UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3528 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (January 23, 2017)
Faculty Council (February 28, 2017)

From: Professor Jean Zu
Chair, Department of Mechanical & Industrial Engineering

Date: February 10, 2017

Re: **Proposal for a Dual Degree Program: MIE and South China University of Technology's School of Mechanical & Automotive Engineering**

REPORT CLASSIFICATION

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

BACKGROUND

The University's Dual Degree Program (DDP) comprises two existing, approved degree programs, one offered by U of T and the other by an international peer institution. DDPs allow students to study in two approved degree programs at the same time and to complete the requirements of both, providing a distinctive academic benefit to students such as academic enrichment, student mobility, and in some cases, academic acceleration. DDPs build on a strong academic rationale or synergy between the programs in the combination and are governed by a Memorandum of Agreement (MOA) between the parties.

PROPOSAL

The attached proposal will create a DDP involving the Bachelor of Engineering (BEng) program offered by the South China University of Technology's (SCUT) School of Mechanical and Automotive Engineering (SMAE), and the Master of Engineering (MEng) program offered by MIE.

The program will allow outstanding third-year students at SMAE to apply to complete their fourth year of undergraduate studies enrolled in MIE as Visiting International Non-Degree Students, and receive a conditional offer of admission into the MEng program for their fifth year.

The proposal is based on a 3+2 program that was created by U of T and SCUT in 2013 to bring top SCUT undergraduate students to U of T to complete their undergraduate degree here, and then proceed into the MEng program offered in MIE, which is actively recruiting international students. Upon expiration of the 3+2 MOA in 2016, the success of the program has led the partner institutions to seek to continue their collaboration. At the U of T, the program will be replaced by the DDP and a new Memorandum of Agreement (MOA).

The DDP will expose SCUT students to an enriched academic environment and immerse them in a new culture. U of T MIE students, both fourth-year undergraduates and MEng, will benefit from interacting with students from a very different educational and cultural background. In addition, the DDP will support the MIE and FASE goals of increasing the number of international undergraduate students and growing the professional MEng program, and more broadly, contribute to the University goal of strengthening and deepening key international partnerships.

PROCESS AND CONSULTATION

The academic rationale for the proposal, need and demand, program requirements, admissions process and requirements, and information on resources and the consultation and governance processes, are described in the attached.

The Office of the Vice-Provost, Academic Programs will assist in the creation of a new MOA which will be executed by all parties after the proposal has been approved by our Faculty Council.

PROPOSAL/MOTION

THAT the creation of a dual degree program between the Faculty of Applied Science & Engineering's Department of Mechanical & Industrial Engineering and the South China University of Technology's School of Mechanical & Automotive Engineering, as outlined in Report 3528 Revised, be approved with the first cohort to be registered in September 2017.

University of Toronto
Major Modification Proposal:
International Dual Degree Program

A Dual Degree Program (DDP) comprises two existing, approved degree programs, one offered by the University of Toronto and the other by an international peer institution. DDPs allow a student to study in two approved degree programs at the same time and to complete the requirements of both, providing a distinctive academic benefit to the student through academic enrichment, student mobility, academic acceleration, etc. DDPs build on a strong academic rationale or synergy between the programs in the combination. DDPs are governed by a Memorandum of Agreement (MOA) between the parties.

	Institution	**Undergraduate Program Option**	**Undergraduate Degree**	**Graduate Degree and Program**
1	University of Toronto Faculty of Applied Science and Engineering Department of Mechanical and Industrial Engineering	--	--	Master of Engineering in Mechanical & Industrial Engineering
2	South China University of Technology School of Mechanical and Automotive Engineering	Mechanical and Automotive Engineering	Bachelor of Engineering	--

	University of Toronto	**South China University of Technology**
Faculty:	Faculty of Applied Science and Engineering	School of Mechanical and Automotive Engineering
Dean's office contacts:	Prof. Markus Bussmann Vice-Dean, Graduate	TBD
Department / unit:	Department of Mechanical and Industrial Engineering	School of Mechanical and Automotive Engineering
Proponent in each department / unit:	Prof. Jean Zu Chair, Department of Mechanical and Industrial Engineering	Prof. Zhang Xianmin Chair
Version date of proposal:	February 8, 2017	

1. Summary

This is a proposal to create a dual degree program (DDP) involving the Bachelor of Engineering (BEng) program offered by the South China University of Technology's (SCUT) School of Mechanical and Automotive Engineering (SMAE), and the Master of Engineering in Mechanical & Industrial Engineering (MEng) program offered by the University of Toronto's (U of T) Department of Mechanical & Industrial Engineering (MIE).

The DDP will allow outstanding third-year students at SMAE to apply to complete their fourth year of undergraduate studies enrolled in MIE as Visiting International Non-Degree Students, and receive a conditional offer of admission into the MEng program for their fifth year.

The DDP is based on a 3+2 program that was created by U of T and SCUT in 2013 to bring top SCUT undergraduate students to U of T to complete their undergraduate degree here, and then proceed into the MEng program offered in MIE, which is actively recruiting international students. Upon expiration of the 3+2 MOA in 2016, the success of the program has led the partner institutions to seek to continue their collaboration. At the U of T, the program will be replaced by the DDP and a new Memorandum of Agreement (MOA).

This DDP will expose SCUT students to an enriched academic environment and immerse them in a new culture. U of T MIE students, both fourth-year undergraduates and MEng, will benefit from interacting with students from a very different educational and cultural background. In addition, the DDP will support the MIE and FASE goals of increasing the number of international undergraduate students and growing the professional MEng program, and more broadly, contribute to the University goal of strengthening and deepening key international partnerships.

2. Effective Date

The effective date is September 1, 2017, the date the first cohort will be registered in the DDP. For the 2017-2018 academic year, students can apply to the DDP after approval of this proposal and the execution of the MOA (March 2017). Thereafter, students can apply to the DDP starting on February 1 of each year.

3. Academic Rationale

A DDP is usually meant to allow students to register in two degree programs, one at U of T and one at an international institution at the same time and complete the requirements of both in a manner that benefits the students and institutions, more than would result from completing the two programs separately. This proposal is for the simpler arrangement: SCUT undergraduate students will complete their fourth-year by taking courses at the U of T, and then (upon approval) continue into the MIE MEng program. There is no overlap or integration of the two programs.

The proposed DDP will strengthen an international relationship. SCUT is a top research engineering school in China, ranked #42 in the 2015 National Taiwan University Ranking of Scientific Papers; the U of T ranked #39. Students from both institutions will benefit from a richer

and more international academic experience. The DDP will also serve to help identify a few top international students for the MIE MEng program. Finally, the DDP will graduate students who return to China with an appreciation of Canada and of U of T, thereby increasing our profile in a key international market.

SMAE students entering the MEng program will have an advantage over other international students who apply directly from their fourth year of undergraduate studies. They will have a clear pathway and strong background for admission into the graduate program with the potential for early conditional admission to the MEng program, provided they meet the SGS admission requirements. Their improved English-speaking ability will allow them to more smoothly transition into graduate education. Their year of undergraduate studies at U of T will familiarize them with Canadian culture and more importantly, the U of T academic system and culture. With this knowledge and experience, DDP students entering the MEng program will be better prepared and feel more confident in their ability to undertake graduate courses.

4. Need and Demand

In 2013, FASE and SMAE established a 3+2 engineering program that allowed outstanding third-year undergraduate students from SMAE to apply to complete their fourth year of undergraduate studies in the FASE MIE program, and receive a conditional admission offer into the MIE MEng program for their fifth year. Based on the early success of this program, the institutions have agreed to renew the MOA and, at U of T, continue this as a DDP.

Since the program launch in September 2014, it has contributed in a modest way to increase MIE admission of international undergraduate exchange students. Based on the 2014-2016 enrolment numbers and the benefits of the program described above, we anticipate that these numbers are representative of interest in the program going forward.

Enrolment Trends, 2014-2016

Undergrad Program Start	MEng Program Start	Applicants
September 2014	September 2015	2 applied, 2 admitted
September 2015	September 2016	7 applied, 4 admitted
September 2016	September 2017	3 applied, 3 admitted

The first two students who took part in the 3+2 program excelled in their undergraduate studies in MIE, with GPAs of 3.79 and 3.85. They are currently enrolled in the MEng program and continue to excel. Their GPAs for the MEng program are 3.93 and 3.68. They report having enjoyed their studies tremendously and have provided excellent feedback on their academic experience. When asked to compare their SMAE experience to that at MIE, students said that their home program was focused more on theory and examination, whereas MIE focused on the application of

knowledge learned through assignments and projects. They found the MIE curriculum more collaborative and extremely valuable for the development of their problem-solving skills.

Considering the six students who began in 2014 and 2015, their academic records have, for the most part, been very strong with five of the six students averaging at least 3.7/4.0 in the final year of their undergraduate studies in MIE. This is a testament to the quality of the students admitted from SMAE.

5. Program Requirements

Program Components

SMAE students will take the first three years of their Bachelor of Engineering degree at their home institution (SCUT). If eligible, they will take their fourth year at MIE, attending on a full-time basis as Visiting International Non-Degree Students.

Each undergraduate student at SMAE is required to complete a set of courses corresponding to their major. (The SMAE undergraduate curriculum is described at http://en.scut.edu.cn/teaching/undergraduateTrainingPlan.jsp).

Since the outstanding course credits at the end of third year may vary from student to student, SMAE will create and approve a personalized study plan for each student before their departure to U of T. Students will work with their advisor to complete a course selection application form in which they state which courses they will take at U of T and to which SCUT courses these correspond. This will be reviewed to determine if the student has the proper pre-requisite courses for the U of T courses, and if the courses will be granted transfer credit and fulfil the undergraduate degree requirements. It will be approved by the Dean of the students' SMAE department, the Deputy Dean of SMAE, and SCUT's Teaching Affairs Office. If requested by SCUT, U of T will provide supporting documents including course descriptions and course syllabi, to assist SCUT in evaluating credit transfer. U of T will also provide student academic records and grades to students as they become available.

The fourth year MIE curriculum offers students a variety of courses. DDP students may choose to enrol in the fourth-year capstone design course, the undergraduate thesis course, and a variety of technical electives. They may take courses from the mechanical engineering streams (manufacturing, mechatronics, solid mechanics and design, energy and environment, and bio-engineering) and from the industrial engineering areas of focus (human factors, operations research, and information engineering). For a list of courses, refer to the FASE academic calendar (http://www.apsc.utoronto.ca/Calendars/Current/). Permission will be required to take some MIE courses, and all courses external to MIE.

Upon successful completion of a student's fourth year of undergraduate studies at U of T and confirmation that the courses fulfill the SCUT undergraduate degree requirements, SCUT will grant the undergraduate degree. Students will confirm completion of their undergraduate degree by providing an official transcript and presenting their original bachelor's diploma with English translation to the MIE graduate office. Students will then be assessed for eligibility to enter the

MEng program in their fifth year on a full-time (one year) or extended full-time (two-year) basis as international students by fulfilling any conditions placed on their admission offer. Upon successful completion of the MEng program, this degree will be granted by U of T. Students may access a full range of options in the MEng program as indicated in the SGS Calendar, except to enrol in the program as a part-time student.

Curricular Path

There will be no double-counting of courses in the DDP and therefore no program acceleration.

The DDP takes five years to complete, with the MEng degree comprising one year. Students can, however, choose to complete the MEng degree over a two-year period (extended full-time option), in which they can take a maximum of six half-credit courses per year.

6. Admission Process

Each year, SMAE will recruit outstanding third-year students to apply to the DDP. SMAE will limit that number to 20, but based on experience since 2014, we expect that the annual number of applicants will be fewer than ten.

1. Students nominated by SMAE can normally apply for the DDP as early as February 1 (see Section 2). Once students apply, U of T and SCUT will share their information, including that of a personal nature, as though they were one institution as necessary for the dual degree program as outlined in the Memorandum of Agreement between the two institutions.

2. By March 1, SMAE will provide the names and email addresses of nominated students to the MIE Undergraduate Program Coordinator.

3. By April 1, nominated SMAE students will:
   - Complete a School of Graduate Studies application for the MEng program (containing transcripts, a letter of intent, references, CV/resume, and English Language Proficiency scores), and pay the application fee
   - Send a list of SMAE courses currently enrolled in to U of T's Centre for International Experience (CIE).

4. The MEng Admissions Officer will forward completed application packages to the Visiting International Student Program (VISP) at CIE, who will review the packages for admissibility to enroll in fourth year level courses at MIE. The VISP office will forward successful applications to the FASE Admissions Officer, who will confirm admissibility and provide the admission decision for enrollment in fourth year level courses at MIE. At this stage, the MEng Admissions Officer will review the applicants for conditional entrance to the MEng program.

5. When deemed admissible to both programs, SMAE students will be notified by email by the Undergraduate Program Counsellor no later than May 1. The email will contain an offer to allow enrolment in fourth year level courses at MIE and a conditional offer to the MEng program.

   To accept the offers, students must:

   - Complete and forward to the MEng Admissions Officer an SGS Confirmation Form, indicating his or her acceptance of the conditional offer to the MEng Program
   - Agree and send to CIE the Undergraduate CIE Confirmation and Terms

6. After the offers are accepted, CIE will send students a welcome letter with orientation and general housing information. FASE will contact students regarding course enrolment in late-June for the undergraduate component. Students should indicate which MIE courses will be used as core and elective courses towards their degree requirements. FASE will collect and evaluate student course choices and MIE will determine eligibility to enrol in the courses. MIE will guarantee a spot for students' core courses, but since enrolment space is not guaranteed for the elective courses, the department will assist students in finding alternative courses. Once MIE confirms eligibility, FASE will enrol students in the courses (see course selection information in section 5).

Students will pay U of T directly as international students and will be charged tuition plus all compulsory incidental and ancillary fees. CIE will issue a visa letter with the offers of admission, based on the students' period of study. This will help students obtain the appropriate study permit/entry visa, based on their status. Students must ensure that their travel documents are valid for the MEng program and apply early for extension, if required.

In mid-July of the following year, after the fourth year of undergraduate study, MIE will review each student's academic performance and record to determine admissibility to the MEng program, based on conditions placed on the original admissions offer. Students who have met the admissions conditions will have the conditionals lifted and be permitted to enrol in the MEng that September. If a student completes courses towards the BEng at SCUT during the summer before starting the MEng in MIE, the student will arrange for a final transcript to be sent to the graduate office as part of the usual assessment of undergraduate study prior to clearing conditions for admission to the MEng in MIE. Students generally will not be able to defer their MEng program start date. However, with permission from the Associate Chair of Graduate Students in MIE, under exceptional circumstances, a deferral up to one year can be accommodated.

7. Admission Requirements

English Language Proficiency

Candidates whose first language is not English must present proof of proficiency in English. The English language proficiency requirement must be met at the time of application to the DDP for

both the undergraduate and MEng programs. Applicants must meet the highest English Language Proficiency requirements of both programs to be admissible.

Requirements for entry:

- TOEFL Internet-based Test (IBT): minimum 100 overall + 22 on the writing section (highest requirement for Undergraduate program)
- International English Language Testing System (IELTS) minimum score requirement: overall band of 7.0, with no band below 6.5 (highest requirement for Graduate program)

Test scores earned on the TOEFL or IELTS are valid for two years from when the student took the test. For example, students intending to start their study at U of T in September 2016 should have a valid test score from September 2014 or later.

Admission to U of T in Visiting International Non-Degree Student Category (Year 4 of DDP)

U of T will assess candidates from SMAE who have taken the first three years of their BEng degree at SCUT for admission into fourth-year studies at U of T, based on meeting the U of T minimum academic requirement of an 80% average during their second and third years. Students will pay full international tuition during their fourth year at U of T.

Upon successful completion and transfer of fourth-year credits from U of T, SCUT will confer the undergraduate degree. No undergraduate degree will be granted by FASE.

Admission to U of T Master of Engineering Program (Year 5 of DDP)

SMAE students admitted to the DDP will receive a conditional offer of admission to the MEng program in MIE, subject to the condition that with their U of T courses transferred to SCUT, their final year average from SCUT is minimum mid-B average (74-76%) with their undergraduate degree conferred. Candidates admitted into the MEng program will pay full international tuition.

Candidates for the MEng program must present their official transcript from SCUT (indicating that they have completed their undergraduate degree) in a sealed envelope from SCUT along with their bachelor's diploma to the MEng Admissions Officer for registration. Both documents must be accompanied by an official English translation.

8. Calendar Copy

See Appendix A.

9. Consultation

This proposal is the product of extensive consultation between MIE and the Faculty of Applied Science & Engineering's Dean's Office. The South China University of Technology and the Centre for International Experience have also be consulted. Specific arrangements between FASE and SCUT are outlined in an MOA.

10. Resources

The Centre for International Experience will provide a brief orientation for students regarding some of the academic and non-academic services they have to offer. There is no cost associated for this.

The MIE undergraduate office will oversee undergraduate course administration and the MIE graduate office will administer the MEng admission and program requirements.

11. Governance Process

The University of Toronto Quality Assurance Process (UTQAP) pathway is summarized in the table below.

Steps	**Approval**
Development of proposal by Department of Mechanical & Industrial Engineering and Dean's Office	
Consultation with Provost's Office: • Office of the Vice-Provost, Academic Programs • Office of Planning & Budget • Office of the Vice-Provost, Faculty & Academic Life • Government, Institutional & Community Relations • Office of the Vice-Provost, Graduate Research & Education	September 20, 2016
Approval of proposal by Dean's and Provost's Offices	January 2017
Development and approval of MOA by Dean's and Provost's Offices	January-February 2017
Approval of proposal by FASE Council*	February 28, 2017
Signing of MOA by SCUT and U of T (Provost and Dean)	March 2017
Submission to Provost's office	March 2017
Report to AP&P (by VPAP)	April-May 2017
Report to Ontario Quality Council (by VPAP)	Spring 2017

* Proposals for DDPs go through governance with the understanding that the dual degree cannot launch without a completed and signed MOA.

Appendix A: Proposed SGS Calendar Entry

Mechanical and Industrial Engineering: Introduction

Faculty Affiliation

Applied Science and Engineering

Degree Programs

Mechanical and Industrial Engineering

MASc *Emphases:*
Robotics and Mechatronics
Sustainable Energy

MEng *Emphases*:
Advanced Manufacturing
Engineering and Globalization
Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE)
Robotics and Mechatronics
Sustainable Energy

BEng/MEng Dual Degree with South China University of Technology
Emphases:
Advanced Manufacturing
Engineering and Globalization
Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE)
Robotics and Mechatronics
Sustainable Energy

PhD *Emphases*:
Robotics and Mechatronics
Sustainable Energy

Collaborative Programs

The following collaborative programs are available to students in participating degree programs as listed below:

1. **Biomedical Engineering**
    - Mechanical and Industrial Engineering, MASc, PhD

2. **Engineering Education**
    - Mechanical and Industrial Engineering, MASc, PhD
3. **Environmental Engineering *(admissions have closed)***
    - Mechanical and Industrial Engineering, MASc, MEng, PhD
4. **Health Care, Technology, and Place *(admissions have closed)***
    - Mechanical and Industrial Engineering, PhD
5. **Knowledge Media Design**
    - Mechanical and Industrial Engineering, MASc, MEng, PhD
6. **Resuscitation Sciences**
    - Mechanical and Industrial Engineering, MASc, MEng, PhD

Overview

The Department of Mechanical and Industrial Engineering accepts qualified applicants for study in a wide range of topics, spanning the breadth of mechanical and industrial engineering, including advanced manufacturing and materials engineering; applied mechanics and design; biomedical engineering; energy and environmental engineering; robotics, mechatronics and instrumentation; thermal and fluid sciences engineering; human factors/ergonomics; information engineering; and operations research.

The **Master of Applied Science** (MASc) degree program provides students with an opportunity to pursue research-intensive advanced studies in a particular field of interest.

The **Master of Engineering** (MEng) degree program is designed for students preparing for advanced professional activity; it is not a research-oriented degree.

The **Doctor of Philosophy** (PhD) degree program is for students anticipating a career in which they will be performing or directing research at the most advanced level.

Contact and Address

Web: www.mie.utoronto.ca/contact/grad.php
Email: grad.admission@mie.utoronto.ca
Telephone: (416) 978-8823
Fax: (416) 978-7753

Department of Mechanical and Industrial Engineering
University of Toronto
Mechanical Engineering Building
5 King's College Road
Toronto, Ontario M5S 3G8
Canada

MIE: Mechanical and Industrial Engineering MEng

Master of Engineering

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Mechanical and Industrial Engineering's additional admission requirements stated on the department's website.
- Applicants whose primary language is not English and who graduated from a university where the language of instruction and examination was not English must demonstrate proficiency in English. See [link] General Regulations section 4.3 for requirements.

Program Requirements

- 5.0 full-course equivalents (FCEs) or 3.5 FCEs plus a supervised project. A majority of the courses must be taught by the Department of Mechanical and Industrial Engineering.
- The program may be taken on a full-time, extended full-time, or part-time basis.
    - Full-time option: completion is possible in three sessions (one year).
    - Extended full-time option: students are expected to complete the requirements in six sessions (two years) and are limited to six half courses per year and three half courses per session.
    - Part-time option: students are limited to four half courses per year and two half courses per session. Time to completion will be greater than two years.
- Students in the MEng program have the option of completing an emphasis in Advanced Manufacturing; Engineering and Globalization; Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE); Robotics and Mechatronics; or Sustainable Energy as part of their degree program. Please see details below.

Program Length

3 sessions full-time (typical registration sequence: F/W/S);
6 sessions extended full-time (typical registration sequence: F/W/S/F/W/S)
9 sessions part-time

Time Limit

3 years full-time and extended full-time;
6 years part-time

MIE: Mechanical and Industrial Engineering MEng

Master of Engineering: Dual Degree

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies.
- Applicants whose first language is not English must present proof of proficiency in English. The following are the requirements for entry:
    - TOEFL Internet-based Test (IBT): minimum 100 overall and 22/30 on the writing section. These scores will be valid for 2-years from the original test date.
    - International English Language Testing System (IELTS): minimum overall band of 7.0, with no band below 6.5. These scores will be valid for 2-years from the original test date.
- Applicants are required to have a minimum 80% average (mid-B) in Years 2 and 3 in the bachelor of engineering.
- During Year 4 of the bachelor of engineering, applicants who have been selected for the dual degree, and have received a conditional offer of admission to the master of engineering, must maintain a minimum mid-B average until the conferral of the bachelor of engineering.

Program Requirements

- 5.0 full-course equivalents (FCEs) or 3.5 FCEs plus a supervised project. A majority of the courses must be taught by the Department of Mechanical and Industrial Engineering.
- The program may be taken on a full-time or extended full-time basis.
    - Full-time option: completion is possible in three sessions (one year).
    - Extended full-time option: students are expected to complete the requirements in six sessions (two years) and are limited to six half courses per year and three half courses per session.
- Students program have the option of completing an emphasis in Advanced Manufacturing; Engineering and Globalization; Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE); Robotics and Mechatronics; or Sustainable Energy as part of their degree program. Please see details below.

Program Length

3 sessions full-time (typical registration sequence: F/W/S);
6 sessions extended full-time (typical registration sequence: F/W/S/F/W/S)

Time Limit

3 years full-time and extended full-time

MIE: Mechanical and Industrial Engineering MASc, MEng, PhD Emphases

Emphasis: Advanced Manufacturing

MEng students must successfully complete:

- Four half courses (2.0 full-course equivalents [FCEs]), including at least one core course.
- Elective courses may include other core courses, and courses from either of two streams: Manufacturing Engineering and Manufacturing Management.

Core Courses

AER 501H, AER 1403H, APS 1028H, CHE 1123H, MIE 1740H, MIE 1742H.

Elective Courses—Manufacturing Engineering

AER 521H, AER 1415H,
CHE 575H, CHE 1134H,
MIE 506H, MIE 540H, MIE 1713H, MIE 1718H, MIE 1743H,
MSE 558H, MSE 561H, MSE 1013H, MSE 1015H, MSE 1028H, MSE 1029H, MSE 1031H,
ROB 501H.

Elective Courses—Manufacturing Management

APS 520H, APS 1005H, APS 1011H, APS 1012H, APS 1013H, APS 1014H, APS 1017H, APS 1020H, APS 1023H, APS 1026H, APS 1088H, APS 1501H,
CHE 561H, CHE 1434H,
MIE 1505H, MIE 1514H, MIE 1715H, MIE 1721H, MIE 1723H, MIE 1727H.

Emphasis: Engineering and Globalization

MEng students must successfully complete four half courses (2.0 full-course equivalents [FCEs]) from the following lists, with at least two half courses (or one full course) taken from Group A.

Group A

APS 510H, APS 530H, APS 1420H, GLA 1000H, JCR 1000Y (full-year course)

Group B

APS 1015H, APS 1020H, APS 1024H, CHL 5700H, JMG 2020H

Note: Students who choose to pursue an MEng project in their home department that aligns with the Centre for Global Engineering (CGEN)'s disciplinary focus, as deemed by the CGEN Director, may count the project as one required Group B course.

Emphasis: Entrepreneurship, Leadership, Innovation and Technology in Engineering (ELITE)

MEng students must successfully complete any four of the following courses (2.0 full-course equivalents [FCEs]):

Leadership

APS 1010H, APS 1011H, APS 1019H, APS 1026H, APS 1027H, APS 1029H, APS 1030H, APS 1501H

Entrepreneurship and Innovation

APS 1012H, APS 1013H, APS 1015H, APS 1023H, APS 1033H, APS 1035H, APS 1036H, APS 1088H

Finance and Management

APS 502H, APS 1001H, APS 1004H, APS 1005H, APS 1009H, APS 1014H, APS 1016H, APS 1017H, APS 1020H, APS 1022H, APS 1028H, APS 1032H

Engineering and Society

APS 510H, APS 1018H, APS 1024H, APS 1025H, APS 1031H, APS 1034H, APS 1420H, JMG 2020H

Emphasis: Robotics and Mechatronics

MASc, MEng, and PhD students must successfully complete four courses chosen (2.0 full-course equivalents [FCEs]) from at least three of the following groups:

Group 1: Control

ECE 1619H, ECE 1636H, ECE 1647H, ECE 1653H, ECE 1657H, ECE 557H (exclusion: ECE 410H),
MIE 1064H, MIE 1068H

Group 2: Signal and Image Processing

AER 1513H,
CSC 2503H, CSC 2506H, CSC 2515H,
ECE 1511H, ECE 1512H, ECE 516H,
JEB 1433H

Group 3: Dynamics

AER 1503H, AER 1512H, AER 506H,
JEB 1444H,
MIE 1001H

Group 4: Systems Integration

AER 1514H, AER 525H (exclusion: ECE 470H),
ECE 1373H, ECE 1460H, ECE 532H,
MIE 1070H, MIE 1071H, MIE 1809H, MIE 505H, MIE 506H

Emphasis: Sustainable Energy

Doctoral-stream (MASc/PhD) students must successfully complete:

- At least three half courses (1.5 full-course equivalents [FCEs]) from the course lists below.
- A thesis in an area of relevance to sustainable energy with approval of the Institute of Sustainable Energy steering committee.

MEng students must successfully complete:

- Four courses (2.0 FCEs) from the following lists below, of which at least one (0.5 FCE) must be a core course.

Core Courses

APS 1032H,
MIE 515H, MIE 1120H

Elective Courses

AER 507H, AER 1304H, AER 1315H, AER 1415H,
CHE 568H, CHE 1053H, CHE 1123H, CHE 1142H, CHE 1143H,
CIV 575H, CIV 576H, CIV 577H, CIV 1303H, CIV 1307H,
ECE 533H, ECE 1055H, ECE 1057H, ECE 1085H, ECE 1086H, ECE 1094H,
MIE 516H, MIE 517H, MIE 1128H, MIE 1129H, MIE 1130H, MIE 1715H,
MSE 558H, MSE 1022H, MSE 1028H