UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3728 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (November 15, 2022)
Faculty Council (December 6, 2022)

From: Professor Dionne Aleman
Associate Dean, Cross-Disciplinary Programs

Date: November 7, 2022; revised November 22, 2022

Re: **Proposed Certificate in Public Policy and Engineering**

REPORT CLASSIFICATION

This is a major policy matter that will be considered by the Executive Committee for endorsement and forwarding to Faculty Council for vote as a regular motion (requiring a simple majority of members present and voting to carry).

BACKGROUND

Engineering decisions can and should reflect public policy concerns, and likewise, public policy decisions can benefit from engineering analysis. The two disciplines have strong historical connections, and engineers with training in public policy can mitigate contemporary social challenges by contributing to improved policy outcomes.

The impetus for this certificate came from a meeting with a group of current engineering students who were keen to find avenues to develop their knowledge of political science, governance and policy in a way that could be recognized on their transcript. The Munk School of Global Affairs and Public Policy at the University of Toronto is excited to work with the Faculty of Applied Science and Engineering to introduce public policy to engineering students and thus better prepare them for professional practice.

PROPOSED

A certificate in engineering and public policy is proposed to provide students in the Core-8 engineering programs and Engineering Science with training in the extensive intersections between the two disciplines. This program will offer an introduction to public policy that might also inspire Engineering's technological experts to pursue careers or graduate studies in policy-making.

CONSULTATIONS

This proposal was developed through discussions with the Munk School of Global Affairs and Public Policy and the Faculty of Arts and Science.

RECOMMENDATION FOR COUNCIL

THAT a Certificate in Public Policy and Engineering, as described in Report 3728 Revised, be approved effective September 2023.

University of Toronto
Proposal to Create a Certificate in Public Policy and Engineering

This is a for-credit certificate offered in conjunction with an undergraduate program (category 2) and is governed by the Policy for Certificates (For-Credit and Not-For-Credit).

Proposed certificate name:	**Certificate in Public Policy and Engineering**
Undergraduate degree(s) the certificate will be offered in conjuction with:	*Any Engineering Bachelor's Degree (BASc or BASc in Engineering Science)*
Faculty/academic division:	*Faculty of Applied Science and Engineering (FASE)*
Unit:	*Cross-Disciplinary Programs Office, FASE*
Dean's Office contact:	*Dionne Aleman, Associate Dean, Cross Disciplinary Programs* *Caroline Ziegler, Faculty Governance and Programs Officer*
Version date:	*November 22, 2022*

1 Summary

Engineering decisions can and should reflect public policy concerns, and likewise, public policy decisions can benefit from engineering analysis. The two disciplines have strong historical connections, and engineers with training in public policy can mitigate contemporary social challenges by contributing to improved policy outcomes. A certificate in engineering and public policy is proposed to provide students in the Core-8 engineering programs and Engineering Science with training in the extensive intersections between the two disciplines. This program will offer an introduction to public policy that might also inspire Engineering's technological experts to pursue careers or graduate studies in policy-making.

2 Effective Date

September 1, 2023

3 Academic Rationale

Engineering is a fundamentally public endeavour. Many foundational engineering projects – from bridges to waterworks to recent climate mitigation efforts – are undertaken with government partners. Private projects are similarly shaped by public regulations. Public policy training will enable engineers to build effective and informed collaborations with these public actors, from governments to regulatory agencies. This proficiency will also help engineers knowledgeably participate in policy making. Technological expertise is essential to public decision-making, and familiarity with public institutions and processes will facilitate engineers' contributions to the many issues facing an urbanizing, changing planet.

The Munk School of Global Affairs and Public Policy at the University of Toronto (an EDU:A within the Faculty of Arts and Science) is excited to work with the Faculty of Applied Science and Engineering (FASE) to introduce public policy to engineering students and thus better prepare them for professional practice. Notably, some engineers have already sought out graduate studies in public policy, and the synchronicity between the two fields is also evident in the number of degree programs which offer a dual concentration in engineering and public policy. As well, FASE already offers several courses which intersect with policy issues, such as classes on municipal engineering, environmental engineering, mine design and health care systems. This certificate is an opportunity for students to expand on that content, to learn more about how public policy intersects with their technological expertise and how to help shape better policy outcomes.

4 Need and Demand

The impetus for this certificate came from a meeting with a group of current engineering students who were keen to find avenues to develop their knowledge of political science, governance and policy in a way that could be recognized on their transcript. While the Faculty of Arts and Science (FAS) offers minors in these areas, the 4.0 FCE is a significant burden on engineering students, who typically have 2.0 FCE of elective spaces available for courses in these areas. In addition, some of these courses are highly popular within FAS and our students do not have priority access to the courses which adds to the difficulty in pursuing those credentials.

This certificate will be open to students in any engineering discipline. The courses in the program are classed as Complementary Studies (CS) or Humanities and Social Sciences (HSS) which will allow students from any discipline to pursue them in conjunction with their degree requirements. Those who do not have sufficient CS/HSS elective spaces can take the remaining course(s) as a Free Elective or an Extra credit.

FASE previously offered a graduate collaborative program in Engineering and Public Policy which closed after a few years due to low enrolment. However, we believe that since these courses will fit into the required CS/HSS elective course categories, there's a stronger likelihood of attracting students to these courses and to the program as a whole.

We anticipate an initial enrolment in the courses of about 20 students. The Munk School will offer these courses. Funding will be arranged with FAS via the FAS/FASE Interdivisional Teaching Agreement. The third course in the certificate, PPG402H1, may be co-taught as a 1000-level course graduate course for engineering.

Current plans are for the courses to only be available to Engineering students. In future years, the Munk School may make these courses or similar offerings available to students from other interested non-FAS/FASE faculties.

5 Admission Requirements

There are no admission requirements for engineering certificate programs. The certificate is open to all undergraduate students in any engineering discipline. Successful completion of the certificate by an eligible student will be recorded on the student's academic transcript as part of their undergraduate program.

6 Program Requirements

The certificate consists of three half-course requirements, totaling 1.5 FCE. The courses can be completed as part of the elective credits in a student's program or taken as Extra credits (not counting towards their degree requirements).

1. PPG201H1F Microeconomics for Engineers (new)
2. PPG302H1F Institutions and Public Policy for Engineers (new)
3. PPG402H1S Public Policy Analysis for Engineers (new)

The first course, PPG201H1, will provide an enhanced examination of microeconomics concepts which goes beyond the content that is already found in the typical engineering economics course. The course will have an emphasis on mathematical approaches, taking advantage of the strong math background required in first year engineering.

PPG302H1 will examine the role of institutions in making social change and policy through a study of historic and current policy and institutional practices and the relationship of institutions to democracy.

PPG201H1 and PPG302H1 will be offered in the Fall term and can be taken concurrently.

In the final course, PPG402H1, students will examine the theories of policy-making, the role of regulation and the policy process in action from proposal through development, consultation, implementation, and reform.

This course will be offered in the Winter term and requires PPG201H1 and PPG302H1 (or approval of the instructor) as pre-requisites.

These courses are currently being ushered through FAS governance processes by the Munk School (approval forthcoming in January) with the expectation that they all will be offered starting in the 2023-2024 academic year. The Munk School will be responsible for the course administration and will bear the costs (as well as benefits) of mounting them.

7 Consultation

This proposal was developed through discussions between FASE and the Munk School of Global Affairs and Public Policy, including:

Faculty of Applied Science and Engineering:

- Chris Yip – Dean
- Dionne Aleman – Associate Dean, Cross-Disciplinary Programs
- Daniel Posen – Assistant Professor, Civil and Mineral Engineering, Canada Research Chair in System-Scale Environmental Impacts of Energy and Transport Technologies
- Sharon Brown – Assistant Director, Cross-Disciplinary Programs Office

Munk School of Global Affairs and Public Policy:

- Peter Lowen – Director
- Alexandra Rahr – Director, Undergraduate Programs and Student Experience
- Shari Eli – Director, Undergraduate Program in Public Policy
- Ariana Bradford – Executive Director

The following from the **Faculty of Arts and Science** were also consulted:

- Alana Boland – Associate Dean, Curriculum and Learning
- Horatio Bot – Executive Director, Faculty Budget, Planning & Finance Office
- Gillian Hamilton – Acting Vice-Dean, Academic Operations

The proposal has been endorsed by the Munk School of Global Affairs and Public Policy (Prof. Peter Lowen); and the Faculty of Arts and Science Vice-Dean (Acting), Academic Operations (Prof. Gillian Hamilton).

8 Resources

Administration of the certificate program will be managed through the Cross-Disciplinary Programs Office as part of its regular activities. No additional resources will be required to offer the certificate.

Funding for the new courses will be developed as part of the existing IDT agreement between FAS and FASE.

9 Oversight & Accountability

Minors and certificates in the Faculty of Applied Science and Engineering are subject to periodic review in conjunction with the review of the Cross-Disciplinary Programs Office.

10 Summary of Process Steps & Approvals

Steps	**Dates**
Development/consultation within CDPO	July-October 2022
Endorsement by Undergraduate Curriculum Committee	October 28, 2022
Consultation with Dean's Office	October-November 2022

Steps	Dates
Endorsement by Munk School of Global Affairs and Public Policy	November 10, 2022
Endorsement by Faculty of Arts & Science	November 2022 (courses to be approved January 27, 2023)
Consultation with VPAP	November 14, 2022
Approval of FASE Council	December 6, 2022
Submission to VPAP upon approval	December 6, 2022
Reported by VPAP to AP&P	June 2023

Appendix A: Proposed Learning Outcomes and Undergraduate Degree-Level Expectations

The Faculty of Applied Science and Engineering aims to provide all of its undergraduate students with an education that will encourage them to be leaders in society in developing solutions to its most pressing problems. In order to achieve this, each graduate will have achieved the Undergraduate Degree-Level Expectations for the BASc described below.

Engineering minors and certificates are designed to recognize students for focusing their degree-program electives in a particular area of study. They are optional structures above and beyond a student's degree requirements and are therefore enhancements to existing rigorous degree-level expectations for engineering programs.

The certificate is structured around a broad, interdisciplinary introduction to the field of public policy and its constituent elements.

The first course, PPG201H1, will provide an enhanced examination of microeconomics concepts which goes beyond the content that is already found in the typical engineering economics course. The course will have an emphasis on mathematical approaches, taking advantage of the strong math background required in first year engineering.

PPG302H1 will examine the role of institutions in making social change and policy through a study of historic and current policy and institutional practices and the relationship of institutions to democracy.

In the final course, PPG402H1, students will examine the theories of policy-making, the role of regulation and the policy process in action from proposal through development, consultation, implementation, and reform.

In addition to the following Undergraduate Degree-Level Expectations, upon completion of the certificate program, students will be able to:

1. Recognise and critically assess public policy dimensions of current and proposed engineering activities;
2. Use their understanding of the policy process and the role of institutions to enable effective dialogue in multidisciplinary collaboration; and
3. Transfer engineering knowledge to public policy related challenges and applications.

Degree Level Expectations for Graduates
Receiving the Degree of Bachelor of Applied Science

Faculty of Applied Science and Engineering
University of Toronto

1. Degree Learning Objectives and Requirements

Overall Learning Objectives

The Faculty of Applied Science and Engineering aims to provide all of its undergraduate students with an education that will allow them to be leaders in society in developing solutions to its most pressing problems. Our graduates will be able and inspired to:

- be leading practitioners of engineering and engineering design
- be known for their technical literacy as well as their knowledge of mathematics and the basic sciences and the role of technology in society
- be able to formulate and solve problems in complex systems independently and in teams
- pursue independent lifelong learning within their field of study and more broadly
- be prepared for careers, including graduate programs, that build upon their advanced technical knowledge
- participate meaningfully as leaders in society

In order to achieve this, each graduate will have achieved the following general learning objectives:

a. Depth of knowledge that cultivates critical understanding and intellectual rigour in at least one engineering discipline.
b. Competencies in learning and applying knowledge to solve problems facing society and that are fundamental to responsible and effective participation in the workplace, in the community, in scholarly activity, and in personal life:
    i. Critical and Creative Thinking
    ii. Oral and Written Communication
    iii. Quantitative Reasoning
    iv. Teamwork
    v. Information Literacy
    vi. Ethical Thinking and Decision-Making
c. Breadth of knowledge across mathematics, basic sciences, engineering sciences, engineering economics and engineering design that cut across the engineering disciplines and across a range of nontechnical areas including the humanities and social sciences and an awareness of the impact of technology on society.
d. Integration of skills and knowledge developed in a student's course of study through a capstone experience in the upper years.

2. Requirements to Graduate

In order to graduate with a BASc degree, each student in the Faculty of Applied Science and Engineering will have completed a full undergraduate program as outlined in the Faculty Calendar within nine calendar years of first registration, exclusive of mandatory absences from his/her program. Current programs include: Chemical, Civil, Computer, Electrical, Industrial, Mineral, Materials and Mechanical Engineering as well as the BASc in Engineering Science.

The practice of engineering is regulated, by statute, in all Canadian provinces and territories. To become a Professional Engineer (PEng), an individual must satisfy the requirements of the licensing bodies.

These requirements include a degree from an accredited program, successful completion of a professional practice examination in engineering law and ethics, and suitable experience. At present, all programs in the Faculty of Applied Science and Engineering are accredited and evaluated regularly by the Canadian Engineering Accreditation Board (CEAB) of the Canadian Council of Professional Engineers. Therefore, graduation from the Faculty may lead to registration in the provincial Associations of Professional Engineers, in accordance with individual policies. No student will be permitted to graduate who does not meet these requirements.

The criteria set out by the CEAB are designed to ensure that each graduate has a foundation in Mathematics and Basic Sciences, a broad preparation in Engineering Sciences and Engineering Design and an exposure to non-technical subjects (Complementary Studies) that complement the technical aspects of the curriculum. Basic Sciences must include physics and chemistry and also may include elements of life sciences and earth sciences; they impart an understanding of natural phenomena. Engineering Sciences normally involve Mathematics and Basic Sciences but carry knowledge further to creative applications. Complementary Studies include the humanities, social sciences, arts, management, engineering economics and communication skills.

Each program in the Faculty consists of a technical component and complementary studies component. The curriculum for students in their early years forms a basis in the fundamental subjects prior to subsequent specialization in the various engineering disciplines. Students are able to choose from a range of technical electives in their senior years. In the senior years, all programs contain a capstone experience through a design project, which integrates their skills and knowledge and provides students with the opportunity to carry out original work in their chosen fields of study.

There are a set of common requirements, described below, that cut across all programs in the following categories: Coursework, Promotion, English Proficiency, and Practical Experience. In this context, a course is defined as one half-course equivalent, which may consist of a half course (“S,” “F” or “H”) or half of a full-year “Y” course.

1. **Coursework:** Each program will have courses that provide the following:
    a. Complementary Studies Electives
    b. A basic knowledge of Engineering Economics
    c. Technical Electives
    d. Courses with substantial design content in Years 1, 2 and/or 3

e. Capstone course(s) in Years 3 and/or 4 with strong integrative, design and independent work elements
f. Across all four years, programs will provide sufficient opportunities for the development of professional awareness and practice.

2. **Promotion:** All undergraduate programs will consist of eight Fall and Winter Sessions taken in order.

    a. To gain credit for a session a student must:
        i. satisfy the academic regulations to proceed to the succeeding session as described in the calendar and
        ii. not be subsequently required to repeat the session for which credit is to be gained, and
        iii. achieve a course mark of 50% or greater in every course taken as part of the academic load in a session, and
        iv. not have any outstanding designations of 'standing deferred,' 'incomplete' or 'No Grade Available' for any course in any session.

    b. To be eligible to graduate, each student must attain a weighted Session Average of 60% or greater in the final session of their program. Any student who does not achieve a weighted Session Average of 60% in their final session (4W), but has attained a weighted Session Average that allows them to proceed to the next session on probation, shall repeat the final session and achieve a weighted Session Average of 60% or greater to graduate.

3. **English Proficiency:** Each student must show an ability to write English coherently and correctly. Every student will also take at least one course that includes a written communication component within their curriculum. Satisfactory completion of the course or courses is required for graduation.

4. **Practical Experience:** The Faculty requires that all students complete a minimum of 600 hours of practical work before graduation.

3. Degree Level Expectations for the Bachelor of Applied Science

1.1. Depth and Breadth of Knowledge

The Faculty ensures that a student has mastered a body of knowledge with appropriate depth by requiring that each student completes the requirements of one of the degree Programs of Study (POSt) as described in the Faculty Calendar. The curriculum for students in First Year forms a common basis in the fundamental subjects, including the natural sciences and mathematics, prior to a subsequent specialization in the various engineering disciplines. Each program consists of a technical component and a complementary studies component.

Critical analysis and thinking and analytical skills are emphasized through the student's exposure to an increasingly sophisticated understanding of their program of study. Specialization within the discipline is developed through technical electives taken in the 3rd and 4th years of study. A detailed knowledge of and experience in design is ensured through the Design Course requirements, beginning with courses in the first three years as well as the

Capstone course(s) in each program. Opportunity to further develop these skills is provided through a research thesis that is available in most POSts.

The Faculty assures that students have breadth of knowledge in a number of ways. Breadth across engineering is assured through a First Year of study that prepares a student for any of the programs of study. Breadth beyond engineering is developed through the Complementary Studies Electives as well as the Engineering Economics requirement.

1.2. Knowledge of Methodologies

Every POSt has requirements which demonstrates a student's understanding of the methods of engineering design. Students in all engineering programs must successfully complete courses with substantial design in their first three years and a Capstone design course in their senior years. These courses require students to evaluate the appropriateness of various approaches to analyze and solve the design problem and also to devise and sustain arguments for their design. In most POSts, students have the opportunity to participate in a research thesis course that familiarizes them with the specific methodologies currently in use in the development of knowledge in their discipline.

1.3. Application of Knowledge

The application of science and mathematics to solve problems is fundamental to all programs in Engineering and therefore is required in many of the courses within all POSt. A minimum level of instruction in Engineering Science and Engineering Design is required, both of which directly involve the application of knowledge.

1.4. Communication Skills

The Faculty requires students to communicate information, arguments and analysis accurately and reliably, orally and in writing, to specialist and non-specialists audiences. The requirement for courses with substantial engineering design that are required across all programs require a series of technical reports and presentations with direct involvement with our Engineering Communication Program. In addition, our Capstone Design Courses and research theses all involve a written report and most involve oral presentations. The course requirements for instruction in Complementary Studies also adds to the education our students receive in communication skills. Also, the English Proficiency requirement insures a minimum level of writing ability for all graduates.

1.5. Awareness of Limits of Knowledge

Each POSt develops, through a sequence of courses starting at the 100-series or 200-series and culminating at the 300-series or 400-series or 500-series of courses, an understanding of a discipline as it is currently appreciated by educators who are at the same time involved in original scholarship in the subject area. The course content at the upper series level is designed, in part, to provide students with an appreciation of the uncertainties, ambiguities and limitations of knowledge in the specific area.

1.6. Autonomy and Professional Capacity

The development of an awareness and understanding of professional practice is required for all POSt. The required design courses require students to work in teams and also accept responsibility for their own contributions. Students are required to make their own decisions for their own learning through selection of their technical and nontechnical electives. Finally, in completing their course requirements, the Faculty expects strict adherence by students to

the Code of Behaviour on Academic Matters, which requires students to not tolerate or encourage the creation of an environment of cheating, misrepresentation or unfairness.

1.7. Other Degree Level Expectations

The Faculty requires all students to have developed competency in several areas of learning and applying knowledge not identified explicitly in the previous sections. In particular, the Faculty requires students to have developed competencies in quantitative reasoning and in information literacy.

Quantitative reasoning is considered the ability to identify, assemble and interpret quantitative information and make and test hypotheses based on such data. Development of this competency is an explicit part of all POSts offered by the Faculty.

The Faculty requires all students to develop an advanced understanding of how to obtain information, manipulate and evaluate it and bring diverse sources together to develop a comprehensive understanding of specific issues, solve problems or apply the scientific method to create further knowledge in the discipline. These advanced information literacy skills are developed through the studies in their concentration(s) and are demonstrated in the advanced courses required in each POSt.

Appendix B: Proposed Calendar Copy

Course Requirements for the Certificate in Public Policy and Engineering

Engineering is a fundamentally public endeavour. Many foundational engineering projects – from bridges to waterworks to recent climate mitigation efforts - are undertaken with government partners. Private projects are similarly shaped by public regulations. Public policy training will enable engineers to build effective and informed collaborations with these public actors, from governments to regulatory agencies. This proficiency will also help engineers knowledgeably participate in policy making. Technological expertise is essential to public decision-making, and familiarity with public institutions and processes will facilitate engineers' contributions to the many issues facing an urbanizing, changing planet.

All undergraduate Engineering students are eligible to participate in this certificate program. Students who complete the requirements of the Certificate will receive a notation on their transcript upon graduation.

The requirements for the Certificate are the successful completion of the following courses:

1. PPG201H1F: Microeconomics for Engineers
2. PPG302H1F: Institutions and Public Policy for Engineers
3. PPG402H1S: Public Policy Analysis for Engineers

Note: Availability of the courses for timetabling purposes is not guaranteed; the onus is on the student to ensure compatibility with their timetable.

Courses	Term	Lec	Lab	Tut	Wgt
Fall Courses					
PPG201H1 – Microeconomics for Engineers	F	2		1	0.5
PPG302H1 – Institutions and Public Policy for Engineers	F	2			0.5
Winter Courses					
PPG402H1 – Public Policy Analysis for Engineers	S	2			0.5