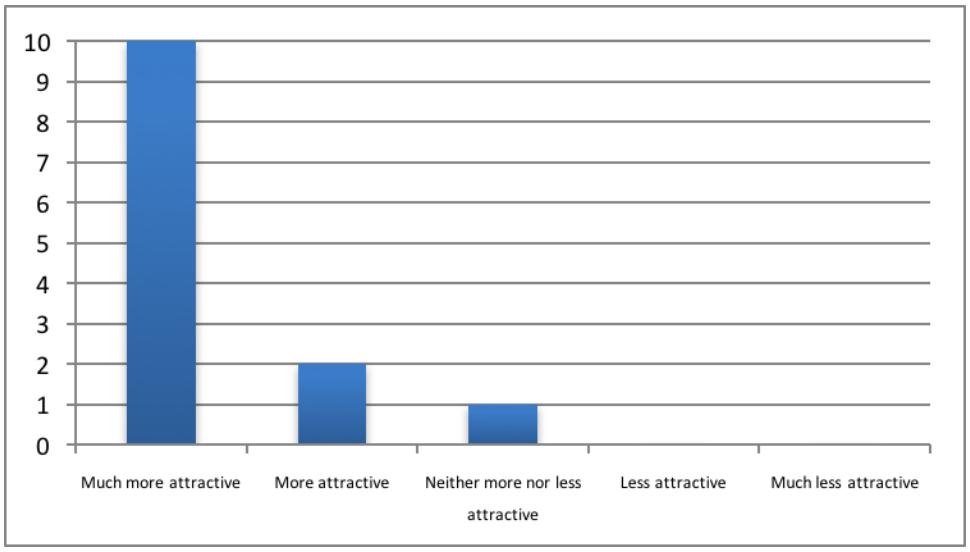


Figure 1: Responses to the question "Compared to a Ph.D. in Mathematics with a specialization in Probability and Statistics, a Ph.D. in Statistics is:" by students currently enrolled in the Statistics master's program.

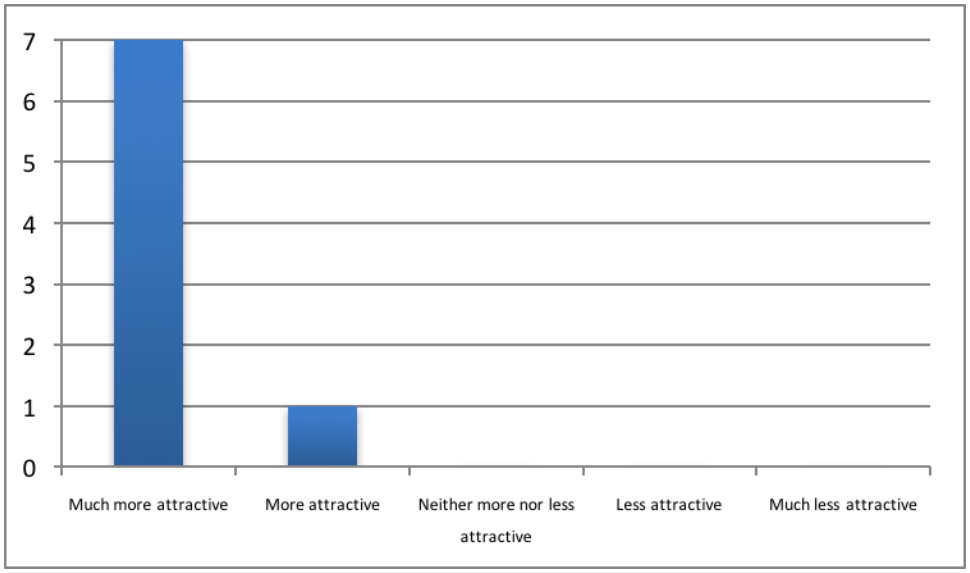


Figure 2: Responses to the question "Compared to a Ph.D. in Mathematics with a specialization in Probability and Statistics, a Ph.D. in Statistics is:" by students currently enrolled in a Ph.D. program (3 in Mathematics and 5 in CSE).

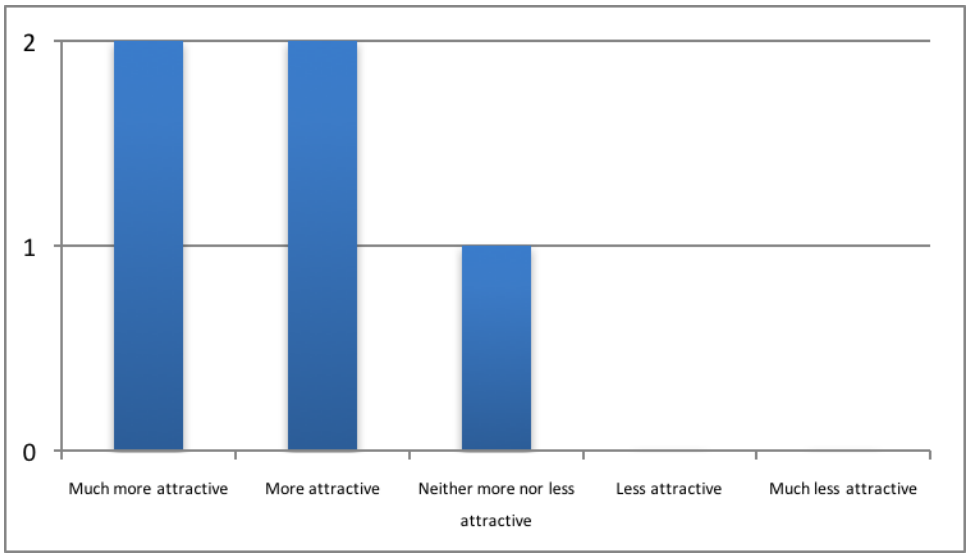


Figure 3: Responses to the question "Compared to a Ph.D. in Mathematics with a specialization in Probability and Statistics, a Ph.D. in Statistics is:" by students currently enrolled in programs not included in Figures 1 and 2.

In addition to its limited attractiveness to students, the present system of having Statistics Ph.D. students embedded within other graduate programs at McMaster (primarily the Mathematics Ph.D. program) is not ideal as it limits the type of training that can be provided. This system was workable when there were a relatively small number of Ph.D. students interested in Statistics, and provided their research topics fit within the other programs. That is no longer the case. The tables in the Appendix give the number of Ph.D. students at McMaster University supervised by our Category 1 faculty (see Section 6.4.VI), as well as the jobs that many of them now hold, and clearly reflect the growing interest among doctoral students for training in Statistics. Understandably, it has become increasingly difficult to accommodate the breadth of research interests using the present system. Added to this is the recent appointment of Dr. Paul McNicholas as Canada Research Chair (Tier I) in Computational Statistics. His added expertise, together with the ever-growing demand for doctoral training in Statistics, provides a strong rationale for the establishment of a separate Ph.D. program.

In terms of student demand, it is also notable that around 25% of students completing the M.Sc. in Statistics go on to Ph.D. studies. The M.Sc. program in Statistics was started about four decades ago and involves faculty supervisors from such diverse departments/faculties as Mathematics and Statistics, Clinical Epidemiology and Biostatistics (now Health Research Methods, Evidence and Impact), Economics, and Business. Besides the roughly 25% of graduates who have gone on to further study, others have gone on to successful careers in health, banking, finance, and industry, where there is a strong demand for workers with training in analytics and statistics.

III. Justifiable Duplication

There are several Ph.D. programs in Statistics in Ontario, most notably at the University of Toronto and the University of Waterloo. There is no Ph.D. program in Statistics in Ontario that mixes the traditional elements of a Ph.D. program with significant research focus on computational statistics. To put meat on the bones of this claim, at present, around half of the students currently in the Probability and Statistics specialization of the Mathematics Ph.D. program are studying computational statistics, as are around one-third of the thesis students in the M.Sc. in Statistics. Even without having a dedicated Ph.D. program in Statistics, this is already the largest concentration of graduate students studying computational statistics in statistics programs in Ontario.

As home to the Canada Research Chair in Computational Statistics as well as a large concentration of statistics graduate students studying computational statistics, McMaster University is uniquely positioned to deliver a program that combines a traditional Ph.D. program in Statistics, covering many areas of research, with an unusually significant research strength in computational statistics. In addition to the significant research strength in computational statistics, the core faculty in the program have expertise covering a broad range of areas, including applied statistics, bioinformatics, biostatistics, classification, ensemble methods, evolutionary algorithms, meta-analysis, mixture models, multivariate statistics, order statistics, probability, statistical genetics, statistical inference, statistical methodology, survival analysis, and theoretical statistics.

1.7 DEGREE NOMENCLATURE

The proposed program is a “classic” research-focused Ph.D. program. The field of study is Statistics. Upon approval of the proposal Ph.D. program, the Probability and Statistics specialization of the Mathematics Ph.D. program will be phased out without harm to current students. Specifically, no new students will be admitted to the specialization, and all current students will be given the option of transferring into the proposed Ph.D. program.

ADMISSION & ENROLMENT

2.1 ADMISSION REQUIREMENTS

Prior to admission, all successful applicants will have a supervisor that is willing to guide them and provide a stipend. This is the best and most practical way to ensure sufficient research potential. Beyond this requirement, the specifics depend on whether an applicant has an appropriate master’s degree, as follows.

Applicants with a suitable master's degree.
Successful applicants will have a master's degree equivalent to the M.Sc. in Statistics with thesis option at McMaster University with GPA equivalent to at least B+ over the last two years equivalent of full time study.

Applicants currently enrolled in a master's degree (transfer option).
Students in the M.Sc. in Statistics program, with thesis option, at McMaster University who have completed the course requirements for the M.Sc. with GPA equivalent to at least B+ may transfer into the Ph.D. in Statistics.

Direct entry.
Successful applicants will have a bachelor's degree with a major in Statistics with GPA equivalent to at least B+ over the last two years equivalent of full time study.

2.2 ENROLMENT PLANNING AND ALLOCATIONS

The following forecast starts with five new students per year and allows for a small increasing uptick based on the existence and advertising of a separate Statistics program. Of course, neither the increase in the quality of applicants nor the deeper applicant pool that will come with the proposed program is reflected in these forecasts. Note that continuing students in Year 1 are expected transfers from the Probability and Statistics specialization of the Mathematics Ph.D. program; we expect two students to transfer from each of the four years of the program. Note also that it is assumed that two students complete in each of the first four years of the program; this corresponds to completing students who transferred from the Probability and Statistics specialization of the Mathematics Ph.D. program. However, it should also be noted that this number would be expected to increase in Year 5 and beyond, as students who enter the new program in Year 1 started to complete.

Program Year	New	Continuing	Total
Year 1	4	8	12
Year 2	4	10	14
Year 3	5	12	17
Year 4	5	15	20

Crucially, the proposed Ph.D. program in Statistics will not just lead to an increase in the quantity of new students but also to an increase in the quality of new students. This increase in quality will be the result of a richer applicant pool. Furthermore, the proposed Ph.D. program in Statistics will have a positive impact on the M.Sc. in Statistics by increasing the quality and quantity of applications. The current situation, whereby the M.Sc. in Statistics program will remain a terminal program for the majority of students, will continue. However, those who

wish to continue their studies will now have a Ph.D. program in Statistics to go into; this will be particularly important for students who want to study Statistics but would not wish to pursue a specialization within a Mathematics Ph.D. program.

2.3 ALTERNATIVE REQUIREMENTS

Applicants who do not hold a suitable master's degree (see Section 2.1), are not enrolled in the M.Sc. in Statistics program at McMaster University, and do not hold a suitable bachelor's degree (for direct entry purposes, see Section 2.1), may follow an alternative admission route whereby they first enter the M.Sc. in Statistics program and later apply to transfer into the Ph.D. in Statistics program. Note that this route is also open to students who have a suitable bachelor's degree but do not have the supervisory support to take the direct entry route.

STRUCTURE

3.1 ADMINISTRATIVE, GOVERNANCE AND COMMUNICATION

The administrative, governance, and communication responsibilities for the Ph.D. in Statistics will be shared by the Associate Chair (Statistics) and the Program Committee. The day-to-day responsibilities will be discharged by the Associate Chair (Statistics). Decisions on admissions, student progress, and all other matters will be taken by majority decision of the Program Committee. The Program Committee will comprise the Associate Chair (Statistics), who will act as chair, as well as faculty members who are involved in supervision in the program.

3.2 STRUCTURE AND REGULATION

Course Requirements

Students who have completed a suitable master's degree (cf. Section 2.1), are transferring into the Ph.D. program while also completing the M.Sc. in Statistics degree, or have been granted direct entry into the program are required to take two 700 level STATS courses (total of 6 units). Students transferring into the Ph.D. program in Statistics without taking the M.Sc. in Statistics degree must first complete the course requirements for the M.Sc. in Statistics with a GPA of at least 10. Because these course requirements exceed the two level 700 STATS courses (total of 6 units) required for other students, no additional courses are required; however, such students must pass a Transfer Exam administered by the Supervisory Committee prior to transferring. Students entering the Ph.D. program via direct entry (see Section 2.1) will be required to take four 700 level STATS courses (total of 12 units).

Comprehensive Exam

During their course of study, doctoral candidates will have to pass a

Comprehensive Examination. The purpose of this examination is to ensure that the candidate possesses sufficient knowledge and maturity in statistics. The Comprehensive Examination will be in two parts.

- **Part I** will be a written examination.
- **Part II** will take the form of a written literature review, research proposal, and an oral examination.

3.3 PROGRAM LENGTH & PROGRESSION

The normal duration of the program is four years of full-time study. During this time, students will attend the weekly statistics seminars as well as other relevant talks, e.g., as may take place at the departmental colloquium. The following is the normal progression for students who have completed a suitable master's degree or are direct entry students (cf. Section 2.1):

Term	Milestone
1	Two 700 level STATS courses are completed.
2	Completion of Part I of the Comprehensive Exam. Preparation for Part II begins.
4	Part II of the Comprehensive Exam is completed.
11	Complete draft of thesis to supervisory committee.
12	Thesis defence.

The following is the normal progression for Students transferring into the Ph.D. program in Statistics without completing the M.Sc. in Statistics (note that Term 1 is the first term of graduate studies, with the student transferring to the Ph.D. program effective Term 3):

Term	Milestone
1	Courses are taken as part of M.Sc. program.
2	Course requirements for the M.Sc. program are completed.
3	Completion of Transfer Examination and transfer into Ph.D. program. Completion of Part I of the Comprehensive Exam.
4	Preparation for Part II of the Comprehensive Exam begins.
6	Part II of the Comprehensive Exam is completed.
13	Complete draft of thesis to supervisory committee.
14	Thesis defence.

The following is the normal progression for Students transferring into the Ph.D. program in Statistics while also completing the M.Sc. in Statistics (note that Term 1 is the first term of graduate studies, with the student transferring to the Ph.D. program effective Term 4):

Term	Milestone
1	Courses are taken as part of M.Sc. program.
2	Course requirements for the M.Sc. program are completed.
3	Research towards the M.Sc. thesis is carried out.
4	Transfer into Ph.D. program. Work towards the M.Sc. thesis is completed. The M.Sc. thesis is defended. Two additional 700 level STATS courses are completed.
5	Completion of Part I of the Comprehensive Exam. Preparation for Part II of the Comprehensive Exam begins.
7	Part II of the Comprehensive Exam is completed.
14	Complete draft of thesis to supervisory committee.
15	Thesis defence.

CURRICULUM AND TEACHING

4.1 PROGRAM CONTENT

Courses

The following 700 level courses will be of interest to Ph.D. students:

STATS 743 – Foundations of Statistics (6 units)
STATS 744 – Special Topics (3 units)
STATS 752 – Linear Models and Experimental Designs (3 units)
STATS 754 – Stochastic Processes and Applications (3 units)
STATS 758 – Multivariate Analysis and Applications (3 units)
STATS 761 – Advanced Time Series Analysis (3 units)
STATS 780 – Data Science (3 units)
STATS 794 – Directed Reading (3 units)

Of these courses, STATS 780 covers a hot and emerging topic in statistics. Depending on the topic at hand, STATS 744 and 794 can also consider emerging topics. In fact, based on recent offerings of STATS 749, it often covers emerging topics.

Comprehensive Exam

Part I of the comprehensive is designed to test a student's breadth of knowledge at a basic level. Part II of the comprehensive exam tests a student's depth of knowledge in topics directly related to the thesis topic and takes the form of a research proposal.

Thesis

The completion of the thesis requires that the student remains up-to-date on developments in the field, even after completion of the Comprehensive Exam. The thesis must be written as specified in the Graduate Calendar.

4.2 PROGRAM INNOVATION

The proposed Ph.D. program in Statistics covers many areas of research (see Section 1.1 for details). However, it will be the only statistics Ph.D. program in Ontario that mixes the traditional elements of a Ph.D. program with significant research focus on computational statistics. This is a major draw when one considers the growing importance of computationally intensive approaches in the "big data" era. Around half of the students currently focusing on statistics through the Probability and Statistics specialization are focused on computational statistics. This, already, is the largest concentration of Ph.D. students studying computational statistics in a statistics program in Ontario. More generally, a dedicated Ph.D. program in Statistics will allow for easier adaption to new data types and methodology as they arise in the future.

4.3 MODE(S) OF DELIVERY

As a research-intensive program, the Ph.D. in Statistics will be delivered primarily via regular meetings between the student and their supervisor. This "apprentice" system, whereby the student learns from working under the guidance of her/his supervisor, has proven extremely effective in the training of Ph.D. students. In general, supervisors will be expected to meet with their supervisees regularly. Supervisory committee meetings, which will take place at least annually, will be an important means of tracking progress. Statistics seminars, department colloquia, and other seminars on campus, e.g., the MacData seminars and the Computational Sciences and Engineering (CSE) seminars in Scientific Computing, will also provide students with exposure to new research ideas. The same is true of conferences. Students will also be able to avail themselves of the benefits of McMaster's membership of the Canadian Statistical Sciences Institute (CANSSI), e.g., through participation in CANSSI sponsored workshops or through reciprocity agreements with the Statistical and Applied Mathematical Sciences Institute (SAMSI), and the Fields Institute, e.g., via seminars and workshops.

4.4 EXPERIENTIAL LEARNING

Statistics, as a discipline, is inherently applicable to real-world problems and to problems that arise in virtually all other areas of endeavor at McMaster University. In keeping with the current tradition for students studying Statistics within the Probability and Statistics specialization of the Mathematics Ph.D. program, students in the proposed program will have the opportunity to be involved in collaborations between their supervisor and researchers in other departments across campus. Such experiences give students hands-on experience working with real problems. In some cases, they lead to co-authorship of work in subject matter journals. In addition to such collaborations, there are several resources on campus that students could turn to for experiential learning opportunities; these include a Statistics Canada Research Data Centre and ICES (Institute for Clinical

Evaluative Sciences) McMaster.

4.5 ACCESSIBILITY

There are no impediments to accommodations in the proposed Ph.D. program that come within McMaster's policy and recommendations (http://accessibility.mcmaster.ca/). This policy states that accommodations are a shared responsibility between the individuals requesting and providing the accommodation and that the nature of an accommodation is specific to the individual and should be determined on a case-by-case basis. For example, the classrooms and workspaces that will be utilized all meet high standards of accessibility. Academic accommodations such as special conditions for exams (including the Comprehensive Exam), other coursework, and the thesis defence will be arranged on a case-by-case basis.

4.6 RESEARCH REQUIREMENTS (IF APPLICABLE)

Development of a research proposal is required towards completion of the Comprehensive Exam (cf. Section 4.1). Thereafter, a thesis is required, which is a significant research undertaking. Research completed towards the thesis is expected to be original and result in the publication of papers in high-quality peer-reviewed journals. The research carried out and presented in the thesis must represent a significant contribution to the field, i.e., to Statistics.

ASSESSMENT OF LEARNING

5.1 METHODS FOR ASSESSING STUDENTS

Level 700 STATS courses are assessed using a combination of assignments, projects, midterm exams, and final exams. Parts I and II of the Comprehensive Exam are assessed by an examination committee. The thesis is examined by a committee comprising the supervisory committee and an examiner external to the university, in accordance with the Graduate Calendar. Throughout the program, progress is monitored by the supervisor at regular meetings (cf. Section 4.3). Annual, and formal, assessments of progress are made by the supervisory committee and the associated documentation is submitted to the School of Graduate Studies. If needed, supervisory committee meetings may take place more often, e.g., each term.

5.2 CURRICULUM MAP

There follows a table, mapping program learning outcomes to degree level expectations, teaching activities, and assessments.

Program Learning Outcomes	Ph.D. DLEs	Program Requirements	
		Teaching Activities and Learning Opportunities	Assessment and Evidence
PLO1 Provide graduates with advanced education, knowledge, and technical expertise in the broad area of Statistics.	Depth and Breadth of Knowledge	Level 700 STATS courses. Regular meetings with the supervisor. Preparation for the Comprehensive Exam. Statistics seminar series.	Course assignments, projects, and exams. Comprehensive Examination.
PLO2 Produce graduates with both a broad understanding of the discipline of Statistics as well as in-depth knowledge of the literature surrounding the sub-discipline that forms the topic of the thesis.	Awareness of Limits of Knowledge	Level 700 STATS courses. Regular meetings with the supervisor. Preparation for the Comprehensive Exam. Statistics seminar series. Preparation of the thesis.	Course assignments, projects, and exams. Comprehensive Examination. Thesis defense.
PLO3 Ensure that, at completion, students can effectively communicate their knowledge of the discipline, and results of their research, both orally and in writing.	Communication Skills	Regular meetings with the supervisor. Preparation for the Comprehensive Exam. Preparation of the thesis.	Annual Supervisory Committee meetings/reports. Comprehensive Examination. Thesis defense.
PLO4 Foster academic and intellectual growth, as well as interactions between graduate students, faculty, the university, and the wider research community – within Ontario, Canada, and abroad.	Research and Scholarship	Statistics seminar series. Department colloquia. Other seminars on campus, e.g., the MacData Seminar. Attendance at conferences and meetings, e.g., the SSC meeting.	Comprehensive Examination, Part II. Thesis defense.
PLO5 Develop highly competent, independent, and creative statisticians who will provide leadership in academic institutions and in research and development within industry or government agencies.	Research and Scholarship Autonomy and Professional Capacity	Preparation for Part II of the Comprehensive Exam. Preparation of the thesis. Statistics seminar series.	Annual Supervisory Committee meetings/reports. Comprehensive Examination, Part II. Thesis defense.
PLO6 To produce graduates who have been trained to understand theory and develop computational and statistical tools for the analysis of the increasingly diverse types of emerging data.	Research and Scholarship Application of Knowledge	Regular meetings with the supervisor. Preparation for Part II of the Comprehensive Exam. Preparation of the thesis. Statistics seminar series. Other seminars on campus, e.g., the MacData Seminar. Attendance at conferences and meetings, e.g., the SSC meeting.	Annual Supervisory Committee meetings/reports. Comprehensive Examination, Part II. Thesis defense.

5.3 DEMONSTRATING STUDENT ACHIEVEMENT

The ultimate demonstration of student success in the proposed Ph.D. program is the publication of high-quality peer-reviewed publications in impactful journals or other relevant media, e.g., published proceedings or book chapters – this is true regardless of whether the thesis is written as a monograph or as a collection of manuscripts. As students progress through the program, there will be several means to ensure that they are on track to produce such publications. These include regular meetings with the supervisor, annual supervisory committee

meetings, Part II of the Comprehensive Examination, and the thesis defense.

RESOURCES

6.2 GRADUATE PROGRAMS

i. ADMINISTRATIVE, PHYSICAL AND FINANCIAL RESOURCES

The administrative, physical, and financial resources necessary for the proposed program are already in place in support of the existing Probability and Statistics specialization of the Mathematics Ph.D. program.

ii. LIBRARY, TECHNOLOGY, AND LABORATORY RESOURCES

Although these needs are identical to those currently present in support of the Probability and Statistics specialization of the Mathematics Ph.D. program, details are given for completeness. The vast resources of the McMaster Library system will be critical for research and scholarly work within the proposed Ph.D. program in Statistics. The existing periodical subscriptions include electronic access for the McMaster community to all the relevant international journals on statistics and related disciplines. The Statistics faculty will continue to make recommendations for Library acquisition of hard and electronic copies of important and relevant textbooks. It is also important that students in the proposed Ph.D. program have access to software, most notably R and Python, which are freely available. The typesetting software LaTeX is essential for writing reports, papers, and the thesis; this is also freely available. Students will be able to access desktop computer facilities within the department; however, experience suggests that most have their own laptops. Students conducting research in computational statistics will require access to high-performance computing equipment, which is available though (relatively small) computer clusters within the Department as well as large-scale infrastructure available via SHARCNET – the latter is available through sponsorship from the supervisor.

iii. FACULTY

Faculty Quality

The core faculty for the program are listed in Section 6.2.VI, and include a Distinguished University Professor (Balakrishnan) and two senior research chairs – the John D. Cameron Endowed Chair (Beyene) and a Tier 1 Canada Research Chair (McNicholas). In addition to theoretical excellence, e.g., Balakrishnan is one of the most prolific researchers in statistical theory worldwide, faculty members have demonstrated experience with real-world applications. In fact, some have shown leadership in this regard, e.g., two of the Category 1 faculty are former Presidents of the Business and Industrial Statistics Section of the Statistical

Society of Canada, and one is a member of the CANSSI Industrial Innovation Committee. The core faculty have brought in over $6,000,000 in relevant research funding (i.e., funding that can support personnel) since 2009 and have already supervised 88 Ph.D. students to completion.

Supervisory Capacity

Based on the fact that, as of the November 2016 count, there were 17 Ph.D. students studying statistics as part of the Probability and Statistics specialization of the Mathematics Ph.D. program, there is clear supervisory capacity. In all, 14 of these 17 students (~82.4%) are supervised by either Dr. Balakrishnan or Dr. McNicholas. The presence of such productive professors amongst the Category 1 faculty is seen as a distinct advantage of the proposed program. In addition to Drs. Balakrishnan and McNicholas, there are several Category 1 faculty who have previously supervised Ph.D. students and are expected to have better access to students under the proposed program. A three year rolling average of Ph.D. students supervised by our Category 1 faculty (Figure 4) very nicely illustrates supervisory capacity.

Furthermore, with relatively minor involvement from other categories at present, there is certainly potential for growth. Further evidence for the supervisory capacity for the proposed Ph.D. program can be found by considering supervisors for students taking the M.Sc. in Statistics. Of the 29 thesis students entering the M.Sc. program in Fall 2015 or 2016, 25 were/are supervised by faculty in Categories 1 or 2, with Category 1 faculty carrying almost all the supervisory load (24 students).

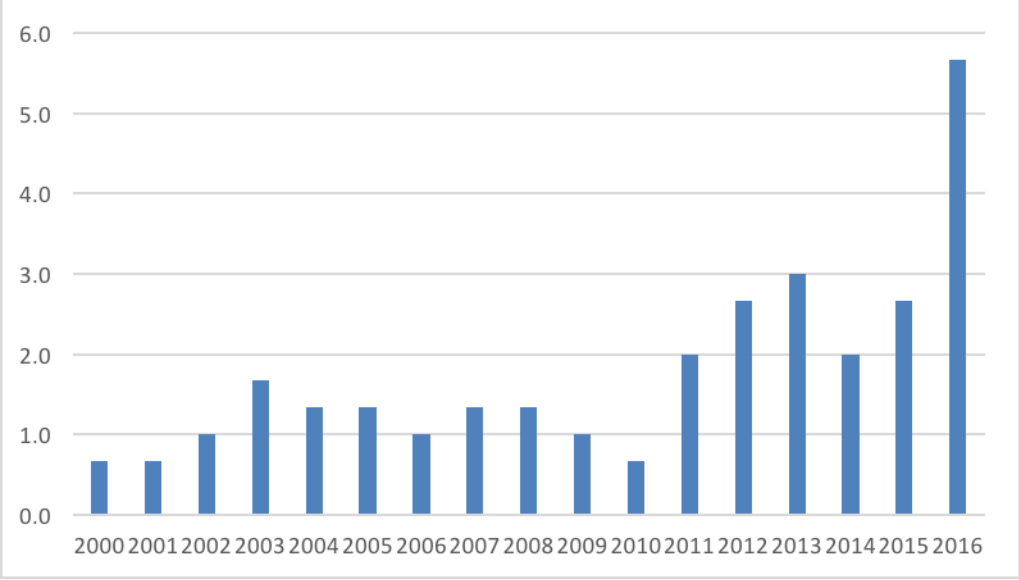


Figure 4: Three year rolling average number of Ph.D. degrees awarded to students supervised by Category 1 faculty.

Faculty Research

While research strength in computational statistics is a unique aspect of the proposed program, there is very broad research strength amongst the core faculty (see Section 6.2.VI for a list of core faculty). As mentioned in Section 1.1, there is notable expertise in applied statistics, bioinformatics, biostatistics, classification, ensemble methods, evolutionary algorithms, meta-analysis, mixture models, multivariate statistics, order statistics, probability, statistical genetics, statistical inference, statistical methodology, survival analysis, and theoretical statistics. Whatever the focus of a student's research, they will have some exposure to applications through their research. In fact, the work of core faculty has applications in many areas including biology, business, economics, environmental science, finance, physics, and medicine.

iv. STUDENT FINANCIAL SUPPORT

The competitive level of financial support currently available to students in the Probability and Statistics specialization of the Mathematics Ph.D. program will be available to students in the proposed Ph.D. program. The annual funding will break down as follows, and will be provided for four years. Note that visa students' tuition bursaries help cancel out the difference in tuition fees between Canadian Citizens and Permanent Residents; however, there will be a very limited number of such bursaries available.

- Canadian Citizens and Permanent Residents

Teaching Assistantships	$11,520
Department Support	$17,500
Total	**$29,020**

- Visa holders

Teaching Assistantships	$11,520
Department Support	$19,000
Tuition Bursary	$ 7,600
Total	**$38,120**

Some notes on the above tables follow. Department Support represents a combination of grant support, endowment funding (e.g., Britton and/or Stewart funds), scholarships, etc. The Department will discuss, with the School of Graduate Studies, the possibility of creating new scholarships for Ph.D. students in Statistics using the sizable gift recently received from the estate of Jim Stewart. The funding level attached to teaching assistantships given herein is that which is effective September 1, 2017; this funding level is subject to change over time.

v. FACULTY RESEARCH FUNDING

The Table provided below is intended to show the amount of funding available to support faculty research and potentially available to support students' work, either through the provision of stipends or materials for the conduct of the research.

Operating Research Funding by Source and Year				
	Source			
Year	Granting Councils	Other Peer Adjudicated [1]	Contracts	Others
2009-10	$502,148	$417,986	$50,000	$63,000
2010-11	$457,528	$402,986	$50,000	$63,000
2011-12	$465,731	$375,486	$50,000	$39,000
2012-13	$543,834	$179,489	$50,000	$238,721
2013-14	$550,168	$37,500	$50,000	$238,721
2014-15	$397,447	$37,500	$50,000	$240,721
2015-16	$342,346	$10,000	$50,000	$220,450
Totals	**$3,259,201**	**$1,460,947**	**$350,000**	**$1,103,614**

1. *The sources include the Ontario Early Researcher Award program, the Juvenile Diabetes Research Foundation, and the National Institutes of Health.*

vi. SUPERVISION

Faculty Members by Field							
				Fields			
Faculty Name & Rank	**M/F**	**Home Unit**	**Supervisory Privileges**	**Statistics**			
***Category 1*[4]**							
Dr. N. Balakrishnan – Professor	M	Mathematics & Statistics	Full	X			
Dr. Angelo Canty – Associate	M	Mathematics & Statistics	Full	X			
Dr. Aaron Childs – Associate	M	Mathematics & Statistics	Full	X			
Dr. Shui Feng – Professor	M	Mathematics & Statistics	Full	X			
Dr. Fred Hoppe – Professor	M	Mathematics & Statistics	Full	X			

Dr. Paul McNicholas – Professor	M	Mathematics & Statistics	Full	X			
Dr. Roman Viveros-Aguilera – Professor	M	Mathematics & Statistics	Full	X			
Category 2							
Dr. Sharon McNicholas – Assistant	F	Mathematics & Statistics	Co-Supervision	X			
Category 3							
Dr. Joseph Beyene – Professor	M	Health Research Methods, Evidence, and Impact	Full	X			
Dr. Ben Bolker – Professor	M	Mathematics & Statistics	Full	X			
Dr. Tom Hurd – Professor	M	Mathematics & Statistics	Full	X			
Dr. Traian Pirvu – Associate Professor	M	Mathematics & Statistics	Full	X			
Dr. Jeff Racine – Professor	M	Economics	Full	X			
Category 5							
Dr. Ejaz Ahmed – Professor	M	Mathematics & Statistics (Adjunct)	Co-supervision	X			

Category 1: tenured or tenure-track core faculty members whose graduate involvement is exclusively in the graduate program under review. For this purpose the master's and doctoral streams of a program are considered as a single program. Membership in the graduate program, not the home unit, is the defining issue.

Category 2: non-tenure-track core faculty members whose graduate involvement is exclusively in the graduate program under review.

Category 3: tenured or tenure-track core faculty members who are involved in teaching and/or supervision in other graduate program(s) in addition to being a core member of the graduate program under review.

Category 5: other core faculty: this category may include emeritus professors with supervisory privileges and persons appointed from government laboratories or industry as adjunct professors. Please explain who would fall into this category at your institution.

Completed and Current Numbers of Thesis Supervisions by Faculty Member						
	Completed			**Current**		
Member	**Master's**	**Ph.D.**	**PDF**	**Master's**	**Ph.D.**	**PDF**
Dr. E. Ahmed	12	11	1	2	5	1

Dr. N. Balakrishnan	63	43	0	5	14	0
Dr. J. Beyene	11	3	6	3	5	5
Dr. B. Bolker	1	8	0	0	2	0
Dr. A. Canty	16	2	3	2	0	1
Dr. A. Childs	10	0	1	0	0	0
Dr. S. Feng	6	3	3	1	1	0
Dr. F. Hoppe	6	3	2	0	0	0
Dr. T. Hurd	1	2	3	0	0	1
Dr. P. McNicholas	33	12	9	7	5	0
Dr. S. McNicholas	0	0	0	1	0	0
Dr. T. Pirvu	3	1	5	1	1	0
Dr. J. Racine	1	2	0	0	1	0
Dr. R. Viveros-Aguilera	24	3	3	2	0	0

QUALITY AND OTHER INDICATORS

7.1 ACADEMIC QUALITY OF THE PROGRAM

Over the first five years, the department will use the following indicators to document and to demonstrate the quality of this program:

- The quality of students entering the program, e.g., NSERC and OGS scholarships, GPA, etc.
- GPA and supervisory committee reports for students in-program.
- Student publications in peer-reviewed journals and conference proceedings as well as oral and poster presentations at conferences.
- An in-program student satisfaction survey will be administered each year to directly assess student satisfaction.
- Graduate outcomes, i.e., what jobs do graduates end up in. This will be tracked via alumni outreach.
- Retention rates and time-to-completion.
- Student awards beyond the aforementioned NSERC and OGS scholarships, e.g., travel awards, presentation awards, dissertation awards, and NSERC postdoctoral fellowships.

7.2 INTELLECTUAL QUALITY OF THE STUDENT EXPERIENCE

The intellectual quality of the student experience will be promoted and enhanced in the following ways:

- Beyond their own work, there will be many opportunities for students in the proposed Ph.D. program to gain exposure to intellectually exciting topics. The Department has a vibrant statistics seminar series, which takes place every week during the fall and winter terms. In addition to all students being encouraged to attend the seminar, more senior Ph.D. students will also be given the opportunity

to present their work.

- Ph.D. students will be encouraged to attend and present their work at the Statistical Society of Canada annual meeting. In recent years, several students in the Probability and Statistics specialization of the Mathematics Ph.D. program have done this; in fact, such students won presentation awards at the 2015 and 2016 meetings. Attendance at other conferences and meetings will also be encouraged.
- In addition to the statistics seminar series, the Department colloquium and related social activities also provide an excellent environment and opportunity for students to engage with faculty and other graduate students. The same is true of several other seminar series across campus, e.g., the MacData and CSE seminars.

CHECKLIST FOR NEW PROGRAM PROPOSALS

The following section indicates all the items that are required as part of a ***complete*** new program proposal package which includes all the necessary documents. Part I, II and III should be submitted as separate files to iqap@mcmaster.ca.

PART I: COMPLETE NEW PROGRAM PROPOSAL DOCUMENT

- ☐ **Complete New Program Proposal Template**
- ☐ **Faculty CVs** (can be submitted on CD or USB)
- ☐ **Memorandum(s) of Understanding (Letters of Support)** (if applicable)

PART II: RESOURCE IMPLICATIONS AND FINANCIAL VIABILITY TEMPLATE

- ☐ Completed
- ☐ Approved

PART III: FEES MEMO

- ☐ Completed
- ☐ Approved

APPENDIX

The following table details Ph.D. students supervised to completion, by Category 1 faculty, at McMaster University since the year 2002.

Year	Graduate	Degree	Supervisor	Thesis Title
2017	Yang Tang	Ph.D. Math	McNicholas	*Dimensionality Reduction with Non-Gaussian Mixtures*
2017	Monica Wong	Ph.D. Math	McNicholas	*Topics in One-Way Supervised Biclustering Using Gaussian Mixture Models*
2016	Chu-Shu Gu	Ph.D. HRM	Canty	*A Quasi-likelihood Method to Detect Differentially Expressed Genes in RNA-sequence Data*
2016	Hon Yiu So	Ph.D. Math	Balakrishnan	*Some Inferential Results for One-shot Device Testing Data Analysis*

2016	Amay Cheam	Ph.D. Math	McNicholas	*Mixture Models for ROC Curve and Spatio-Temporal Clustering*
2016	Paula Murray	Ph.D. Math	McNicholas	*Detecting Non-Elliptical Clusters*
2015	Dan Quach	Ph.D. Math	Hoppe	*A statistical framework for distinguishing between aleatory and epistemic uncertainties in the best-estimate plus uncertainty(BEPU) nuclear safety analyses.*
2015	Xiaojun Zhu	Ph.D. Math	Balakrishnan	*Inference for Birnbaum-Saunders, Laplace and Some Related Distributions under Censored Data*
2014	Xingli Wei	Ph.D. Math	Hoppe	*Parameter Estimation and Prediction Intervalsfor location - Scale Models with Nuclear Applications*
2014	Ick Huh	Ph.D. Math	Viveros-Aguilera	*Optimal Monitoring Models for Univariate and Multivariate Control Charts*
2013	Suvra Pal	Ph.D. Math	Balakrishnan	*Likelihood -Based Inferential Methods for some Flexible Cure Rate Models*
2013	Youzhou Zhou	Ph.D. Math	Feng	*Asymptotic Theory for Three Infinite Dimensional Diffusion Processes*
2012	Laila Al-Khalfan	Ph.D. CSE	Balakrishnan	*Inference for a Gamma Step-Stress Model Under Censoring*
2012	Man Ho Ling	Ph.D. Math	Balakrishnan	*Inference for one-shot Device Testing Data*
2012	Debanjan Mitra	Ph.D. Math	Balakrishnan	*Likelihood Inference For Left Truncated and Right Censored Lifetime Data*
2012	Feng Su	Ph.D. Math	Balakrishnan	*Exact likelihood inference for multiple exponential populations under joint censoring*
2012	Fang Xu	Ph.D. Math	Feng	*Stochastic models associated with the two-parameter Poisson-Dirichlet distribution*
2011	William Volterman	Ph.D. Math	Balakrishnan	*On Some Inferential aspects for Type II and progressievely Type II censoring*
2009	Xuan Zhang	Ph.D. Math	Balakrishnan	*Exact Analysis of Exponential Two-Component System Failure Data*
2008	Donghoon (David) Han	Ph.D. Math	Balakrishnan	*Some Contributions to Inferential Issues of Censored Exponential Failure Data*
2008	Xingqiu Zhao	Ph.D. Math	Balakrishnan	*New Nonparametric Tests for Panel Count Data*
2007	Yongmin Yu	Ph.D. Math	Viveros-Aguilera	*Some Contributions to Statistical Process Control*
2006	Qihao Xie	Ph.D. Math	Balakrishnan	*Exact inference for step-stress model under different forms of censoring*
2005	Tao Li	Ph.D. Math	Balakrishnan	*Ordered Ranked Set Samples and Applications to Statistical Inference*
2004	Jeong-Ae Kim	Ph.D. Math	Balakrishnan	*Inferential Methods for Censored Bivariate Normal Data*
2004	Po Yang	Ph.D. Math	Balakrishnan	*Indicator Polynomial Functions and their Applications in Two-level Factorial Designs*
2003	Ping Wu	Ph.D. Math	Feng	*Financial Filtering and Model Calibration*
2002	Hon Keung Tony Ng	Ph.D. Math	Balakrishnan	*Contributions to Parametric and Nonparametric Inference in Life Testing*
2002	Qi Jessie Zhou	Ph.D. Math	Balakrishnan	*Inferential Methods for Extreme Value Regression Models*

Current positions for 26 of the last 28 Ph.D. students supervised to completion, by Category 1 faculty, at McMaster University:

Assistant Professor, Hong Kong Institute of Education
Assistant Professor, Indian Institute of Management, Udaipur, India
Assistant Professor, Kuwait University
Assistant Professor, Mathematics, Syracuse University
Assistant Professor, Mathematics, University of Texas, Arlington
Assistant Professor, Xi'an Jiaotong-Liverpool University (previously Statistical Analyst, McMaster University)
Assistant Professor, Zhongnan University of Economics and Law
Associate Professor, Guangzhou Maritime University, China

Associate Professor, Hong Kong Polytechnic University
Associate Professor, Management Science and Statistics, College of Business, University of Texas, San Antonio
Associate Professor, Shanghai University of Business and Economics
Associate Professor, Statistics, University of Manitoba
Director, Nuclear Safety Analysis
Manager, Capital Modelling Group, Bank of America
Methodologist, Cancer Care Ontario
Postdoctoral Fellow, University of Toronto/Centre for Addiction and Mental Health
Professor, Statistical Sciences, Southern Methodist University
Professor, Seneca College
Risk Analyst, Toronto Dominion Bank
Risk Manager, Bank of Montreal
Scientist, Bombardier Canada
Senior Biostatistician, Health Canada, Ottawa
Senior Manager, Capital Market Group, Bank of Montreal and Adjunct Professor, York University
Senior Scientist, LG Inc., Daejeon, South Korea
Statistical Analyst - Programmer, Ontario Clinical Oncology Group, Juravinski Hospital
Statistician, Institutional Research and Analysis, McMaster University

McMaster University **School of Graduate Studies** 1280 Main Street West Phone 905.525.9140
Hamilton, Ontario, Canada Ext. 23679
L8S 4L8 http://graduate.mcmaster.ca

To : Graduate Council

From : Christina Bryce
Assistant Graduate Secretary

At its meeting on October 20th the Faculty of Engineering Graduate Curriculum and Policy Committee approved the following graduate curriculum recommendations.

Please note that these recommendations were approved at the November 9th meeting of the Faculty of Engineering Meeting.

FOR APPROVAL OF GRADUATE COUNCIL:

- **School of Engineering Practice and Technology**
  - **Change to Course Requirements and Calendar Copy**
    - Technology, Entrepreneurship and Innovation
    - Engineering, Entrepreneurship and Innovation
    - Engineering and Public Policy
    - Engineering Design

FOR INFORMATION OF GRADUATE COUNCIL:

- **School of Engineering Practice and Technology**
  - **New Courses**
    - 714 Workflow management for animated prototypes
    - 715 Rendering techniques
    - 790 Proof-of-Concept Studio
  - **Course Title Changes**
    - 6PM3 The Management of Technical Projects
    - 758 Software Prototyping Tools and Methods
  - **Change to Course Offering**
    - 700 Project Course
    - 771 W Booth School of Engineering Practice and Technology Practitioner's Forum

- **Civil Engineering**
  - **New Courses**
    - 751 Behaviour and Design of Masonry Components and Systems
    - 750 Advanced Structural Dynamics

- **Course Title Change**
  - 739 Advanced Structural Dynamics

- **Course Cancellations**
  - 6W04 Design of Low-Rise Buildings
  - 702 Rehabilitation of Structures
  - 718 Random Vibrations
  - 720 Behaviour and Design of Masonry Components
  - 722 Design and Construction of Masonry Buildings
  - 724 Tall Building Analysis and Design
  - 728 Introduction to Wind Engineering
  - 738 Seismic Behaviour, Analysis and Design of Masonry Structures
  - 742 Experimental Soil Mechanics

McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	W. Booth School of Engineering Practice and Technology
NAME OF PROGRAM and PLAN	Master of Technology, Entrepreneurship and Innovation
DEGREE	Master of Technology, Entrepreneurship and Innovation

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☐ No

CREATION OF NEW MILESTONE ☐

CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	X

CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR	x	**EXPLAIN:** Update the Graduate Calendar to reflect the changes described in this form.
OTHER CHANGES		**EXPLAIN:**

DESCRIBE THE EXISTING REQUIREMENT/PROCEDURE:

1. Entrepreneurship students currently work throughout their project with guidance from their mentors. In term 3, there is a "Proof of Concept Studio" but no way to assign a grade to the students for that work. Consequently, if a student doesn't work towards fulfilling the expectations, there is no possibility to remove the student from the program.
2. SEP 771, W Booth School of Engineering Practice and Technology Practitioner's Forum is a zero credit two term course.
3. Part-time studies in Entrepreneurship are available.
4. McMaster undergraduate students can choose 600 level courses only from the approved list

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE ***(Attach additional pages if space is not sufficient.)***

1. Introduce a new course SEP 7nn "Proof of Concept Studio" in Term 3. This is a zero credit, pass/fail course which is mandatory for all Entrepreneurship students.
2. Divide SEP 771 "W Booth School of Engineering Practice and Technology Practitioner's Forum" in two parts: SEP 771 "W Booth School of Engineering Practice and Technology Practitioner's Forum, Part 1" and SEP 771 "W Booth School of Engineering Practice and Technology Practitioner's Forum, Part 2".
3. No part time studies in Entrepreneurship program.
4. McMaster undergraduate students can take any 600 level courses in Engineering intended for credit in their M.Eng. studies with approval of the Associate Dean of Graduate studies.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department's program and/or tie to existing Program Learning Outcomes from the program's IQAP cyclical review?):

1. Course SEP 7nn "Proof of Concept Studio" in Term 3 will enable the instructor to grade appropriately each student.
2. Dividing the course SEP 771 "W Booth School of Engineering Practice and Technology Practitioner's Forum" in two parts allows us to deliver the course during the Winter Term and the Fall term and not have issue with Mosaic.
3. Our experience with the part time studies has not been very positive. It takes a long time for students to complete the studies and the impact is not as expected. In addition, with the current increase in enrollment, there is simply no bandwidth to offer a high quality part time program.
4. Reduce course load.

PROVIDE IMPLEMENTATION DATE: ***(Implementation date should be at the beginning of the academic year)***

September 1, 2018

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

No

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

Admission

While students in the Technology Entrepreneurship and Innovation program are not expected to have any engineering or scientific background, they are expected to embrace creativity and innovation. Some basic familiarity with technology is expected, but the required technological depth will depend on the project itself and will be evaluated on a case-by-case basis. Considerable emphasis will be placed on team-based experiential learning in which all members of the team will learn from each other as they complete the project.

Applications for admission will be made directly through the W~~alter G.~~ Booth School of Engineering Practice and Technology. In addition to the general requirements for entry into a graduate program in Engineering, candidates applying to the Master of Technology Entrepreneurship and Innovation program must hold an Honours Bachelor's degree from any discipline, with at least a B- average (equivalent to a McMaster 7.0 GPA out of 12) students in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work.

Strong letters of recommendation are also required. The delivery of the program relies heavily on the synergy created between members of student teams, and successful operation of the program requires that each cohort have an appropriate blend of skills and experience. Therefore each applicant will be interviewed. A strong performance in the interview is a critical requirement for admission.

The program will accept full~~- or part-~~time students. The full program is expected to take 20 months full-time study~~ or 32 months part-time~~. Candidates are admitted for September only. No part-time option is available.

Prospective applicants who did not attain the required standing in their undergraduate degree, but who have at least four (4) years of relevant work experience, should discuss their situation with the Program Lead. If the experience is deemed sufficient, the Program Lead may then recommend an interview. Evidence of ability to do graduate work will still be required (see sections 2.1.1 Admission Requirements for Master's Degree and 2.1.5 Admission of Students with Related Work Experience or Course Work Beyond the Bachelor's Degree in the Graduate Calendar.)

A candidate is required to complete successfully two one-term advanced graduate courses and the ~~five~~ six compulsory Entrepreneurship and Innovation module courses. Additionally, full-time students must successfully complete SEP 771, Part I and II and SEP 772. A faculty advisor will assist the student in selecting relevant graduate courses. Students will normally be required to complete two graduate level (700 -level) graduate courses in fulfillment of the requirements for Advanced Studies. Advanced studies are an integral component of the program and are offered by various departments in the Faculty of Engineering and beyond. The objective is to acquire leading-edge skills and apply them to the enterprise project.

~~In addition,~~ McMaster students may receive advanced standing for only one additional ~~the following~~ course~~s~~ (note that a maximum of two 600-level courses can count towards a SEPT graduate program including mandatory 600 level courses) with the approval of the Associate Dean of Graduate Studies.~~:~~

- ~~Only a student enrolled in their final year of a degree at McMaster University immediately entering a SEPT graduate program can be eligible for advanced credit. There can be no banking, no retroactive accommodations of advanced credit options.~~
- ~~SEP 6EL3 / Leading Innovation~~
- ~~SEP 6E03 / Entrepreneurial Opportunity Identification~~
- ~~SEP 6X03 / LIVABLE CITIES, THE BUILT AND NATURAL ENVIRONMENT~~
- ~~SEP 6PM3 / The Management of Technical Projects~~

Innovation and Entrepreneurial Skills Development

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~~Five~~Six compulsory enterprise modules will focus on providing the Master's degree candidate with basic skills to select an idea with good potential, manage the innovation process, then create and manage the business outcome. The skills will broadly cover all the business cycle from start, growth and sustainability. The modules will develop an understanding of both the innovation and the entrepreneurial processes through lectures, workshops and hands-on work~~, and will enable the student to fully exploit the potential of the engineering enterprise project~~ as well as embed sustainability into their enterprise project as a source of competitive advantage

~~.~~ Each module is considered the equivalent of a half-course as defined by the School of Graduate Studies, but will contain elements of lecture, group work, presentation and other activities as defined in the course outline. The module courses will be delivered in an intensive format~~.; and it is expected that students will take the module courses in sequenced numerical ordet.~~ The module courses are:

- SEP 6E03 / Entrepreneurial Opportunity Identification ~~(Module 1~~)
- SEP 773 / Leadership for Innovation
- SEP 753 / Enterprise Opportunity Development
- SEP 755 / Business Launch and Development
- SEP 770 / Total Sustainability Management
- SEP 790 / Proof-of-Concept Studio

All full-time candidates are required to successfully complete:

- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II
- SEP 772 / Innovation Studio

Enterprise Project

The Enterprise Project will run throughout the entire study period and will result in both a business and a viable Proof-of-Concept defined as the combination of (i) a technical plan for an engineering prototype product (ideally with an actual prototype device or software produced) plus (ii) an identified customer base and a plan outlining the way to commercialization. ~~technical plan for an engineering prototype product (ideally with an actual prototype device or software produced) with an identified customer base and a plan outlining the way to commercialization.~~ The project will bring together complementary streams of activities, one technical and the other commercial to bring an idea to the proof of concept phase. The ~~core~~ Entrepreneurial course stream, which will run coincidentally with the advanced engineering studies will guide the technological work performed in the research laboratory so that the concept becomes, by the end of the degree, the nucleus of a business proposition. ~~The Enterprise project development will be supported by two additional graduate level courses.~~

The Enterprise Project will have three phases, which will end with project gate assessments to determine the project's readiness to proceed to the next phase:

Phase 1 - Project Preparation

Market research to arrive at a proposed product or service with clear value proposition; define the market for the intended product or service revealing competitive threat, opportunities, and margins and volumes projections; draw up development plans for the product or service indicating the required resources and estimated investment cost; seek the resources within the university and without; build a team of support that might include a partner.

Phase 2 - Technical Research and the Development of the Prototype

Develop a research plan, identifying key issues and opportunities (with the assistance of academic technical and business supervisors); conduct technical research and development; implement the engineering research plan within the research group in the host-engineering department; build a development network within the engineering research community; ready the technology for transfer to market; conduct initial market engagement to get customer feedback and reactions.

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Phase 3 - Technology Transfer to Market

Apply for IP protection if applicable; develop a path-to-market strategy; develop a business case; seek out financing ~~present to funding institutions~~ and explore business arrangements; plan for business start-up. Each phase has two equally important components, one technical and the other business:

Phase I

Concept initiation proposal; Technology development plan presentation and documentation

Phase II

Technical Proof-of-concept; Draft financial plan presentation and documentation

Phase III

Business Strategy and Go-to-market plan or a Venture feasibility presentation and documentation

The Phase III evaluation will be a defence of your project in an oral examination to your board (technical mentor, enterprise advisor, business advisor and your business mentor). Candidates are required to complete and pass through each phase in order to graduate.

Leadership Skill Development and the Enterprise Project~~Peer Evaluation and the Enterprise Project~~

The ability to effectively work in a team environment is an important learning outcome of team-based project work on the Enterprise project~~, as in individual learning outcomes developed in a team environment. Candidates will be mentored on their progress in this aspect by their enterprise advisor based on input from their peers in the project team and from assesment of the enterprise advisor. Team member evaluations will be collected in confidence from team members by the enterprise advisor, or their designate, on a six-month basis. Every six months the Enterprise Advisor will review the performance of the individual candidate in the team with the candidate. The enterprise advisor will generate an assessment of performance. To successfully complete the program, the candidate must maintain an average rating of "Good" over the span of the enterprise project in team assesment and demonstrate individual achievement in team experienced learning outcomes.~~ The MTEI program uses a confidential service to provide each individual with personalized performance feedback from their peers on a periodic basis. Approaches to improving ones own performance include mentoring and guidance by their Enterprise Advisor.

- SEP 6E03 / Entrepreneurial Opportunity Identification
- SEP 6EL3 / Leading Innovation
- SEP 719 / Special Topics in Engineering/ Technology Entrepreneurship and Innovation
- SEP 725 / Practical Project Management for Today's Business Environment
- SEP 753 / Enterprise Opportunity Development
- SEP 755 / Business Launch and Development
- SEP 770 / Total Sustainability Management
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II
- SEP 772 / Innovation Studio
- SEP 773 / Leadership for Innovation
- SEP 790 / Proof-of-Concept Studio

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CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: Vladimir Mahalec Email: mahalec@gmail.com Extension: 26386 Date submitted: Oct. 2, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

SGS/2013

McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	W. Booth School of Engineering Practice and Technology
NAME OF PROGRAM and PLAN	Master of Engineering, Entrepreneurship and Innovation
DEGREE	Master of Engineering, Entrepreneurship and Innovation

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☒ No

CREATION OF NEW MILESTONE ☐					
CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	X
CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR	x	**EXPLAIN:** Update the Graduate Calendar to reflect the changes described in this form.			
OTHER CHANGES		**EXPLAIN:**			

DESCRIBE THE EXISTING REQUIREMENT/PROCEDURE:

1. Entrepreneurship students currently work throughout their project with guidance from their mentors. In term 3, there is a “Proof of Concept studio” but there is no way to assign a grade to the students for that work. Consequently, if a student doesn’t work towards fulfilling the expectations, there is no possibility to remove the student from the program.
2. SEP 771, W Booth School of Engineering Practice and Technology Practitioner's Forum is a zero credit two term course.
3. Part-time studies in Entrepreneurship are available.
4. McMaster undergraduate students can choose 600 level courses only from the approved list

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE *(Attach additional pages if space is not sufficient.)*

1. Introduce a new course SEP 7nn “Proof of Concept Studio” in Term 3. This is a zero credit, pass/fail course which is mandatory for all Entrepreneurship students.
2. Divide SEP 771, W Booth School of Engineering Practice and Technology Practitioner's Forum`in two parts: SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum, Part 1” and SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum, Part 2”.
3. No part time studies in Entrepreneurship program.
4. McMaster undergraduate students can take any 600 level courses in Engineering intended for credit in their M.Eng. studies with approval of the Associate Dean of graduate studies.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department’s program and/or tie to existing Program Learning Outcomes from the program’s IQAP cyclical review?):

1. Course SEP 7nn “Proof of Concept Studio” in Term 3 will enable the instructor to grade appropriately each student.
2. Dividing the course SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum” in two parts allows us to deliver the course during the Winter Term and the Fall term and not have issue with Mosaic.
3. Our experience with the part time studies has not been very positive. It takes a long time for students to complete the studies and the impact is not as expected. In addition, with the current increase in enrollment, there is simply no bandwidth to offer a high quality part time program.
4. To reduce course load.

PROVIDE IMPLEMENTATION DATE: *(Implementation date should be at the beginning of the academic year)*

September 1, 2018

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

No

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

Admission

Applications for admission will be made directly through the W~~alter G.~~ Booth School of Engineering Practice and Technology. In addition to the general requirements for entry into a graduate program in Engineering, candidates applying to the Master of Engineering Entrepreneurship and Innovation program must hold an Honours Bachelor's degree in engineering or closely related discipline (i.e. science, technology, math), with at least a B- average (equivalent to a McMaster 7.0 GPA out of 12) in the final year in all courses.

Strong letters of recommendation are also required. The delivery of the program relies heavily on the synergy created between members of student teams, and successful operation of the program requires that each cohort have an appropriate blend of skills and experience. Therefore, each applicant will be interviewed. A strong performance in the interview is a critical requirement for admission.

The program will accept full~~- or part~~-time students. The full program is expected to take 20 months full-time study ~~or 32 months part-time~~. Candidates are admitted for September only. No part-time option is available.

Prospective applicants who did not attain the required standing in their undergraduate degree, but who have at least four (4) years of relevant work experience, should discuss their situation with the appropriate Program Lead. If the experience is deemed sufficient, the Program Lead may then recommend an interview. Evidence of ability to do graduate work will still be required. (See Sections 2.1.1 Admission Requirements for Master's Degree and 2.1.5 Admission of Students with Related Work Experience or Course Work Beyond the Bachelor's Degree in the Graduate Calendar.)

A candidate is required to complete successfully two one-term advanced engineering courses and the ~~five~~six compulsory Engineering Entrepreneurship and Innovation module courses. Additionally, full-time students must successfully complete SEP 771, Part I and II and SEP 772. A faculty advisor will assist the student in selecting relevant engineering courses. Students will normally be required to complete two graduate level (700-level) engineering courses in fulfillment of the requirements for Advanced Engineering Studies. Advanced engineering studies are an integral component of the program and are offered by various departments in the Faculty of Engineering and beyond. The objective is to acquire leading-edge engineering skills and apply them to the enterprise project.

McMaster ~~S~~students may receive advanced standing for ~~up to two of the following~~ only one additional course~~s~~ with the approval of the Associate Dean of Graduate Studies (note that a maximum of two 600-level courses, including mandatory 600 level courses can count towards a SEPT graduate program).

~~Only a student enrolled in their final year of a Bachelors of Engineering or Technology at McMaster University immediately entering a SEPT graduate program can be eligible for advanced credit. There can be no banking, no retroactive accommodations and no offer for students outside of Engineering to participate in advanced credit options.~~

- ~~SEP 6E03 / Entrepreneurial Opportunity Identification~~
- ~~SEP 6EL3 / Leading Innovation~~
- ~~SEP 6X03 / LIVABLE CITIES, THE BUILT AND NATURAL ENVIRONMENT~~
- ~~SEP 6PM3 / The Management of Technical Projects~~

Innovation and Entrepreneurial Skills Development

~~Five~~Six compulsory enterprise modules will focus on providing the Master's degree candidate basic skills to select an idea with good potential, manage the innovation process, then create and manage the business outcome. The skills will broadly cover all the business life cycle from start, growth and sustainability. The modules will develop an understanding of both the innovation and the entrepreneurial processes through lectures, workshops

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and hands-on work as well as embed sustainability into their enterprise project as a source of competitive advantage. ~~and will enable the student to fully exploit the potential of the engineering enterprise project~~.

Each module is considered the equivalent of a half-course as defined by the School of Graduate Studies, but will contain elements of lecture, group work, presentation and other activities as defined in the course outline. The module courses will be delivered in an intensive format.~~; and it is expected that students will take the module courses in sequenced numerical order~~. The module courses are:

- SEP 6E03 / Entrepreneurial Opportunity Identification
- SEP 773 / Leadership for Innovation
- SEP 753 / Enterprise Opportunity Development
- SEP 755 / Business Launch and Development
- SEP 770 / Total Sustainability Management
- SEP 790 / Proof-of-Concept Studio

All full-time candidates are required to successfully complete:

- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II
- SEP 772 / Innovation Studio

Engineering Enterprise Project

The Engineering Enterprise Project will run throughout the entire study period and will result in both a business and a viable Proof-of-Concept defined as the combination of (i) a technical plan for an engineering prototype product (ideally with an actual prototype device or software produced) plus (ii) an identified customer base and a plan outlining the way to commercialization. ~~and a technical plan for an engineering prototype product (ideally with an actual prototype device or software produced) with an identified customer base and a plan outlining the way to commercialization.~~ The project will bring together the two complementary streams of activities, one technical and the other commercial ~~entrepreneurial~~, to bring an idea to the proof of concept phase. The Entrepreneurial course stream, which will run coincidentally with the advanced engineering studies, will guide the technological work performed in the research laboratory so that the concept becomes, by the end of the degree, the nucleus of a business proposition. The Engineering Enterprise Project will have three phases, which will end with project gate assessments to determine the project's readiness to proceed to the next phase:

Phase 1 - Project Preparation

Market research to arrive at a proposed product or service with clear value proposition; define the market for the intended product or service revealing competitive threat, opportunities, and margins and volumes projections; draw up development plans for the product or service indicating the required resources and estimated investment cost; seek the resources within the university and without; build a team of support that might include a partner.

Phase 2 - Technical Research and the Development of the Engineering Prototype

Develop an engineering research plan, identifying key issues and opportunities (with the assistance of academic technical and business supervisors); conduct technical research and development; implement the engineering research plan within the research group in the host-engineering department; build a development network within the engineering research community; ready the technology for transfer to market; conduct initial market engagement to get customer feedback and reactions.

Phase 3 - Technology Transfer to Market:

Apply for IP protection if applicable; develop a path-to-market strategy; develop a business case; seek out financing ~~present to funding institutions~~ and explore business arrangements; plan for business start-up. Each phase has two equally important components, one technical and the other business:

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The Phase 3 evaluation will be a defense of your project in an oral examination to your board (technical mentor, enterprise advisor, business advisor and your business mentor). Candidates are required to complete and pass through each phase in order to graduate.

Leadership Skill Development and the Enterprise Project~~Peer Evaluation and the Enterprise Project~~

The ability to effectively work in a team environment is an important learning outcome of team-based project work on the Enterprise project~~, as in individual learning outcomes developed in a team environment. Candidates will be mentored on their progress in this aspect by their enterprise advisor based on input from their peers in the project team and from assesment of the enterprise advisor. Team member evaluations will be collected in confidence from team members by the enterprise advisor, or their designate, on a six-month basis. Every six months the Enterprise Advisor will review the performance of the individual candidate in the team with the candidate. The enterprise advisor will generate an assessment of performance. To successfully complete the program, the candidate must maintain an average rating of "Good" over the span of the enterprise project in team assesment and demonstrate individual achievement in team experienced learning outcomes.~~ The MEEI and MTEI programs use a confidential service to provide each individual with personalized performance feedback from their peers on a periodic basis. Approaches to improving ones own performance include mentoring and guidance by their Enterprise Advisor.

Courses

SEP 6E03 / Entrepreneurial Opportunity Identification
SEP 6EL3 / Leading Innovation
SEP 719 / Special Topics in Engineering/ Technology Entrepreneurship and Innovation
SEP 725 / Practical Project Management for Today's Business Environment
SEP 748 / Development of Sustainable Communities
SEP 753 / Enterprise Opportunity Development
SEP 755 / Business Launch and Development
SEP 770 / Total Sustainability Management
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II
SEP 772 / Innovation Studio
SEP 773 / Leadership for Innovation
SEP 790 / Proof-of-Concept Studio

CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: Vladimir Mahalec Email: mahalec@gmail.com Extension: 26386 Date submitted: Oct. 2, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

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McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	W. Booth School of Engineering Practice and Technology
NAME OF PROGRAM and PLAN	Master of Engineering and Public Policy
DEGREE	Master of Engineering and Public Policy

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☐ No

CREATION OF NEW MILESTONE ☐					
CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	X
CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR	x	**EXPLAIN:** Update the Graduate Calendar to reflect the changes described in this form.			
OTHER CHANGES		**EXPLAIN:**			

DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:

1. Course SEP 773 “Leadership for Innovation” is mandatory for M.Eng. Public Policy students.
2. SEP 771 “Practitioners forum” is a zero credit two term course.
3. Part time students can complete the program in minimum two years and one term (seven courses total; three courses per academic year) since the total required course load is 7 courses, 3 units each. The calendar states that the part time students can complete the program in two years.
4. McMaster undergraduate students can choose 600 level courses only from the approved list

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE *(Attach additional pages if space is not sufficient.)*

1. Course SEP 773 “Leadership for Innovation” or course SEP 6EL3 “Leading Innovation” is mandatory for M.Eng. students. Students can take either of these courses to meet the requirements.
2. Divide SEP 771 “W Booth School of Engineering Practice and Technology Practitioners forum” in two parts: SEP 771 “W Booth School of Engineering Practice and Technology Practitioners forum, Part 1” and SEP 771 “W Booth School of Engineering Practice and Technology Practitioners forum Practitioners forum, Part 2”.
3. State in the calendar that the part time students require minimum two years plus one term (28 months) to complete the program.
4. McMaster undergraduate students can take any 600 level courses in Engineering intended for credit in their M.Eng. studies with approval of the Associate Dean of Graduate studies.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department’s program and/or tie to existing Program Learning Outcomes from the program’s IQAP cyclical review?):

1. We do not have the capacity to offer SEP 773 “Leadership for Innovation” in both Fall term and Winter term. Course SEP 6EL3 “Leading Innovation” is an appropriate substitute.
2. Dividing the course SEP 771 “W Booth School of Engineering Practice and Technology Practitioners forum” in two parts allows us to deliver the course for January cohort during the Winter Term and the Fall term and not have issue with Mosaic.
3. The calendar needs to be consistent with the actual requirements.
4. To reduce course load or complete the program in 2 terms for full time students.

PROVIDE IMPLEMENTATION DATE: *(Implementation date should be at the beginning of the academic year)*

September 1, 2018

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

No

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

In today's complex world engineers and scientists are called upon to design technical systems that provide goods and services to society in a safe, efficient and environmentally sound manner. In this context, engineers and scientists can serve as key advisors to and take the lead as decision makers in both the public and private sectors. Therefore, engineers and scientists need more than extensive technical skills~~;~~; They also~~you~~ need an enhanced understanding of public policy and the role of engineering and science in sustainable technological, social, ecological and economic systems.

A professional Master's degree in Engineering and Public Policy (MEPP) is offered within the W~~alter G.~~ Booth School of Engineering Practice and Technology. Engineers and applied scientists from a wide cross-section of organizations who want professional graduate training will find our program goes well beyond a conventional technical Master's to develop candidates as leaders in the public policy area. ~~The ideal candidate will have an undergraduate degree in engineering or applied science and 3-5 years of professional work experience.~~

Admission

~~In addition to the general requirements for entry into a graduate program in Engineering,~~ ~~s~~Students ~~must~~ should hold a 4-year engineering, science, technology or mathematics undergraduate degree, with at least a B- average (equivalent to a McMaster 7.0 GPA out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. Each applicant will also be interviewed as part of the admission process and discuss their qualifications if the candidate has expertise outside of the STEM disciplines. Professional work experience is desirable but not essential.

~~Candidates may be enrolled on a full- or part-time basis. Students are admitted for September or January.~~

However, ~~P~~prospective applicants who did not attain the required standing in their undergraduate degree, ~~but who have at least four (4) years of relevant work experience,~~ should discuss their situation with the ~~Program Lead~~ Associate Director of Graduate Studies in SEPT. If the applicant's experience is deemed sufficient, the ~~Program Lead~~Associate Director of Graduate Studies in SEPT will recommend an interview. Evidence of ability to do graduate work will be required. (See Sections 2.1.1 Admission Requirements for Master's Degree and 2.1.3 Admission of Students with Related Work Experience or Course Work Beyond the Bachelor's Degree in the Graduate Calendar.)

The W~~alter G.~~ Booth School of Engineering Practice and Technology has the following program objectives for the Master's degree in Engineering and Public Policy (MEPP):

to provide a high quality educational experience to graduate engineers and scientists in the areas of engineering, science and public policy;

to foster applied research in the areas of engineering, science and public policy through the successful completion and dissemination of a research paper;

~~to develop viable, working linkages between engineering, science and fields of study within social sciences and the humanities (public policy, economics, society, and others);~~

~~to nurture a diverse group of students who will be active participants within the broader range of activities in the Walter G. Booth School of Engineering Practice and Technology;~~

to produce graduates who will provide inspired leadership in the engineering, science and public policy areas within the public, private and NGO sectors.

Candidates may be enrolled on a full- or part-time basis. Full-time students will complete the degree in twelve consecutive months of study, beginning in September or January. Part-time students will normally be expected to complete the program in ~~two years~~ 28 months.

McMaster ~~S~~students may receive advanced standing for up to two ~~f the following~~ courses (note that a maximum of two 600-level courses can count towards a SEPT graduate program) with the approval of the Associate Dean of Graduate Studies.~~.~~

~~Only a student enrolled in their final year of a Bachelors Degree at McMaster University immediately entering a SEPT graduate program can be eligible for advanced credit. There can be no banking and no retroactive accommodations participate in advanced credit options.~~

~~SEP 6E03 / Entrepreneurial Opportunity Identification~~
~~SEP 6EL3 / Leading Innovation~~
~~SEP 6X03 / LIVABLE CITIES: THE BUILT AND NATURAL ENVIRONMENT~~

Curriculum

The curriculum has four main components:

Core courses that provide the content and methodological skills necessary for understanding and analyzing societal issues for which engineering and science can contribute to public policy solutions;
Focus elective courses that allow students to deepen their knowledge of a range of engineering, science and social science applications;
The completion of a substantive research paper on a problem at the interface of engineering, science and public policy;
Attendance and participation at an intensive workshop/seminar week on engineering and public policy.

Research Project - Inquiry/Thesis in Engineering and Public Policy

Students select a research topic at the interface of engineering, science and public policy which is of interest to them and carries out inquiry-driven research; completes a formal research paper and prepares to publish their results for broad dissemination.

Candidates for the MEPP degree will follow a program consisting of the following:

Required Courses

Four half-courses:

SEP 701 / Theory and Practice of Policy Analysis: Frameworks and Models
SEP 702 / Systems Engineering and Public Policy
SEP 709 / Emerging Issues, Technology and Public Policy
SEP 773 / Leadership for Innovation or SEP 6EL3 / Leading Innovation

~~SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum~~ ~~(Full-time students only)~~

In addition students are required to take:
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum Part I (Full-time students only)
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum Part II (full-time students only)

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SEP 772 / Innovation Studio (Full-time and part time students)
~~SEP 773 / Leadership for Innovation~~

Focus Elective Courses

Three half-courses are required for electives. Students may select from the following options:

SEP 6I03 / Sustainable Manufacturing Processes
SEP 6X03 / LIVABLE CITIES, THE BUILT AND NATURAL ENVIRONMENT
~~SEP 703 / Applied Microeconomics and Environmental Economics~~
SEP 705 / Green Engineering, Sustainability and Public Policy
SEP 706 / Energy and Public Policy
SEP 707 / Communication Technology and Public Policy
SEP 708 / Special Topics in Engineering and Public Policy
SEP 710 / International Governance and Environmental Sustainability
~~SEP 756 / International Water Policy~~
POL SCI 784 / Quantitative Political and Policy Analysis
POL SCI 785 / Public Sector Management
POL SCI 790 / The Politics of Economic Policy in Market Economies

Additional Courses

Up to two graduate engineering half courses from departments within the Faculty of Engineering
Other courses in other departments and Faculties with approval of the Associate Director of the ~~School~~ Graduate Studies in SEPT.

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CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: Vladimir Mahalec Email: mahalec@gmail.com Extension: 26386 Date submitted: Oct. 2, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

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McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	W. Booth School of Engineering Practice and Technology
NAME OF PROGRAM and PLAN	Engineering Design, M. Eng. Design
DEGREE	Engineering Design, M. Eng. Design

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☐ No

CREATION OF NEW MILESTONE ☐					
CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	X
CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR	x	**EXPLAIN:** Update the calendar to reflect the changes to the program length for the part times students, remove SEP 757 or SEP 758 as mandatory for the Product Design stream. Divide SEP 700 in two parts. Modify the calendar to describe changes in SEP 771, SEP 772, SEP 773 offering (see below).			
OTHER CHANGES		**EXPLAIN:**			

DESCRIBE THE EXISTING REQUIREMENT/PROCEDURE:

1. The course SEP 700 “M.Eng. Project in Engineering Design” is currently a single course spanning 2 terms, 6 credit units.
2. The courses SEP 758 “Software Prototyping tools and methods” and SEP 757 “ Hardware Prototyping tools and methods” are mandatory for the Product Design stream.
3. The course SEP 773 “Leadership for Innovation” is mandatory for M.Eng. Design students.
4. The course SEP 771 “ W Booth School of Engineering Practice and Technology Practitioner's Forum ” is a zero credit two-term course.
5. Part time students can complete the program in minimum two years (three courses per academic year) since the total required course load is 6 courses, 3 units each.
9. McMaster undergraduate students can choose 600 level courses only from approved list.
10. SEP 748, Development of Sustainable Communities is strongly recommended.

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE *(Attach additional pages if space is not sufficient.)*

1. The course SEP 700 “M.Eng. Project in Engineering Design” is split into two mandatory courses, SEP 700 “M.Eng. Project in Engineering Design, Part 1” and SEP 700 “M.Eng. Project in Engineering Design, Part 2”.
2. Make the course SEP 758 “Software Prototyping tools and methods” and the course SEP 757 “Hardware Prototyping tools and methods” optional for all Design students.
3. The course SEP 773 “Leadership for Innovation” or the course SEP 6EL3 “Leading Innovation” is mandatory for M.Eng. Design students. Student can take either of these courses to meet the requirements
4. Split SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum ” in two parts: SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum , Part 1” and SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum , Part 2”.
5. Part time students require a minimum of two years plus one term (28 months) to complete the program.
6. Introduce a new course SEP 7xx “Rendering Techniques”.

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7. Introduce a new course SEP 7xx “Workflow Management for Animated Prototypes”.
    9. McMaster undergraduate students (in SEPT or in SEAS) can take any 600 level courses in Engineering intended for credit in their M.Eng. studies with approval of the Associate Dean of Graduate studies.
    10. Either SEP 748, Development of Sustainable Communities or SEP 6X03, Liveable Cities, Revitalization of Built and Natural Assets is strongly recommended for SCI stream.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department’s program and/or tie to existing Program Learning Outcomes from the program’s IQAP cyclical review?):

1. Dividing SEP 700 “M.Eng. Project in Engineering Design” in two courses SEP 700 “M.Eng. Project in Engineering Design, Part 1” and SEP 700 “M.Eng. Project in Engineering Design, Part 2” enables part time students to taker both Part 1 and Part 2 in a single term. Otherwise they would be required to attend McMaster for 2 terms, taking only one course each term and making their studies even more expensive.
2. Content of SEP 758 “Software Prototyping tools and methods” and the course SEP 757 “Hardware Prototyping tools and methods is sometimes not necessary for students who already have that knowledge.
3. January cohort needs to take a leadership course in their first term of studies. We do not have the bandwidth to offer SEP 773 in both Fall and Winter terms.
4. Splitting the course SEP 771 “W Booth School of Engineering Practice and Technology Practitioner's Forum ” in two parts allows us to deliver the course for January cohort during the Winter Term and the Fall term and not have issue with Mosaic.
5. Introduction of the SEP 700 “M.Eng. Project in Engineering Design” has increased the total number of units to 24. This means that the part time students will need minimum 28 months to complete the program. Since the number of part time students is minimal, the overall impact of the change is very small. NOTE: if we could charge a program fee, instead of a fee by the term, then there would be no issues with the increased tuition for part time students.
6. Design students have already produced relatively simple 3D renderings in some of their projects. For instance, the project with Community Living Hamilton (2016/2017) had 3D renderings of redesigned spaces. The course SEP 7xx “Rendering Techniques” will enable them to produce much better quality renderings, thereby enhancing their deliverables to the community partners.
7. The course SEP 7xx “Rendering Techniques” will enable the students to acquire rendering capabilities. Animated 3D prototypes (e.g., machinery parts moving, people moving through spaces at Community Living Hamilton) require management of their (digital) parts. The course SEP 7xx “Workflow Management for Animated Prototypes” will enable the students to do that.

9. Even though some of our programs are not technically focused (e.g. MEPP or MTEI), or a course my not be directly related to the program content (e.g. a course in software architecture may be not be deemed to be related to M.Eng. in Design), there are circumstances when the student project or course research requires knowledge of some specialized field. Allowing students to take advance credit, subject to the approval of the SEPT Graduate Studies, will open up the learning horizons for the prospective SEPT students.

10. Both courses deal with liveability aspects of a community and have 30% overlap. Allowing the students to take either one course or the other will provide them with a good understanding of the topic an enable us to have a larger class size.

PROVIDE IMPLEMENTATION DATE: ***(Implementation date should be at the beginning of the academic year)***

September 1, 2018

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

No

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

Innovative new designs and the ability to improve performance of existing systems have become a basis for a competitive advantage in the marketplace~~markets~~. Performance, environmental sustainability, safety, usability, desirability, viability and efficiency are integral parts of the requirements in the design of industrial products, healthcare products, ~~-~~large-scale systems, or software solutions. Within this complex set of constraints, successful engineers and engineering managers must be able to lead transformation of an idea to a complete design by working in interdisciplinary teams. The Master of Engineering Design program provides its ~~students~~participants with technical expertise and leadership capabilities required to invent novel solutions and to lead technically-oriented organizations. Strong emphasis on solving engineering problems from industrial practice is accomplished via industrially motivated and supported projects.

The M.Eng. Design program emphasizes development of competencies in:

Leadership, collaboration, and management skills to lead diverse teams.

Design thinking and innovations methodologies.

Engineering disciplines leading to breakthrough design and operation of systems in:

Sustainable community infrastructure (renewable energy systems, environmental systems, sustainable products and systems design, local economy)

Process industries (refining, chemicals, specialty chemicals, pharmaceuticals, power, oil and gas production, and similar)

Manufacturing of industrial and consumer products

Health, wellness and aging device and software solutions

Admission

In addition to the general requirements for entry into a graduate program in Engineering, students must hold a four-year engineering undergraduate degree or equivalent, with at least a B- average (equivalent to a McMaster 7.0 GPA out of 12) in the final year in all courses in the discipline, or relating to the discipline, in which the applicant proposes to do graduate work. Students with a degree in Science, Technology and Mathematics will also be considered.

Strong letters of recommendation are also required. Each applicant will also be interviewed as part of the admission process. Professional work experience will be highly desirable.

Candidates may be enrolled on a full- or part-time basis. Full-time students will complete the degree in twelve consecutive months of study. Students are admitted for September or January. Part-time students will normally be expected to complete the program in ~~two~~ two years and one term (28 months).

Prospective applicants who did not attain the required standing in their undergraduate degree, but who have at least four (4) years of relevant work experience, should discuss their situation with the Program Lead. If the experience is deemed sufficient, the Program Lead may then recommend an interview. Evidence of ability to do graduate work will still be required. (See Sections 2.1.1 Admission Requirements for Master's Degree and 2.1.5 Admission of Students with Related Work Experience or Course Work beyond the Bachelor's Degree in the Graduate Calendar.)

McMaster ~~S~~students may receive advanced standing for up to two ~~of the following~~ courses (note that a maximum of two 600-level courses can count towards a SEPT graduate program) with the approval of the Associate Dean of Graduate Studies.

~~Only a student enrolled in their final year of a Bachelors of Engineering or Technology at McMaster University immediately entering a SEPT graduate program can be eligible for advanced credit. There can be no banking, no retroactive accommodations and no offer to students outside of Engineering to participate in advanced credit options.~~

- ~~SEP 6AS3 / Advanced System Components and Integration~~
- ~~SEP 6AT3 / Conceptual Design of Electric and Hybrid Electric Vehicles~~
- ~~SEP 6BC3 / Building Science~~
- ~~SEP 6DM3 / Data Mining~~
- ~~SEP 6PD3 / Power System Analysis and Control~~
- ~~SEP 6EL3 / Leading Innovation~~
- ~~SEP 6E03 / Entrepreneurial Opportunity Identification~~
- ~~SEP 6TB3 / Advanced biotechnology~~
- ~~SEP 6PM3 / The Management of Technical Projects~~
- ~~MANUF 6RM3 / Robot Mechanics and Mechatronics~~
- ~~SEP 6DA3 / Data Analytics and Big Data~~
- ~~SEP 6ES3 / Real Time Systems~~
- ~~SEP 6PQ3 / Power Quality~~
- ~~SEP 6SS3 / System Specification and Design~~

Curriculum

Candidates will be required to complete satisfactorily the equivalent of at least three full courses, plus full-time students must successfully complete SEP 771, Part I and II and SEP 772. ~~.~~

The curriculum has five main components:

1. Leadership and Management Capabilities courses that will enable M.Eng. Design graduates to deal with complex situations in the work environment, to lead teams, and to manage projects.
2. Interdisciplinary engineering courses in product design, project management, and risk management.
3. Core technical courses that provide expert knowledge in targeted technical areas.
4. Elective courses that allow students to acquire broader expertise in the technical areas which are at the centre of their studies.
5. An industrially oriented project that solves complex problems requiring synthesis of knowledge from several disciplines and presenting the students with an opportunity to develop the solution in an industrial environment.

Process and Production Systems

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Master of Engineering Design program in the field of Process and Production Systems provides advanced competencies for engineers and supervisors typically working in:

- Process Design
- Advanced Process Control
- Plant Operations
- Process Industry Oriented R&D

- Control Systems and Software

The following course requirements need to be fulfilled by the candidate:

Required Courses

Candidates are required to take the following:

SEP 700 / M.Eng. Project in Engineering Design, Part I

SEP 700 / M.Eng. Project in Engineering Design, Part II

- SEP 760 / Design Thinking
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum , Part I (Full-students only)
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II (full-time students only)
- SEP 772 / Innovation Studio
- SEP 773 / Leadership for Innovation or SEP 6EL3 / Leading Innovation

Electives

Candidates are required to select four half courses which should be selected from graduate courses offered by departments within the Faculty of Engineering. Candidates are required to have their elective course selection approved by the ~~Program Lead~~ Associate Director for Graduate Studies in SEPT~~.~~

~~Strongly Recommended~~

- ~~SEP 757 / Hardware Prototyping Tools and Methods~~
- ~~SEP 758 / Software Prototyping Tools and Methods~~

~~Process Design, Process Control, or Plant Operations~~

Recommended courses for candidates focusing on *Process Design, Process Control, or Plant Operations* include:

- SEP 751 / Process Design and Control for Operability
- SEP 752 / Systems Modeling and Optimization
- SEP 6C03 / Statistics for Engineers
- SEP 754 / Process Design and Integration for Minimal Environmental Impact
- CHEM ENG 752 / Optimization of Chemical Processes
- CHEM ENG 765 /SEP 767 Multivariate Statistical Methods for Big Data Analysis and Process Improvement

~~Control Systems Engineering~~

Recommended courses for students with a background or interest in *Control Systems Engineering* are:

- CAS *6CD3 / Distributed Computer Systems
- CAS*6EB3 / Database Management System Design
- CAS 704 / Embedded, Real-Time Software Systems
- CAS 703 / Software Design
- CHEM ENG 6E03 / Digital Computer Process Control
- ~~ECE*726/ Local Area Networks in Manufacturing Environment~~
- ~~ECE 732 / Non-linear Control Systems~~
- ECE 771 / Algorithms for Parameter and State Estimation
- ECE 772 / Neural Networks and Learning Machines
- Mech Eng 761 / Industrial Components, Networks, and Interoperability

Product Design

Innovation and creative system, solutions, or product design are emphasized through problem solving via interdisciplinary teams in a design studio environment, while learning about the use of materials in product

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design and design for manufacturing are led by the faculty who are also members of McMaster's advanced centres (including Centre for Automotive Materials, Manufacturing Research Institute, Institute for Polymer Production Technology and the Centre for Advanced Polymer Processing and Design). The interdisciplinary nature of the program enables its participants to work on a variety of designs, such as industrial machinery, consumer products, automotive, etc.

The following course requirements need to be fulfilled by the candidates:

Mandatory Courses

Candidates are required to take the following:

SEP 700 / M.Eng. Project in Engineering Design, Part I

SEP 700 / M.Eng. Project in Engineering Design, Part II

- ~~SEP 757 / Hardware Prototyping Tools and Methods~~
- ~~OR~~
- ~~SEP 758 / Software Prototyping Tools and Methods~~
-
- SEP 760 / Design Thinking
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I (full-time students only)
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II (full-time students only)
- SEP 772 / Innovation Studio
- SEP 773 / Leadership for Innovation or SEP 6EL3 / Leading Innovation

Electives

Candidates are required to take ~~three~~four half courses which should be selected from graduate courses offered by departments within the Faculty of Engineering. Candidates are required to have their elective course selection approved by ~~the program lead~~ Associate Director of Graduate Studies in SEPT~~.~~

Strongly recommended

SEP 757 / Hardware Prototyping Tools and Methods

Or

SEP 758 / Prototyping tools (mobile applications)

- ~~SEP 760 / Design Thinking~~
- ~~SEP 761 / Human-Centred Design~~
-

Sustainable Community Infrastructure

Candidates in this field of study cover various aspects of the design of sustainable communities, including:

- Public realm spaces (parks, sidewalks, recreation facilities)
- Storm water management
- Housing and energy efficient buildings
- Development of local business
- Sustainable transportation systems
- Sustainable energy generation

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The following course requirements need to be fulfilled by the candidates:

Mandatory Courses

Candidates are required to take:

SEP 700 / M.Eng. Project in Engineering Design, Part I

SEP 700 / M.Eng. Project in Engineering Design, Part II

- SEP 760 / Design Thinking
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I (full-time students only)
- SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II (full-time students only)
- SEP 772 / Innovation Studio
- SEP 773 / Leadership for Innovation or SEP 6EL3 / Leading Innovation

Electives

Candidates are required to take four elective courses, which should be selected from graduate courses offered by departments within the Faculty of Engineering. Suggested courses in sustainable energy systems and manufacturing are:

- Strongly Recommended:
- SEP 6X03 / LIVABLE CITIES, THE BUILT AND NATURAL ENVIRONMENT
- SEP 748 / Development of Sustainable Communities
- ~~SEP 757 / Hardware Prototyping Tools and Methods~~
- ~~SEP 758 / Software Prototyping Tools and Methods~~
-
- Other Electives:
- SEP 6I03 / Sustainable Manufacturing Processes
- SEP 705 / Green Engineering, Sustainability and Public Policy
- SEP 746 / Design of Sustainable Community Infrastructure
- SEP 747 / Energy Efficient Buildings
- ~~SEP 748 / Development of Sustainable Communities~~
- SEP 757 / Hardware Prototyping Tools and Methods
- SEP 758 / Prototyping tools (mobile applications)
-

Candidates are required to have their elective course selection approved by ~~the Program Lead~~ the Associate Director of Graduate Studies in SEPT~~.~~

Courses

SEP 7xx / Rendering Techniques

SEP 7xx / Workflow Management for Animated Prototypes

SEP 6AS3 / Advanced System Components and Integration
SEP 6AT3 / Conceptual Design of Electric and Hybrid Electric Vehicles
SEP 6BC3 / Building Science
SEP 6BI3 / Bioinformatics
SEP 6BL3 / Biomaterials and Biocompatibility
SEP 6BM3 / Biopharmaceuticals
SEP 6BS3 / Biotechnology Regulations

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SEP 6C03 / Statistics for Engineers
SEP 6CS3 / Computer Security
SEP 6DA3 / Data Analytics and Big Data
SEP 6DM3 / Data Mining
SEP 6DV3 / Vehicle Dynamics
SEP 6EL3 / Leading Innovation
SEP 6ES3 / Real-Time Systems
SEP 6IC3 / Industrial Networks and Controllers
SEP 6I03 / Sustainable Manufacturing Processes
SEP 6MS3 / Modelling and Simulation
SEP 6PD3 / Power System Analysis and Control
SEP 6PM3 / The Management of Technical Projects
SEP 6PQ3 / Power Quality
SEP 6SS3 / System Specification and Design
SEP 6TB3 / Advanced biotechnology
SEP 700 / M.Eng. Project in Engineering Design, Part I
SEP 700 / M.Eng. Project in Engineering Design, Part II
SEP 730 / Reliability and Risk Management
SEP 732 / Sustainable Energy - Technology and Options Selection
SEP 733 / Project Management
SEP 746 / Design of Sustainable Community Infrastructure
SEP 747 / Energy Efficient Buildings
SEP 748 / Development of Sustainable Communities
SEP 750 / Model Predictive Control Design and Implementation
SEP 751 / Process Design and Control for Operability
SEP 752 / Systems Modeling and Optimization
SEP 754 / Process Design and Integration for Minimal Environmental Impact
SEP 757 / Hardware Prototyping Tools and Methods
SEP 758 / Software Prototyping Tools and Methods
SEP 760 / Design Thinking
SEP 761 / Human-Centred Design
SEP 763 / Special Topics in Engineering Design
SEP 767 / Multivariate Statistical Methods for Big Data Analysis and Process Improvement
SEP 770 / Total Sustainability Management
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part I
SEP 771 / W Booth School of Engineering Practice and Technology Practitioner's Forum, Part II
SEP 772 / Innovation Studio
SEP 773 / Leadership for Innovation
SEP 774 / Nanobiotechnology
SEP 780 / Advanced Robotics and Automation
SEP 781 / Contaminated Site Management
SEP 782 / Modern Power System Design
SEP 783 / Electromagnetics Sensors and Actuators
SEP 768 / Special Topics in Additive Manufacturing
SEP 769 / Systems Engineering & Cyber Physical Systems

CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

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Name: Vladimir Mahalec Email: mahalec@gmail.com Extension: 26386 Date submitted: Oct. 2, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

SGS/2013

McMaster University **School of Graduate Studies**

1280 Main Street West
Hamilton, Ontario, Canada
L8S 4L8

Phone 905.525.9140
Ext. 23679
http://graduate.mcmaster.ca

To : Graduate Council

From : Christina Bryce
Assistant Graduate Secretary

At its meeting on October 24th, the Faculty of Science Graduate Curriculum, Policy, Admissions and Study Committee approved the following graduate curriculum recommendations.

Please note that these recommendations were approved at the Faculty of Science meeting on November 15th.

For Approval of Graduate Council:

a. **Financial Math**
   i. **New Program Calendar Copy**

b. **M-Phimac**
   i. **Closure**

c. **Psychology**
   i. **Change to Calendar Copy and Course Requirements (M.Sc. and Ph.D.)**

For Information of Graduate Council:

d. **Financial Math**
   i. **New Courses:**
      1. 701 Foundations of Financial Mathematics
      2. 702 Risk and Financial Markets
      3. 703 Computational Finance I
      4. 704 Statistics of Financial Data
      5. 711 Portfolio Theory and Optimization
      6. 712 Credit Risk Modeling
      7. 713 Computational Finance II
      8. 714 Topics in Risk Management
      9. 720 Financial Mathematics Industrial Project

e. **M-Phimac**
   i. **Course Cancellations**
      1. 771 Mathematics of Finance
      2. 772 Topics in Financial Mathematics
      3. 774 The Mathematics of Credit Risk
      4. 775 Portfolio Theory and Incomplete Markets
      5. 776 Financial Markets
      6. 778 Applied Computational Finance I

7. 779 Applied Computational Finance II
8. 797 Industrial Project
9. 721 Statistical Modelling in Practice

f. Physics

i. Course Title and Description Change

1. 6E03 Nuclear Physics
2. 6S03 Biophysics
3. 756 Special Topics in Biophysics

ii. New Courses

1. 6Q03 Introduction to Quantum Field Theory
2. 783 Special Topics in Biophysics

g. Psychology

i. Change to Course Title, Prerequisite and Unit Count

1. 758 Longitudinal Practicum: Psychopathology

ii. Change to Course Prerequisite and Unit Count

1. 755 Advanced Psychopathology
2. 759 Longitudinal Practicum: Core Skills

iii. Change to Prerequisites

1. 750 Scientific and Professional Ethics in Clinical Psychology
2. 751 Understanding Personality and Personality Disorders
3. 752 Psychological Assessment
4. 753 Psychological Intervention
5. 754 Research Design and Test Construction
6. 756 Clinical Practicum I
7. 757 Clinical Practicum II

iv. New Courses

1. 760 History of Psychology

NB: This document, and the accompanying curriculum forms, reference the Program Learning Outcomes (PLOs) and other criteria detailed in the MFM IQAP document.

MFM (Master of Financial Mathematics) Degree

Admission Requirements

• an Honours Bachelor degree in a quantitative subject, such as mathematics, statistics, physics, computer science, or engineering;
• interest in a career in finance;
• for graduates of mathematics or statistics, a minimum B+ average across their level 3 and undergraduate mathematics and statistics courses, or the equivalent standard from another university. Mathematics graduates are expected to have taken real analysis at level 3 or higher. For other graduates, comparable results in level 2,3 and 4 quantitative courses plus complementary achievement in their chosen specialization. For instance, engineering candidates are expected to have studied PDEs and/or a course with notable theoretical mathematics. Physicists are expected to have taken courses where they have studied stochastic processes. All applicants must meet the Level 4 requirements of the School of Graduate Studies.
• for non-native English speakers, evidence of fluency from either TOEFL or IELTS. For TOEFL, a minimum score of 92 (iBT), 580 (paper), or 237 (computer test) is required. For IELTS the requirement is a minimum overall score of 6.5 and a minimum of 5.5 in each section of the Academic test.
• two letters of reference from academic mentors;
• evidence of communication and interpersonal skills, and the ability to work effectively in the North American business culture; other evidence of leadership, analytical expertise, industry experience, or other marketable job skills.

Program Requirements

The duration of this program is normally 12 months. The candidate must complete the following graduate courses:

MFM 701 - Foundations of Financial Mathematics
MFM 702 – Risk and Financial Markets
MFM 703 - Computational Finance I
MFM 704 - Statistics of Financial Data
MFM 711 - Portfolio Theory and Optimization
MFM 712 - Credit Risk Modeling
MFM 713 – Computational Finance II
MFM 714 – Topics in Risk Management
MFM 720 – Financial Mathematics Industrial Project

In addition, candidates will be expected to participate in all officially conducted non-assessed activities such as program field trips and training modules.

McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	MATHEMATICS AND STATISTICS
NAME OF PROGRAM and PLAN	FINANCIAL MATHEMATICS (M-Phimac)
DEGREE	Master of Science (M.Sc.) in Mathematics, with specialization in Financial Mathematics

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☒ Yes ☐ No

CREATION OF NEW MILESTONE ☐

CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	
CHANGE IN THE DESCRIPTION OF A 1SECTION IN THE GRADUATE CALENDAR		**EXPLAIN:** This degree program, also called M-Phimac, is now ended. It has not been offered since Sept 2015 and the last students graduated in Sept 2016. It is being replaced by the new Master of Financial Mathematics (MFM) degree program, which starts Sept 2018.			

OTHER CHANGES		**EXPLAIN:** The last students in the M.Sc. Financial Mathematics degree program graduated in Sept 2016. Since then no students have been admitted.

DESCRIBE THE <u>EXISTING</u> REQUIREMENT/PROCEDURE:

The former program was a 12 month intensive M.Sc in Mathematics with specialization in Financial Mathematics.

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE *(Attach additional pages if space is not sufficient.)*

All references to the existence of the former program have now been removed from departmental websites. We need to ensure that all references in the Graduate Calendar are also removed.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department's program and/or tie to existing Program Learning Outcomes from the program's IQAP cyclical review?):

The new MFM (new M-Phimac) program has Ministry approval following the IQAP process. The old M-Phimac program is now redundant.

PROVIDE IMPLEMENTATION DATE: *(Implementation date should be at the beginning of the academic year)*

September 1, 2017

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

REMOVAL OF THESE TWO REFERENCES TO THE M-PHIMAC PROGRAM IN THE CURRENT GRADUATE CALENDAR:

1.C. Financial Mathematics Option (M-Phimac)

The duration of this option is normally 12 months.

The candidate must complete the following graduate courses:

- MATH 771 / Mathematics of Finance
- MATH 772 / Topics in Financial Mathematics
- MATH 778 / Applied Computational Finance I
- MATH 779 / Applied Computational Finance II
- MATH 774 / The Mathematics of Credit Risk
- MATH 775 / Portfolio Theory and Incomplete Markets
- MATH 776 / Financial Markets
- MATH 797 / Industrial Project
- STATS 721 / Statistical Modelling in Practice (or an alternate statistics course approved by the department)

2. MATH 797 / Industrial Project

Add to Favourites

Share

Print Course

MATH 797 / Industrial Project

3 unit(s)
Students in the M-PhiMac Program work on a summer industrial project. This will explore a topic of current interest with guidance from an industry professional and can be completed while working full time or as an intern. This course is required for fulfillment of the M-PhiMac Program.

CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: THOMAS HURD Email: hurdt@mcmaster.ca Extension: 27304 Date submitted: 02/10/2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

SGS/2013

McMaster University

SCHOOL OF GRADUATE STUDIES

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	Psychology, Neuroscience & Behaviour
NAME OF PROGRAM and PLAN	Science PhD Psychology, Neuroscience & Behaviour PNB Research & Clinical Stream
DEGREE	M.Sc. or Ph.D.

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☒ No

CREATION OF NEW MILESTONE ☐

CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	X

CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR	X	**EXPLAIN:** Adjustments are being made to the course load in the first 2 years. Three courses (PSYCH 750, 755, and 758) will be shifted from first year masters into the first year PhD, and one course (PSYCH 751) will be shifted from first year PhD to the first year masters.

OTHER CHANGES	X	**EXPLAIN:** 1: There is a period missing after Psychology Ph.D. (first heading on the page) 2: Reword the paragraph that describes expectations for years of graduate training. This does not actually change the expectations, it just states them more clearly. 3: Remove the word "Program" from the heading "Psychology Research & Clinical Training (RCT) Program Stream" and from the next paragraph to maintain consistency with the name of the stream. 4: Fix typo by adding "stream" to "Psychology RCT" in one spot so that it reads "Psychology RCT stream". 5: Remove sentence that incorrectly says the RCT interviews will be held in the spring/summer. This sentence is not needed as interviews take place at the same time as all the other incoming PNB students. 6: Rework the second paragraph under "Entry to the Psychology RCT Stream" to represent the course changes (e.g. the courses that have been moved between year 1 masters and year 1 PhD). 7: Remove the sentence under "Entry to the Psychology RCT Stream" section that says that transfer to PhD requires a written report and presentation of the report. It is not necessary to because transfer is the same for both PNB and PNB RCT students. 8: In the paragraph that describes the process of terminating with a masters degree for PNB RCT stream students, add the phrase "as outlined above" to point to the process that is described above for PNB students. 9: Reorder the list of courses so that the courses are in order of course code number. 10: Add a link to a new course PSYCH 760 History of Psychology 11: Last paragraph: Reword so that expectations for length of time in graduate training is clarified. Add "RCT stream" and change "five" to "six" years of graduate training.

DESCRIBE THE EXISTING REQUIREMENT/PROCEDURE:

Source: http://academiccalendars.romcmaster.ca/preview_program.php?catoid=25&poid=14673

Psychology, Ph.D

M.Sc. and Ph.D. Degrees

Graduate training in Psychology at McMaster leads to the Ph.D. degree and is strongly research oriented. The basic approach is that of a research apprenticeship, with the student selecting one faculty member as the research supervisor at the time of application. Normally, the student-supervisor relationship first develops at the time when the student is preparing to submit an application to the Psychology Graduate Program. Students are strongly encouraged to contact a potential faculty advisor and discuss research opportunities with them prior to submitting an application.

The Department provides excellent opportunities for human and non-human animal research in a variety of experimental areas including: Animal Behaviour, Cognition & Perception, Behavioural & Systems Neuroscience, Developmental Psychology, Educational Psychology, and Social & Evolutionary Psychology. The Department also

offers a Research and Clinical Training (RCT) specialty Ph.D. stream with the Psychology Graduate Program.

No special training is offered in the applied areas such as Human Factors, Personality Psychology, or Industrial Psychology, and applications in these fields are discouraged. Students are not usually required to complete a M.Sc. en route to the Ph.D., but they may do so if they wish. The general requirements for the Degree Doctor of Philosophy are described earlier in the calendar.

Admission

Applicants for graduate study in Psychology normally must have received, from a recognized university, either a Master's degree in Psychology, or an Honours Bachelor's degree in Psychology, with at least a B+ standing. Occasional exceptions are made to the above requirements for students with a background in a related or relevant scientific discipline. For example, students with strong backgrounds in biology, neuroscience, computer science, chemistry or physics are encouraged to apply.

First Master's year

In the first Master's year, all students take two courses: Statistics and Research Design (PSYCH 710) and Contemporary Problems in Psychology (PSYCH 720). Students entering the program directly at the Ph.D. level usually are exempted from both of these courses at the discretion of the Graduate Studies Committee (GSC). It is expected that at least one-half of the student's time will be devoted to research on a topic to be chosen by the student in consultation with the faculty supervisor(s) and supervisory committee. Each student submits a report on research progress by May 15 of the first year. Continuation to the Doctoral degree in the graduate training program is determined by the student's research progress and the student's performance in Contemporary Problems, Statistics and any other courses completed. If these performances are acceptable, students who enter without a Master's degree may be permitted to proceed directly to Ph.D. studies. Students must complete Psych 710, Psych 720 as well as a Master's thesis to obtain a Master's degree.

- PSYCH 710 / Statistics and Research Design
- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour

Subsequent Years

In subsequent years, students complete:

The equivalent of an additional 1 1/2 full-year courses

- PSYCH 711 / Advanced Statistics and Computational Methods I
- PSYCH 712 / Advanced Statistics and Computational Methods II *or*
- an approved course equivalent

Two quarter courses

- PSYCH 713 / Special Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 714 / Special Topics in Psychology, Neuroscience and Behaviour II
- and the equivalent of one graduate half course (#721 cannot be counted towards this requirement)

Additional Information

Aside from these courses, the major activities of the student beyond the first year fall into two categories. First, students are expected to carry out their thesis research and report the progress of this research by May 15 of the second and each subsequent year. For the student to continue in the program this report must show that satisfactory progress is being made. Second, to satisfy the comprehensive requirement the student, in consultation with the supervisory committee, must select one or more topics for intensive study. These topics must not be in the student's thesis topic area, and must be approved by the Chair of the Graduate Studies Committee. The study of these topics is then taken up under the guidance of the student's comprehensive examining committee, which includes the student's supervisory committee and up to two other faculty members with relevant expertise. After a period of about six weeks the student will be expected to demonstrate mastery of the material to the satisfaction of the examining committee, first in a written submission and then followed by oral examination. The comprehensive examination must be successfully completed within 24 months of entering the Ph.D. program.

Students entering at the Master's level ideally complete the doctoral thesis and all other requirements for the Ph.D. degree by the end of four years of graduate training. Students admitted directly into the Ph.D. program ideally complete all requirements for the Ph.D. degree within three years. Doctoral students are strongly encouraged to give a departmental colloquium in their final year of study.

Psychology Research & Clinical Training (RCT) Program Stream

Overview

The McMaster Psychology Research & Clinical Training (RCT) PhD program stream augments the McMaster Psychology graduate program, by providing a subset of Psychology graduate students, who are in good standing in the program, with an opportunity for clinical training. The Psychology RCT has as its primary objective to train clinician scientists skilled in core competencies surrounding the pursuit of scientific knowledge and the provision of psychological services. Accordingly, our training model is focused on: i) rigorous training in research methodology, experimental design and statistics and ii) clinical psychology training including both in-class learning and practica experiences. Following completion of the program, it is expected that students will have met the requirements for licensing in Psychology in the Province of Ontario.

Admission

Applicants are asked to apply through the regular Psychology admission process, identifying their interest in the RCT program stream. Enrolment in the Psychology RCT stream is limited and is awarded according to academic excellence, merit and space availability. Admission to the RCT stream is decided by the Psychology RCT Admissions Committee following a screening and interview process. Typically, interviews are scheduled in the spring / summer terms prior to entry into the stream in the subsequent fall term.

Entry to the Psychology RCT Stream

Students entering the RCT stream typically begin at the Master's level. In most instances, students entering directly at the PhD level will not be exempted from the Masters level coursework. Any exemptions will be discretion of the Graduate Studies Committee (GSC).

During the first year at the Masters level students in the RCT stream are engaged in the regular Psychology Masters coursework and must take additional courses in Advanced Psychopathology, Understanding Personality and Personality Disorders and the first Longitudinal Practicum. Following the coursework at the Master's level students are expected to proceed to the PhD level according to the process detailed above. Transfer to PhD requires successful completion of Master's coursework and practica. In addition, students must complete a written report and oral presentation of the report describing the student's Master's research.

The RCT stream is a Doctoral training stream. As such, the stream does not offer a clinical Masters specialization. Students enrolled in the RCT stream and who choose to terminate at the Masters level finish with an MSc in Psychology.

Students must satisfy the regular Psychology PhD thesis and comprehensive requirements outlined above.

The following Graduate-level training courses are required;

- PSYCH 710 / Statistics and Research Design
- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour
- PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology
- PSYCH 750 / Understanding Personality and Personality Disorders
- PSYCH 754 / Research Design and Test Construction
- PSYCH 755 / Advanced Psychopathology
- PSYCH 752 / Psychological Assessment
- PSYCH 753 / Psychological Intervention
- PSYCH 756 / Clinical Practicum I

- PSYCH 757 / Clinical Practicum II
- PSYCH 758 / Longitudinal Practicum: Psychopathology
- PSYCH 759 / Longitudinal Practicum: Core Skills

In addition to the above courses, as in the regular PhD stream, students are expected to carry out their thesis research, report the progress of this research annually, and show that satisfactory progress is being made. Students ideally complete the doctoral thesis and all other requirements for the Ph.D. degree by the end of five years of graduate training.

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE ***(Attach additional pages if space is not sufficient.)***

All deletions and additions are shown in "track changes" format and descriptions of these changes are shown in yellow highlighting just prior to the section being changed.

1: There is a period missing from the first line.

Psychology, Ph.D.

M.Sc. and Ph.D. Degrees

Graduate training in Psychology at McMaster leads to the Ph.D. degree and is strongly research oriented. The basic approach is that of a research apprenticeship, with the student selecting one faculty member as the research supervisor at the time of application. Normally, the student-supervisor relationship first develops at the time when the student is preparing to submit an application to the Psychology Graduate Program. Students are strongly encouraged to contact a potential faculty advisor and discuss research opportunities with them prior to submitting an application.

The Department provides excellent opportunities for human and non-human animal research in a variety of experimental areas including: Animal Behaviour, Cognition & Perception, Behavioural & Systems Neuroscience, Developmental Psychology, Educational Psychology, and Social & Evolutionary Psychology. The Department also offers a Research and Clinical Training (RCT) specialty Ph.D. stream with the Psychology Graduate Program.

No special training is offered in the applied areas such as Human Factors, Personality Psychology, or Industrial Psychology, and applications in these fields are discouraged. Students are not usually required to complete a M.Sc. en route to the Ph.D., but they may do so if they wish. The general requirements for the Degree Doctor of Philosophy are described earlier in the calendar.

Admission

Applicants for graduate study in Psychology normally must have received, from a recognized university, either a Master's degree in Psychology, or an Honours Bachelor's degree in Psychology, with at least a B+ standing. Occasional exceptions are made to the above requirements for students with a background in a related or relevant scientific discipline. For example, students with strong backgrounds in biology, neuroscience, computer science, chemistry or physics are encouraged to apply.

First Master's year

In the first Master's year, all students take two courses: Statistics and Research Design (PSYCH 710) and Contemporary Problems in Psychology (PSYCH 720). Students entering the program directly at the Ph.D. level usually are exempted from both of these courses at the discretion of the Graduate Studies Committee (GSC). It is expected that at least one-half of the student's time will be devoted to research on a topic to be chosen by the student in consultation with the faculty supervisor(s) and supervisory committee. Each student submits a report on research progress by May 15 of the first year. Continuation to the Doctoral degree in the graduate training program is determined by the student's research progress and the student's performance in Contemporary Problems, Statistics and any other courses completed. If these performances are acceptable, students who enter without a Master's degree may be permitted to proceed directly to Ph.D. studies. Students must complete Psych 710, Psych 720 as well as a Master's thesis to obtain a Master's degree.

- PSYCH 710 / Statistics and Research Design
- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour

Subsequent Years

In subsequent years, students complete:

The equivalent of an additional 1 1/2 full-year courses

- PSYCH 711 / Advanced Statistics and Computational Methods I
- PSYCH 712 / Advanced Statistics and Computational Methods II *or*
- an approved course equivalent

Two quarter courses

- PSYCH 713 / Special Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 714 / Special Topics in Psychology, Neuroscience and Behaviour II
- and the equivalent of one graduate half course (#721 cannot be counted towards this requirement)

Additional Information

Aside from these courses, the major activities of the student beyond the first year fall into two categories. First, students are expected to carry out their thesis research and report the progress of this research by May 15 of the second and each subsequent year. For the student to continue in the program this report must show that satisfactory progress is being made. Second, to satisfy the comprehensive requirement the student, in consultation with the supervisory committee, must select one or more topics for intensive study. These topics must not be in the student's thesis topic area, and must be approved by the Chair of the Graduate Studies Committee. The study of these topics is then taken up under the guidance of the student's comprehensive examining committee, which includes the student's supervisory committee and up to two other faculty members with relevant expertise. After a period of about six weeks the student will be expected to demonstrate mastery of the material to the satisfaction of the examining committee, first in a written submission and then followed by oral examination. The comprehensive examination must be successfully completed within 24 months of entering the Ph.D. program.

2: Replace "ideally" with "are expected to" in two places, and replace "four" years and "three" years with "five" years and "four" years, respectively.

> This change provides more realistic and updated information. It is rare that a student would finish in four (entering at the Master's level) or three (entering at the PhD level) years of graduate training.

Students entering at the Master's level ~~ideally~~ are expected to complete the doctoral thesis and all other requirements for the Ph.D. degree by the end of ~~four~~ five years of graduate training. Students admitted directly

into the Ph.D. program ~~ideally~~ are expected to complete all requirements for the Ph.D. degree within ~~three~~ four years. Doctoral students are strongly encouraged to give a departmental colloquium in their final year of study.

3: REMOVE THE WORD "Program" FROM THE HEADING (and from the first line of the paragraph below)

This corrects the heading so that it is consistent with the name of the stream elsewhere.

Psychology Research & Clinical Training (RCT) ~~Program~~ Stream

Overview

4: ADD "stream" TO THIRD LINE

This fixes an error.

The McMaster Psychology Research & Clinical Training (RCT) PhD ~~program~~ stream augments the McMaster Psychology graduate program, by providing a subset of Psychology graduate students, who are in good standing in the program, with an opportunity for clinical training. The Psychology RCT stream has as its primary objective to train clinician scientists skilled in core competencies surrounding the pursuit of scientific knowledge and the provision of psychological services. Accordingly, our training model is focused on: i) rigorous training in research methodology, experimental design and statistics and ii) clinical psychology training including both in-class learning and practica experiences. Following completion of the program, it is expected that students will have met the requirements for licensing in Psychology in the Province of Ontario.

Admission

5: REMOVE LAST SENTENCE. INTERVIEWS WILL HAPPEN AT THE SAME TIME AS ALL THE OTHER PNB STUDENTS IN WINTER TERM.

Applicants are asked to apply through the regular Psychology admission process, identifying their interest in the RCT program stream. Enrolment in the Psychology RCT stream is limited and is awarded according to academic excellence, merit and space availability. Admission to the RCT stream is decided by the Psychology RCT Admissions Committee following a screening and interview process. ~~Typically, interviews are scheduled in the spring / summer terms prior to entry into the stream in the subsequent fall term.~~

Entry to the Psychology RCT Stream

Students entering the RCT stream typically begin at the Master's level. In most instances, students entering directly at the PhD level will not be exempted from the Masters level coursework. Any exemptions will be discretion of the Graduate Studies Committee (GSC).

6: MAKE CHANGES AS SHOWN TO SHIFT COURSES FROM FIRST YEAR MASTERS LEVEL.

The recommended change reduces the number of courses required in the first year at the Masters level. Students in the RCT stream will still be engaged in the regular Psychology Masters coursework and must take only one additional course in Scientific and Professional Ethics in Clinical Psychology. The three courses that were previously required in the first year at the Masters level (Advanced Psychopathology, Understanding Personality and Personality Disorders and the first Longitudinal Practicum) will be taken in the first year at the PhD level.

7: REMOVE LAST SENTENCE. TRANSFER TO PhD WILL FOLLOW THE SAME PROCESS AS OTHER PNB STUDENTS.

The additional criterion that "students must complete a written report and oral

presentation of the report describing the student's Master's research" has been removed as it has been determined that the existing evaluation criteria described for PNB graduate students is sufficient for RCT Stream PNB students.

During the first year at the Masters level students in the RCT stream are engaged in the regular Psychology Masters coursework and must take an additional course~~s~~ in ~~Advanced Psychopathology, Understanding Personality and Personality Disorders and the first Longitudinal Practicum~~Scientific and Professional Ethics in Clinical Psychology (PSYCH 751). ~~Following the coursework at the~~ Master's level students are expected to proceed to the PhD level according to the process detailed above. ~~Transfer to PhD requires successful completion of Master's coursework and practica. In addition, students must complete a written report and oral presentation of the report describing the student's Master's research.~~

8: ADD THE PHRASE "as outlined above" TO POINT TO THE PROCESS DESCRIBED FOR PNB STUDENTS.

This helps to point students to the more detailed description that applies to all PNB students.

The RCT stream is a Doctoral training stream. As such, the stream does not offer a clinical Masters specialization. Students enrolled in the RCT stream and who choose to terminate at the Masters level finish with an MSc in Psychology as outlined above.

Students must satisfy the regular Psychology PhD thesis and comprehensive requirements outlined above.

The following Graduate-level training courses are required;

9: REORDER THE COURSES SO THEY ARE IN ORDER OF COURSE CODE NUMBER

For some reason the courses in the existing version of the calendar are not in a logical order.

10: ADD THE NEW COURSE PSYCH 760

A new course form has been submitted. We are also asking for Dean's Approval for this course to be offered in the winter term 2018.

- PSYCH 710 / Statistics and Research Design
- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour
- ~~PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology~~
- ~~PSYCH 750 / Understanding Personality and Personality Disorders~~
- ~~PSYCH 754 / Research Design and Test Construction~~
- ~~PSYCH 755 / Advanced Psychopathology~~
- PSYCH 750 / Understanding Personality and Personality Disorders
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- PSYCH 755 / Advanced Psychopathology
- PSYCH 756 / Clinical Practicum I
- PSYCH 757 / Clinical Practicum II
- PSYCH 758 / Longitudinal Practicum: Psychodiagnostics ~~Psychopathology~~
- PSYCH 759 / Longitudinal Practicum: Core Skills
- PSYCH 760 / History of Psychology

11: REWORD EXPECTATIONS TO BE EXPLICIT ABOUT COMPLETING WITHIN SIX YEARS OF GRADUATE TRAINING.

ADD "RCT STREAM" TO DISTINGUISH BETWEEN PNB PH.D. AND RCT STREAM PH.D.

In addition to the above courses, as in the regular PhD stream, students are expected to carry out their thesis research, report the progress of this research annually, and show that satisfactory progress is being made. Students ~~ideally~~ are expected to complete the doctoral thesis and all other requirements for the Ph.D. RCT stream degree by the end of ~~five~~ six years of graduate training.

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department's program and/or tie to existing Program Learning Outcomes from the program's IQAP cyclical review?):

An internal department evaluation of the RCT Stream first masters year revealed that there are too many course requirements during the first masters year. Students do not have enough time to complete course work, clinical practica, and begin their research program. We also realized that an additional year was needed for most students to complete research, coursework, and the final clinical internship year. The solution is to reduce the number of courses in the first masters year by shifting some of the courses into the first PhD year, and to allow students to spread out their research and course work across 5 years of PhD, if necessary. These changes will better balance the research training and the clinical training. We have not removed any required courses from the program, we have just shifted them into later years to provide more time for research in the early years.

This adjustment does not change the course requirements, it just changes when the courses are taken and is more explicit about completing the degree requirements within six years of graduate training.

This adjustment does not alter the fit between the RCT Stream and the Program Learning Outcomes:

The other changes are for clarification purposes and/or to fix typos.

PROVIDE IMPLEMENTATION DATE: ***(Implementation date should be at the beginning of the academic year)***

September 2018

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

Psychology, Ph.D.

M.Sc. and Ph.D. Degrees

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encouraged to contact a potential faculty advisor and discuss research opportunities with them prior to submitting an application.

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Two quarter courses

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Additional Information

Aside from these courses, the major activities of the student beyond the first year fall into two categories. First, students are expected to carry out their thesis research and report the progress of this research by May 15 of the second and each subsequent year. For the student to continue in the program this report must show that satisfactory progress is being made. Second, to satisfy the comprehensive requirement the student, in consultation with the supervisory committee, must select one or more topics for intensive study. These topics must not be in the student's thesis topic area, and must be approved by the Chair of the Graduate Studies Committee. The study of these topics is then taken up under the guidance of the student's comprehensive examining committee, which includes the student's supervisory committee and up to two other faculty members with relevant expertise. After a period of about six weeks the student will be expected to demonstrate mastery of the material to the satisfaction of the examining committee, first in a written submission and then followed by oral examination. The comprehensive examination must be successfully completed within 24 months of entering the Ph.D. program.

Students entering at the Master's level ~~ideally~~ are expected to complete the doctoral thesis and all other requirements for the Ph.D. degree by the end of ~~four~~ five years of graduate training. Students admitted directly into the Ph.D. program ~~ideally~~ are expected to complete all requirements for the Ph.D. degree within ~~three~~ four years. Doctoral students are strongly encouraged to give a departmental colloquium in their final year of study.

Psychology Research & Clinical Training (RCT) ~~Program~~ Stream

Overview

The McMaster Psychology Research & Clinical Training (RCT) PhD ~~program~~ stream augments the McMaster Psychology graduate program, by providing a subset of Psychology graduate students, who are in good standing in the program, with an opportunity for clinical training. The Psychology RCT stream has as its primary objective to train clinician scientists skilled in core competencies surrounding the pursuit of scientific knowledge and the provision of psychological services. Accordingly, our training model is focused on: i) rigorous training in research methodology, experimental design and statistics and ii) clinical psychology training including both in-class learning and practica experiences. Following completion of the program, it is expected that students will have met the requirements for licensing in Psychology in the Province of Ontario.

Admission

Applicants are asked to apply through the regular Psychology admission process, identifying their interest in the RCT program stream. Enrolment in the Psychology RCT stream is limited and is awarded according to academic excellence, merit and space availability. Admission to the RCT stream is decided by the Psychology RCT Admissions Committee following a screening and interview process. ~~Typically, interviews are scheduled in the spring / summer terms prior to entry into the stream in the subsequent fall term.~~

Entry to the Psychology RCT Stream

Students entering the RCT stream typically begin at the Master's level. In most instances, students entering directly at the PhD level will not be exempted from the Masters level coursework. Any exemptions will be discretion of the Graduate Studies Committee (GSC).

During the first year at the Masters level students in the RCT stream are engaged in the regular Psychology Masters coursework and must take an additional course~~s~~ in ~~Advanced Psychopathology, Understanding Personality and Personality Disorders and the first Longitudinal Practicum~~Scientific and Professional Ethics in Clinical Psychology (PSYCH 751). ~~Following the coursework at the~~ Master's level students are expected to proceed to the PhD level according to the process detailed above. ~~Transfer to PhD requires successful completion of Master's coursework and practica. In addition, students must complete a written report and oral presentation of the report describing the student's Master's research.~~

The RCT stream is a Doctoral training stream. As such, the stream does not offer a clinical Masters specialization. Students enrolled in the RCT stream and who choose to terminate at the Masters level finish with an MSc in Psychology as outlined above.

Students must satisfy the regular Psychology PhD thesis and comprehensive requirements outlined above.

The following Graduate-level training courses are required;

- PSYCH 710 / Statistics and Research Design
- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour
- ~~PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology~~
- ~~PSYCH 750 / Understanding Personality and Personality Disorders~~
- ~~PSYCH 754 / Research Design and Test Construction~~
- ~~PSYCH 755 / Advanced Psychopathology~~
- PSYCH 750 / Understanding Personality and Personality Disorders
- PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology
- PSYCH 752 / Psychological Assessment
- PSYCH 753 / Psychological Intervention
- PSYCH 754 / Research Design and Test Construction
- PSYCH 755 / Advanced Psychopathology
- PSYCH 756 / Clinical Practicum I
- PSYCH 757 / Clinical Practicum II
- PSYCH 758 / Longitudinal Practicum: Psychodiagnostics ~~Psychopathology~~
- PSYCH 759 / Longitudinal Practicum: Core Skills
- PSYCH 760 / History of Psychology

In addition to the above courses, as in the regular PhD stream, students are expected to carry out their thesis research, report the progress of this research annually, and show that satisfactory progress is being made. Students ~~ideally~~ are expected to complete the doctoral thesis and all other requirements for the Ph.D. RCT stream degree by the end of ~~five~~ six years of graduate training.

CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: Judith Shedden Email: shedden@mcmaster.ca Extension: 24345

Date submitted: October 10, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

SGS/2013

McMaster University **SCHOOL OF GRADUATE STUDIES**

RECOMMENDATION FOR CHANGE IN GRADUATE CURRICULUM - FOR CHANGE(S) INVOLVING DEGREE PROGRAM REQUIREMENTS / PROCEDURES / MILESTONES

IMPORTANT: PLEASE READ THE FOLLOWING NOTES BEFORE COMPLETING THIS FORM:

1. This form must be completed for **ALL** changes involving degree program requirements/procedures. **All** sections of this form **must** be completed.

2. An electronic version of this form (must be in MS WORD **not** PDF) should be emailed to the Assistant Secretary, School of Graduate Studies (cbryce@mcmaster.ca).

3. A representative from the department is **required to attend** the Faculty Curriculum and Policy Committee meeting during which this recommendation for change in graduate curriculum will be discussed.

DEPARTMENT	Psychology, Neuroscience & Behaviour
NAME OF PROGRAM and PLAN	Science PhD Psychology, Neuroscience & Behaviour PNB Research & Clinical Stream
DEGREE	M.Sc. or Ph.D.

NATURE OF RECOMMENDATION *(PLEASE CHECK APPROPRIATE BOX)*

Is this change a result of an IQAP review? ☐ Yes ☒ No

CREATION OF NEW MILESTONE ☐					
CHANGE IN ADMISSION REQUIREMENTS		**CHANGE IN COMPREHENSIVE EXAMINATION PROCEDURE**		**CHANGE IN COURSE REQUIREMENTS**	
CHANGE IN THE DESCRIPTION OF A SECTION IN THE GRADUATE CALENDAR		**EXPLAIN:**			

OTHER CHANGES	X	**EXPLAIN:** 1: Fix error in calendar: PSYCH 755 is not a full course, it is a half course. Remove from full course section and add to half course section. 2: Add the new half course to the list: PSYCH 760 History of Psychology

DESCRIBE THE EXISTING REQUIREMENT/PROCEDURE:

Source: http://academiccalendars.romcmaster.ca/preview_program.php?catoid=25&poid=14749

Psychology Courses

Courses

The following are all full courses:

- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour

The following are all half courses:

- PSYCH 710 / Statistics and Research Design
- PSYCH 722 / Developmental Psychology
- PSYCH 723 / Cognitive Psychology
- PSYCH 724 / Perception
- PSYCH 726 / Behavioural Neuroscience
- PSYCH 727 / Learning
- PSYCH 728 / Animal Behaviour
- PSYCH 729 / Physiological Psychology
- PSYCH 730 / Quantitative Methods
- PSYCH 733 / Evolutionary Psychology
- PSYCH 734 / Neural Network Models for Cognition and Perception
- PSYCH 741 / Advanced Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 742 / Advanced Topics in Psychology, Neuroscience and Behaviour II
- PSYCH 770 / Use of Secondary Data Analyses to Examine Social Determinants of Health

The following are quarter courses:

- PSYCH 711 / Advanced Statistics and Computational Methods I
- PSYCH 712 / Advanced Statistics and Computational Methods II
- PSYCH 713 / Special Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 714 / Special Topics in Psychology, Neuroscience and Behaviour II

- PSYCH 715 / Special Topics in Psychology, Neuroscience and Behaviour III
- PSYCH 716 / Special Topics in Psychology, Neuroscience and Behaviour IV

In Addition

(Please note: The content of #711 and #712 varies significantly from year to year. The Special Topics courses (#713-#716) typically are taken by a single student working with one instructor.

Ph.D. Research and Clinical Training (RCT) Stream Courses

The following are all full courses:

- PSYCH 755 / Advanced Psychopathology
- PSYCH 758 / Longitudinal Practicum: Psychopathology
- PSYCH 759 / Longitudinal Practicum: Core Skills

The following are all half courses:

- PSYCH 750 / Understanding Personality and Personality Disorders
- PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology
- PSYCH 752 / Psychological Assessment
- PSYCH 753 / Psychological Intervention
- PSYCH 754 / Research Design and Test Construction
- PSYCH 756 / Clinical Practicum I
- PSYCH 757 / Clinical Practicum II

PROVIDE A DETAILED DESCRIPTION OF THE RECOMMENDED CHANGE ***(Attach additional pages if space is not sufficient.)***

All deletions and additions are shown in "track changes" format and descriptions of these changes are show in yellow highlighting just prior to the section being changed.

Psychology Courses

Courses

The following are all full courses:

- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour

The following are all half courses:

- PSYCH 710 / Statistics and Research Design
- PSYCH 722 / Developmental Psychology
- PSYCH 723 / Cognitive Psychology
- PSYCH 724 / Perception
- PSYCH 726 / Behavioural Neuroscience
- PSYCH 727 / Learning
- PSYCH 728 / Animal Behaviour
- PSYCH 729 / Physiological Psychology
- PSYCH 730 / Quantitative Methods
- PSYCH 733 / Evolutionary Psychology
- PSYCH 734 / Neural Network Models for Cognition and Perception
- PSYCH 741 / Advanced Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 742 / Advanced Topics in Psychology, Neuroscience and Behaviour II
- PSYCH 770 / Use of Secondary Data Analyses to Examine Social Determinants of Health

The following are quarter courses:

- PSYCH 711 / Advanced Statistics and Computational Methods I
- PSYCH 712 / Advanced Statistics and Computational Methods II
- PSYCH 713 / Special Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 714 / Special Topics in Psychology, Neuroscience and Behaviour II
- PSYCH 715 / Special Topics in Psychology, Neuroscience and Behaviour III
- PSYCH 716 / Special Topics in Psychology, Neuroscience and Behaviour IV

In Addition

(Please note: The content of #711 and #712 varies significantly from year to year. The Special Topics courses (#713-#716) typically are taken by a single student working with one instructor.

Ph.D. Research and Clinical Training (RCT) Stream Courses

1: Move PSYCH 755 / Advanced Psychopathology to the section for half courses. It is not a full course.

2: Add the new half course PSYCH 760 / History of Psychology

The following are all full courses:

- ~~PSYCH 755 / Advanced Psychopathology~~
- PSYCH 758 / Longitudinal Practicum: Psychodiagnostics ~~Psychopathology~~
- PSYCH 759 / Longitudinal Practicum: Core Skills

The following are all half courses:

- PSYCH 750 / Understanding Personality and Personality Disorders
- PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology
- PSYCH 752 / Psychological Assessment
- PSYCH 753 / Psychological Intervention
- PSYCH 754 / Research Design and Test Construction
- PSYCH 755 / Advanced Psychopathology
- PSYCH 756 / Clinical Practicum I
- PSYCH 757 / Clinical Practicum II
- PSYCH 760 / History of Psychology

RATIONALE FOR THE RECOMMENDED CHANGE (How does the requirement fit into the department's program and/or tie to existing Program Learning Outcomes from the program's IQAP cyclical review?):

These changes simply fix two errors in the previous calendar (PSYCH 755 and PSYCH 758), and add the new course (PSYCH 760).

PROVIDE IMPLEMENTATION DATE: *(Implementation date should be at the beginning of the academic year)*

September 2017 if possible (but we realize these changes might not be implemented until September 2018). We hope that we can get Dean's Approval to offer the new course (PSYCH 760 / History of Psychology) in January 2018.

ARE THERE ANY OTHER DETAILS OF THE RECOMMENDED CHANGE THAT THE CURRICULUM AND POLICY COMMITTEE SHOULD BE AWARE OF? IF YES, EXPLAIN.

PROVIDE A DESCRIPTION OF THE RECOMMENDED CHANGE TO BE INCLUDED IN THE CALENDAR (please include a tracked changes version of the calendar section affected if applicable):

Psychology Courses

Courses

The following are all full courses:

- PSYCH 720 / Contemporary Problems in Psychology, Neuroscience and Behaviour

The following are all half courses:

- PSYCH 710 / Statistics and Research Design
- PSYCH 722 / Developmental Psychology
- PSYCH 723 / Cognitive Psychology
- PSYCH 724 / Perception
- PSYCH 726 / Behavioural Neuroscience
- PSYCH 727 / Learning
- PSYCH 728 / Animal Behaviour
- PSYCH 729 / Physiological Psychology
- PSYCH 730 / Quantitative Methods
- PSYCH 733 / Evolutionary Psychology
- PSYCH 734 / Neural Network Models for Cognition and Perception
- PSYCH 741 / Advanced Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 742 / Advanced Topics in Psychology, Neuroscience and Behaviour II
- PSYCH 770 / Use of Secondary Data Analyses to Examine Social Determinants of Health

The following are quarter courses:

- PSYCH 711 / Advanced Statistics and Computational Methods I
- PSYCH 712 / Advanced Statistics and Computational Methods II
- PSYCH 713 / Special Topics in Psychology, Neuroscience and Behaviour I
- PSYCH 714 / Special Topics in Psychology, Neuroscience and Behaviour II
- PSYCH 715 / Special Topics in Psychology, Neuroscience and Behaviour III
- PSYCH 716 / Special Topics in Psychology, Neuroscience and Behaviour IV

In Addition

(Please note: The content of #711 and #712 varies significantly from year to year. The Special Topics courses (#713-#716) typically are taken by a single student working with one instructor.

Ph.D. Research and Clinical Training (RCT) Stream Courses

The following are all full courses:

- ~~PSYCH 755 / Advanced Psychopathology~~
- PSYCH 758 / Longitudinal Practicum: Psychodiagnostics ~~Psychopathology~~
- PSYCH 759 / Longitudinal Practicum: Core Skills

The following are all half courses:

- PSYCH 750 / Understanding Personality and Personality Disorders
- PSYCH 751 / Scientific and Professional Ethics in Clinical Psychology
- PSYCH 752 / Psychological Assessment
- PSYCH 753 / Psychological Intervention
- PSYCH 754 / Research Design and Test Construction
- PSYCH 755 / Advanced Psychopathology
- PSYCH 756 / Clinical Practicum I
- PSYCH 757 / Clinical Practicum II
- PSYCH 760 / History of Psychology

CONTACT INFORMATION FOR THE RECOMMENDED CHANGE:

Name: Judith Shedden Email: shedden@mcmaster.ca Extension: 24345

Date submitted: October 10, 2017

If you have any questions regarding this form, please contact the Assistant Secretary, School of Graduate Studies, cbryce@mcmaster.ca

SGS/2013

McMaster University **School of Graduate Studies**

1280 Main Street West
Hamilton, Ontario, Canada
L8S 4L8

Phone 905.525.9140
Ext. 23679
http://graduate.mcmaster.ca

To : Graduate Council

From : Christina Bryce
Assistant Graduate Secretary

At its meeting on November 1st the Faculty of Health Sciences Graduate Policy and Curriculum Committee approved the following recommendations.

Please note that these recommendations were approved by the Executive Committee of the Faculty of Health Sciences.

For Information of Graduate Council:

- **Biochemistry**
  1. **Change to Course Title and Description:**
     - 720 Biochemistry Colloquium

Scholarships Committee 2017-2018 Changes

Add: Dr. Brad Doble - Biochemistry

December 2017

TO: Graduate Council

FROM: Doug Welch
Vice-Provost and Dean of Graduate Studies

RE: 2016-17 IQAP Cyclical Program Reviews

INTRODUCTION

The purpose of Institutional Quality Assurance Process (IQAP) program reviews is to assist academic units in clarifying their objectives and to assess curriculum and pedagogical policies, including desirable changes for future academic development. Although the primary objective for these reviews is the improvement of our academic programs, the processes that we adopt are also designed to meet our responsibility to the government on quality assurance. The process by which institutions meet this accountability to the government is outlined in the Quality Assurance Framework (QAF), developed by the Ontario Councils of Academic Vice-Presidents (OCAV). Institutions' compliance with the QAF is monitored by the Ontario Universities Council on Quality Assurance, also known as the Quality Council, which reports to OCAV and the Council of Ontario Universities.

The goal of McMaster's IQAP is to facilitate the development and continued improvement of our undergraduate and graduate academic programs, and to ensure that McMaster continues to lead internationally in its reputation for innovation in teaching and learning and for the quality of its programs. McMaster's IQAP is intended to complement existing mechanisms for critical assessment and enhancement, including departmental reviews and accreditation reviews. The uniqueness of each program emerges through the self-study.

All program review reports (including self studies, review team recommendations, departmental responses, and dean's implementation plans) are submitted to McMaster's Quality Assurance Committee, a joint committee of Undergraduate and Graduate Councils. The Quality Assurance Committee assesses all submitted reports and prepares a Final Assessment Report (FAR) for each program review conducted during the previous academic session. Each FAR:

- Identifies significant strengths of the program;
- Addresses the appropriateness of resources for the success of the program;
- Identifies opportunities for program improvement and enhancement;
- Identifies and prioritizes the recommendations;

Undergraduate Council and/or Graduate Council will review this report to determine if it will make additional recommendations.

2016-2017 IQAP CYCLICAL PROGRAM REVIEWS

The following graduate programs were reviewed during 2016-17:

Graduate Programs
French M.A.

Joint Undergraduate and Graduate Reviews
School of Labour Studies (Labour Studies B.A. and Hons. BA. and Work and Society M.A.)

The Final Assessment Reports for the reviews are attached.

FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

French M.A.

Date of Review: April 6 – 7, 2017

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 M.A in French. 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

The French program submitted a self-study to the School of Graduate Studies February 2017. The self-study presented the program descriptions and learning outcomes, an analytical assessment of the program, and program data including the data collected from a student survey along with the standard data package prepared by the Office of Institutional Research and Analysis. Appended were the CVs for each full-time faculty member in the Department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean of the Faculty and selected by the Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a site visit to McMaster University on April 6th and 7th, 2017. The visit included interviews with the Provost and Vice-President (Academic); Associate Vice-President and Dean of Graduate Studies, Dean of the Faculty, Chair of the department and meetings with groups of current students, faculty and support staff.

Strengths

The reviewers note the "very high satisfaction levels among its students", the strength and innovative focus of the curriculum and diverse research activities which challenge and offer to students opportunities to enhance their learning of French/Francophone cultures and literatures while deepening their professional capacity. The program was grateful for the Consultants' high praise for our M.A. program's 100% completion rate.

Here are other specific strengths of the program, highlighted in the report:

1. Diversity in the curriculum: various theoretical approaches **(**post-colonialism, psychoanalysis, queer theory, reader-response theory, Indigenous studies, women's studies, structuralism and postructuralism, among others), and diverse reading materials from the francophone world (France, French-Canada and Quebec, the Caribbean, North Africa and Sub-Saharan Africa and Asia).

2. Interdisciplinarity in literary studies (interconnections between literature and animal studies, science, arts, philosophy, among others).

3. FRENCH 705 — Introduction to Literary and Critical Theory: innovative, team-taught course in theory, textual analysis and research methods.

4. Career training (in accordance with the guidelines of the Tri-Agency and the OCGS Taskforce on Professional Skills): organizing special events and workshops, advising M.A. students in terms of scholarship and grant writing, encouraging publications and participation in conferences, and building relationships between graduate students and MacPherson Institute for Leadership, Innovation and Excellence in Teaching.

5. Annual graduate students colloquium creating a space to present progress and results of their current research, share conclusions and practice professional skills.

6. Research, technological and pedagogical resources (an excellent French collection at Mills Library, the Lyons New Media Centre, the Lewis and Ruth Sherman Centre for Digital Scholarship, the MacPherson Institute for Leadership, Innovation and Excellence in Teaching).

7. Quality of mentoring and training, as well as of the supervision of Teaching Assistants provided by dedicated Faculty members.

8. Inclusive system of governance.

- **Areas for Enhancement or Improvement**

In their report, the Reviewers identified areas for enhancement of improvement:

1. Hiring new Faculty members to compensate for retirements and thus to allow for offering more elective courses.

2. Expanding the use of technology in teaching.

3. Introducing more formative and less summative assessments of graduate students' work.

4. Providing greater funding for international students.

5. Providing M.A. students with access not only to teaching assistantship but also to research assistantship opportunities

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

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
Senior Administration Support for Departmental Mission and Faculty Resourcing	External reviewers acknowledged the key role the Department of French plays not only at the university but also as a French presence in a *designated* city required to offer services in French. Whereas it is at times a challenge to have the second official language given its due place within the university, it is often more difficult to do so with a reduction of close to 50% in faculty resources and this within the last three years. As the reviewers themselves noted, since 2014-15 the Department has been "drastically" reduced and is in need of new tenure-stream faculty or hires (p. 8, 10, 14). The Department has been very mindful of succession planning, and it has reinvented itself at both the undergraduate and graduate levels, and we have strengthened both our mission and our focus. We now need senior administrative support to allow the Department to address effectively the following recommendations. **a)** ***Heavy workload.*** External consultants affirmed that our 15-unit workload contrasts with 12 units in the majority of other French Departments of Ontarian Universities, all of whom recognize the French as a Second Language (FSL) factor. They also acknowledged the additional faculty contribution to the very successful team-taught course	**Chair of the Department**	**2017-2020**

	(FRENCH 705) for which we receive no credit. b) ***Faculty Research Activities and Community Outreach.*** The Department has excellent faculty and many would like to contribute to community organizations and build strong ties with Francophone West African, Vietnamese and Indigenous communities, while others would like to contribute to research institutes and interdisciplinary programs at the University. With all hands on deck strictly to mount our required courses, these opportunities have had to be set aside. **c)** ***Course electivity.*** The Department is acutely aware of our graduate students' strong request for more electives. It is their major complaint. Cognizant of the budgetary situation, we have introduced more undergraduate/graduate courses but this formula is limited by SGS and it doesn't appeal to our Master and PhD students who wish for a more robust graduate experience. A new hire would enrich our curricular offerings at the undergraduate and graduate levels. Building on our strengths and strategic focus on French/Francophone literatures and cultures and cultural diversity, the Department will continue to request hires in the following fields in order to address the gaps in our graduate and undergraduate curricula: French Literature (from Medieval to 19th Century); French/Francophone Cultural Studies and Teaching French as a Second Language. In response to greater collaboration with other Departments and Institutes across the Faculty, we see potential with the		

	Department of English and Cultural Studies. We share many common interests in the areas of World Literatures (African, Asian and Caribbean), Indigenous literature, as well as European literatures written in French/English. Greater cross-disciplinary institutional structure that would encourage more interaction would not only be unique in Canada, but it would also send a very clear message that McMaster University not only recognizes bilingualism but also truly embraces cultural diversity within its community and beyond.		
Curricular Improvements and Enhancements	a) ***Major Research Paper (MRP) length*:** The Department of French is willing to increase the number of pages for our MRP requirement from 25-35 to 35-45 as this reflects our current practice in many cases. **b) *Assessments*:** We appreciate the External Consultants' interview with students and the suggestion that we place more weight on formative assessments rather than summative assessments. Given its importance for students, we shall include this issue at our Departmental meetings and retreat. We shall consult best practices and find ways to ensure a proper balance. **c) *Technology*:** The Department will look at diversifying and increasing our use of technology. d) ***Website*:** We plan to work on updating and improving our website within the next academic year.	**Chair of the Department and Chair of Graduate Studies, with the participation of Faculty Members and Graduate Student Partners (the second phase of the Student Partners Program sponsored by the MacPherson Institute).**	**starting in September 2017, with the goal of introducing changes into 2018-2019 curriculum.**
Graduate Recruitment, Professionalization and	**a) *French Liaison Officer:*** The Department is exploring the possibility of a French/Francophone liaison officer in	**Chair of the Department and Chair of Graduate**	**2017-2019**

Space	order to develop stronger links with a host of schools, government and community organizations as well as improve our recruitment venues. **b)** ***Graduate Colloquium:*** We shall continue to build on this "great strength" and welcome the participation of graduate students from neighbouring universities. We shall work with SGS and the Faculty to increase financial support for student travel and the invitation of eminent scholars and writers to our Distinguished Guest Speakers Series. c) ***Graduate Space*****:** Although we have lost a seminar room (TSH 501), upgraded with donor funding, we are pleased to see that our only remaining graduate seminar room (TSH 530) is being upgraded to add modern technology and new furniture. We are hopeful that a quieter heating/air conditioning unit can be installed in order to resolve the annoyance felt by everyone who utilizes this room. The External Consultants were pleased to hear that our Departmental library, currently used by our Graduate Students for their office hours, their oral defense, Club de français meetings, among others, would remain within the Department. However, this is no longer the case and it has been designated as a shared space. The Department will follow the recommendations of the External Consultants to see if any space in the Wilson Building can be made available to our graduate students, given that the university received warm support from the Deputy Minister of Francophone Affairs for the funding of the	**Studies**	

	Wilson Building.		
Research and Travel Funding & Related Opportunities	**a)** ***Funding support to enhance recruitment.*** We concur with the External Consultants' recommendation that the Department would benefit from more funding support to attract strong candidates who might not only garner scholarships and awards but also consider applying for our doctoral program. **b)** ***International Scholarships, Bursaries and Awards for the French Graduate program.*** Additional funding for *international students* from SGS or other Offices (Research or Provost) would be greatly welcome all the more so because the Department receives many applications from West Africa and these students often require more financial support. With such an investment, the reputational gain of the institution would be seen over time. **c)** ***M.A. Research Assistantships.*** We welcome this suggestion and hope that there is funding available to offer these opportunities to our graduate students.	**Chair of the Department and Chair of Graduate Studies**	**2017 – 2019**
Departmental Structure	The Department is keen on creating an Academic Planning Committee, the terms of which will focus on strategic planning, hiring, budgets and fundraising. Plans are already underway to draft the terms of this Committee and discuss them at our next Departmental Retreat and meetings, so that we can implement it as early as next year.	**Chair of the Department**	**2017 - 2018**

Dean's Response, Faculty of Humanities

The review team clearly identify the core strengths of the program, particularly the high quality of the student experience, and the commitment of faculty members. The Dean supported the response of faculty members in the Department.

He added one comment about the Department's response. The Department focuses a little too much of its response on the need for additional tenure track faculty hires. In his reading of the report, the reviewers actually do not make such a recommendation, although they are concerned about future retirements. They do note the dramatic loss of faculty complement and some its impact. In terms of the graduate program, the reviewers note that the current supervisory assignment per faculty member is sustainable, and might even allow for some growth of the graduate program.

The Dean would not be so concerned with the focus on hiring, except that he would hope the Department would consider some other suggestions made by the reviewers for dealing with the current faculty complement:

1. That the Department offer more 600 level seminars to students, to offer students more choice. Any limit set by SGS focuses only on the proportion of courses that students can take as part of their degree, not the number that the Department can offer. The Department has small undergraduate and graduate enrolments: other Departments offer many of their fourth year/MA seminars in this format, so as to give students at both levels more choice. As it stands, my understanding is that the Department has created only two 600-level courses, neither of which appears to be on offer in 2017-18.

2. That the Department explore collaborations with other Departments in the area that have small graduate programs, to look for potential opportunities to share supervisory resources in a reciprocal manner. Other Departments have at least involved individual faculty members from other institutions in their graduate programs.

3. That the Department explore collaborations with Linguistics and Languages, in the hopes of supporting a visiting professor or even a cross appointment in applied French linguistics.

The Department has been responding effectively to the review of its undergraduate programs, and the Dean looked forward to working with them to enhance their high quality MA program.

Quality Assurance Committee Recommendations

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation and the committee recommends that the program should follow the regular course of action with an 18c month progress report and a subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.

FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

School of Labour Studies (Labour Studies, BA and Honours BA, Work and Society M.A)

Date of Review: March 30 - 31, 2017

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 and graduate programs delivered by the ***School of Labour Studies****. This report identifies the significant strengths of the programs, 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 Cyclical Program Review of the Undergraduate and Graduate Programs in the School of Labour Studies

In accordance with the Institutional Quality Assurance Process (IQAP), the School of Labour Studies program submitted a self-study in February 2017 to the Associate Vice-President, Faculty to initiate the cyclical program review of its undergraduate programs. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained all course outlines associated with the program and the CVs for each full-time member in the department.

Two arm's length external reviewers, one from Ontario and one from British Columbia and one internal reviewer were endorsed by the Dean, Faculty of Social Sciences, and selected by the Associate Vice-President, Faculty and Associate Vice-President and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a site visit to McMaster University on March 30 - 31, 2017. The visit included interviews with the Provost and Vice-President (Academic); Associate Vice-President, Faculty, Associate Vice-President and Dean of Graduate Studies, Associate Dean, Grad Studies and Research, Director of the School of Labour Studies and meetings with groups of current undergraduate students, full-time faculty and support staff.

The Director of the School and the Dean of the Faculty of Social Sciences submitted responses to the Reviewers' Report (May 2017). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

In their report (May 2017), the Review team stated that they found the School of Labour Studies to be a vibrant centre of innovative teaching, productive faculty, dedicated support staff and enthusiastic students. The reviewers highlighted the following strengths of the program:

- This is a Program that has healthy and steady enrolments for their BA and MA degrees; and the PhD has a good number of applications for the first year.
- There is a good record of student success at BA and MA levels; student placements seem to have gone well.
- There is a positive record of completion rates.
- The faculty all have good all-round records: teaching, publications, research, funding, administration, supervision, and engagement in current issues.
- There is a continuing and positive alumni connection thanks to the administrative staff in the School.

Areas of Improvement

The review team had no major concerns but did identify some minor suggestions for alterations and a few observations on the program as a whole.

Undergraduate:
As we expected, the Reviewers had suggestions to make regarding our course offerings. We welcome such suggestions from these seasoned researchers and teachers and we are already in the process of addressing them. At our mini retreats at the beginning of May, we discussed our undergraduate program from top to bottom, and, as a start, have agreed to change the titles, content and scheduling of our first year courses for the 2018-19 academic year. (It is too late to make such changes for the 2017-18 academic year.) Moreover, with regard to their suggestions regarding offering courses – existing and new – with more labour studies content, e.g., collective bargaining, employment standards, and the like, we are very enthusiastic about the possibilities that such courses hold for us in terms of meeting student interest and in terms of how they could assist students in later employment.

In making such recommendations the Reviewers were aware of the difficulties we have in providing our students with a rich and diverse range of courses. Speaking to an issue that also has profound implications for our graduate programs, the Reviewers note our faculty complement is such that we are strained to offer even the bare minimum of required courses at each level, each year. As the Reviewers write: "Some students noted they were doing joint majors not single majors in Labour Studies, precisely because they did not feel there were enough course options for a single major." One of their "solutions" to this set of problems, they write, "is the addition of courses taught by other units to the Labour Studies list of courses." While this "solution" is worthy of discussion, we would point out that our

undergraduate students already have this option, hence, it is not clear if the Reviewers, in making this suggestion, were contemplating that we reduce the number of required courses of our degrees. To date we have not considered this to be a desirable fix for this ongoing issue which in some ways produces a chicken and egg situation: we can not increase the number of our undergraduate courses because we do not have the student enrolment numbers but we do not have the student enrolment numbers because we do not attract enough students. At bottom, we are an interdisciplinary program and would welcome, with open arms, pedagogical and institutional/administrative arrangements with other Departments and Faculties if such arrangements promised to strengthen and deepen our programs without weakening and/or watering down our core mission to study and understand the changing worlds of work.

Graduate:

While our MA in Work and Society was also reviewed very positively, as with our undergraduate programs, there were a number of suggestions regarding changes to our course content and offerings. Consistent with comments from our undergraduate students, our graduate students spoke of their desire for courses with more 'labour studies' content. The Reviewers wonder if this comment stems from students having "fairly traditional definitions of labour studies." Regardless, they recommend that any revisions/additions to our graduate curriculum include "the development of a graduate 'foundation' course, with more material on existing labour problems, policies, and legislation." With regard to this recommendation, we can reply that the Reviewers seem to have missed the change we made last year that increased the number of required Work and Society courses from three to four precisely to expose our MA students to more "labour studies" content. That said, we will keep this recommendation in mind when we next refresh our course offerings.

The biggest issue raised by the Reviewers was, as with the undergraduate programs, the rather limited number of courses offered each year. For the Reviewers, this problem, like the similar problem noted for the undergraduate programs, stemmed directly from the too few faculty members available to offer more courses. Their primary solution to hire more faculty will be addressed below. Additional fixes, they wrote, could possibly be found in developing courses, e.g., methods courses, with other Departments within and outside Social Sciences. Labour Studies faculty discussed this option at our May retreat and it is one option that will pursued. Another possibility, the Reviewers wrote, was to become involved with online courses.

We are prepared to investigate each of these options. With regard to online courses, we believe that the online option is more applicable to undergraduate education. That said, we are generally quite skeptical of such courses given the research that shows poor completions rates. With regard to being able to offer our graduate students a wider range of graduate courses, we cannot do so with our present faculty complement. This leaves adding courses from outside Work and Society. This is something that we already do – both at the MA and in our new PhD program. As the Reviewers write, however, "the problem with this recommendation in terms of electives is that other units have course caps which means that LS MA students sometimes cannot secure spaces in them, and they do not know this until a couple of weeks into the term." This is not a new problem for our Work and Society students and

requires a solution. The Reviewers rightly note that the "solution should come at the chair and administrative level."

The Reviewers make other recommendations geared toward augmenting the richness and attractiveness of our MA and PhD programs. One is to open our supervisory roles and responsibilities to faculty beyond Labour Studies. This would, the Reviewers argue, serve to expose our students to the knowledge and expertise of such faculty while simultaneously lessening the burden of supervision at both the MA and PhD levels. The other recommendation was to give some thought to the development of an "Executive program, credit and/or non-credit, for trade unionists and perhaps others in various social movements.

The first of these recommendations has already been a subject of discussion among Labour Studies faculty. We continue to wonder about the perception of an academic unit that farms out PhD supervisory responsibilities to other faculty members. With regard to the development of an "Executive " MA in Labour Studies, we, like the Social Sciences as a whole, need time to further discuss what would constitute a major departure from our established mandates.

Finally, the Reviewers indicate that the relative controversy regarding the name of our program should be resolved by changing the MA in Work and Society to MA in Labour Studies. In our May retreat we decided to follow that recommendation.

The Dean of the Faculty of Social Sciences, in consultation with the Director of the School of Labour Studies shall be responsible for monitoring the recommendations implementation plan. The details of the progress made will be presented in the progress report and filed in the Associate Vice-President, Faculty's office.

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

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
Review 1st year courses for topical interest and content	Issues discussed at May mini retreat and recommended changes will be implemented	First year course instructors; Undergraduate Committee Chair; Director	Fall 2017
Add "labour studies" content to current courses at both undergraduate and graduate levels	Issues discussed at May mini retreat and recommended changes will be implemented	Undergraduate and Graduate Committee Chairs	Fall 2017; Winter 2018
Add new courses with "labour studies" content, e.g., labour policy	Issues discussed at May mini retreat and recommended changes will be implemented when possible	Undergraduate and Graduate Committee Chairs	Dependent on additional faculty resources
Change name of MA in Work and Society to MA in Labour Studies	Issue discussed at May mini retreat and recommended change will be implemented	Graduate Chair; Director	Fall 2017
Expand space to accommodate School of Labour Studies	Issues discussed with Dean of Social Science and new space has been allocated to School of Labour Studies	Director; Staff	Summer/Fall 2017
Senior Administration and School of Labour Studies enter discussions to promote Labour Studies	Forward this recommendation to Senior Administration	Director	
Additional Faculty Resources	Forward this recommendation to Senior Administration	Director	

Dean's Response, Faculty of Science:

Overall, the reviewers provided a resounding endorsement of the programs, while noting some areas for improvement and recommending some specific actions to undertake in response. The reviewers emphasized the pioneering nature of Labour Studies' educational programs both nationally and internationally, and that the school continues to enjoy a leadership role internationally within labour studies. They also noted the dedication and commitment of faculty and staff in the School, which has been instrumental to maintaining strong programs over the last few years during which the School has experienced the loss of senior faculty through resignations and retirements. This commitment is exemplified by its openness to the recommendations of the reviewers and the speedy implementation of a number of them, which were discussed and approved at the School's May retreat.

The response by the School makes clear that it is taking the recommendations seriously and developing concrete, feasible plans for responding as soon as is feasible to those recommendations that are under its full control, and that it will work with the Faculty of Social Sciences (FSS) and the university on those recommendations that require broader consideration and action. The Dean's response focuses on those observations and recommendations in the reviewers' report that call for consideration and action by the Faculty of Social Sciences.

Recommendation: *The School and McMaster recruitment officials should discuss how to acquaint high school students with the degree because labour studies is not a 'teachable' subject in high schools.*

This past year, with support from the Provost, the FSS (joint with Humanities) hired a recruitment coordinator, for which high school outreach is a central element of the Faculty's recruitment strategy. Beginning this fall, the Dean would encourage Labour Studies to work with the recruitment coordinator to develop ways to highlight the program and the kinds of career opportunities it offers graduates as part of the high school outreach.

Recommendation: *With the new PhD program there will be a need for more TAships; these provide invaluable experience for graduate students at both the MA and PhD levels.*

The FSS recently adopted a new, needs-based approach to allocating TA resources to departments and schools. Labour Studies' TA allocation for 2017-18 explicitly took into account the new Ph.D. program, and in the future the TA allocation will automatically adjust to reflect the enrolment of graduate students in the MA and Ph.D. graduate programs.

Recommendation: *Labour Studies might consider adding "adjuncts with dissertation/MRP supervisory privileges" to its list of faculty, although the listed 'Associate members' of the School may serve this purpose; the parameters to these privileges can be listed elsewhere.*

The FSS is happy to work with Labour Studies to examine the role such appointments could play in strengthening the MA and Ph.D. programs.

Recommendation: *There is a request for more physical space for the program, particularly in light of the coming Ph.D. program. It was not clear to us that a final decision had been made on the use of seemingly available space on the 7th floor. We would encourage this expansion so that the Ph.D.*

program can begin with the possibility of more space for graduate students and perhaps a lounge and meeting room that comes under Labour Studies' jurisdiction.

With good reason, a number of observations and recommendations in the report centre on the theme of faculty resources. The School is small ---even in 2014 the total faculty complement was 5.35 FTE faculty members; further, it has experienced losses and turnover in the last few years as senior faculty have retired or resigned to take up positions at other institutions. This challenge will continue into the future – within the next few years it is expected that the two remaining senior faculty with roots dating back to the founding of the School will retire. This creates challenges of both quantity and historical continuity.

Since its founding, the School has had a strong preference for its faculty to hold joint appointments between Labour Studies and a disciplinary department in the FSS. Indeed, last year marked the first full-time appointment to the School. Because most Labour Studies faculty hold joint appointments, discussion of the faculty complement can be quite confusing when using headcounts, as the review did. For the sake of clarity, here is the recent history of the FTE faculty complement for the School:

2014-15: 5.35 FTE (4.35 tenure stream; 1.0 teaching stream)
2015-16: 4.85 FTE (2.85 tenure stream; 1.0 teaching stream; 1.0 CLA)
2016-17: 5.55 FTE (3.55 tenure stream; 1.0 teaching stream; 1.0 CLA)
2017-18: 5.30 FTE (4.30 tenure stream; 1.0 teaching stream)

This coming year, therefore, the FTE faculty complement is only 0.05 FTEs below it size in 2014. So the faculty complement effectively has been restored to its 2014-15 level. This situation is not accurately represented in the report, which relies on faculty headcounts rather than FTE counts.

This is not to deny that Labour Studies faces legitimate challenges with respect to faculty resources. It does face real challenges offering courses beyond those required for program completion and, as the review notes, the proposal for the Ph.D. program called for an increase of faculty FTEs as the Ph.D. program grows, which will be a challenge in the current fiscal environment. The FSS will continue to work with Labour Studies to address these challenges within the constraints it faces.

Recommendation: *University Advancement should be involved in a significant effort to promote and aid Labour Studies as the new Ph.D. program is launched. Advancement should work with the Labour Studies program to develop a plan for raising funds for specific projects that would highlight the international leadership of McMaster in the study of work. While an endowed chair might be too expensive, other projects could be entertained: a post-doctoral fellowship, specific graduate scholarships, or a visiting professorship for a global scholar, who would come to McMaster on a sabbatical and receive office space and a research allowance (a similar research fellowship at McGill is worth $25,000) annually. All such efforts would raise the profile of Labour Studies, aid the recruiting of graduate students, and also potentially add to the curriculum if a post-doctoral fellow or visitor taught a course.*

This reflects a broader theme that the university administration needs to be aware of the international calibre of the School, and to work with the School to promote it. With respect to this specific recommendation, the re-organization of University Advancement, under which the Faculty of Social Sciences has an advancement officer dedicated to FSS alone, should create greater scope to highlight

and promote advancement opportunities associated with the School of Labour Studies. The Dean notes that he will work with both the advancement officer and the School on such initiatives.

Quality Assurance Committee Recommendation

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation and the committee recommends that the program should follow the regular course of action with an 18-month progress report and a subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.