

4. Educating Future Engineers and Student Experience

As Canada's top engineering school and one of the world's best, we are committed to offering outstanding academic programs and unparalleled co-curricular opportunities that prepare our students to become global engineering leaders. As we enter the final year of our Academic Plan, we have already achieved or exceeded our goals in many of these areas and are making strong progress toward the rest.

Our academic excellence, outstanding international reputation and recruitment activities attracted some of the brightest students from around the world in 2014–2015, drawing a record 10,989 applications for only 1,130 undergraduate places. From that pool, we admitted the most accomplished first-year class in our history, with the mean entering average of Ontario secondary school students increasing to 92.4 per cent. It was also the most diverse: 30.6 per cent of our first-year students were women, the highest proportion of any entering class in Canada, and 31.9 per cent were international students. To continue admitting the most talented undergraduate students, we implemented a new component in our broad-based admissions process for candidates seeking entry in fall 2015. This pilot project — the first of its kind among Canadian engineering schools — uses videos and timed written responses to give our admissions committee more comprehensive knowledge of each applicant. Growth also remained strong in our doctoral and masters programs, with the graduate cohort increasing to 2,194 students in 2014–2015 after surpassing our Academic Plan goal of 2,000 graduate students in 2013–2014, two years ahead of schedule.

U of T Engineering is a leader in advancing diversity, which deepens the engineering creative process, prepares our students to engage different perspectives and enriches our profession. Women now comprise more than one-quarter of our undergraduates thanks to our robust pre-university outreach programs, such as Girls' Leadership in Engineering Experience (GLEE) and the Young Women in Engineering Symposium (YWIES). We also leveraged the record number of women in the 2014–2015 entering class to launch an award-winning media campaign in early 2015 that celebrated women in engineering and drew attention to U of T's leadership in this area. Thanks to our excellent international reputation and strategic recruitment in key global regions, we also attracted outstanding students from around the world, with international students making up 25.8 per cent of undergraduates, in line with our Academic Plan goal of 25.0 per cent by 2015.

We continue to be at the forefront of curriculum innovation and experiential and collaborative learning opportunities that prepare our students to lead in a complex global engineering environment. In December 2014, we received the final report of the Dean's

Task Force for Core Curriculum Review and appointed a working group to oversee implementation of the Task Force's recommendations to improve our first-year curriculum and overall student experience. In fall 2015, we strengthened opportunities for undergraduate students to customize their education by launching a minor in Nanoengineering, a certificate in Communication and an Engineering Science major in Robotics Engineering. We continued to pilot a Technology Enhanced Active Learning (TEAL) room in the Sandford Fleming building to inform decisions about the design of TEAL rooms in the Centre for Engineering Innovation and Entrepreneurship (CEIE). We also offered online versions of some key courses, as well as an "inverted classroom" model, where students watch lectures online prior to class and use classroom time to engage in experiential learning. Participation continued to grow in our multidisciplinary design courses, which offer students in different disciplines opportunities to work in teams on industry challenges. Our Professional Experience Year (PEY), the largest optional internship program of its kind in Canada, also engaged an increasing number of students. In 2014–2015, 724 students — or more than 60 per cent of those eligible — participated in 12 to 16-month work placements, and the number of international positions rose to 61, nearly double the number at the beginning of the Academic Plan in 2011. The PEY program benefits participating students, who can then apply their newly acquired engineering competencies in a professional environment, as well as their employers who gain fresh perspectives and ideas. This past year, demand for our MEng program increased as we strengthened our offerings with new emphases in Sustainable Energy and Advanced Manufacturing and approved creation of a new MEng in Biomedical Engineering, beginning in 2016, which will focus on medical device design.

We are committed to ensuring student success and supporting teaching excellence. Our first-to-second-year undergraduate retention rate increased to 96.3 per cent in 2014–2015, from 94.6 per cent the previous year, due to our enhanced selectivity and the range of supports we offer to transition from high school to university, including Success 101, a summer workshop for admitted students that teaches time management, studying and note-taking skills. We introduced new mechanisms for students to interact with their instructors and provide feedback on courses, and incorporated new training requirements for teaching assistants for different types of tutorials and labs. In May 2015, our biannual Educational Technology Workshop drew 250 instructors from the Faculty, the University and our hospital partners to learn how to integrate the latest learning technologies into their teaching. In 2015, we issued a call for proposals for the Engineering Instructional Innovation Program (EIIP), which was created in 2013 to foster curriculum innovation through strategic investments to improve learning pedagogies and the student experience. From this call, we supported a project to re-energize engineering mathematics instruction through enhanced and focused teaching techniques, and a project to create "parallel

classrooms”, which will enable us simultaneously to deliver integrated and complementary courses to MEng students from a classroom in the Mechanical Engineering Building and a classroom at the University of Toronto Institute for Aerospace Studies (UTIAS), which is located about 20 kilometres north of the St. George campus. Members of our Faculty garnered recognition for teaching excellence both inside and outside the University, including in 2015 the President’s Teaching Award, U of T’s highest teaching honour, and the Ontario Confederation of University Faculty Associations Teaching Award.

We offer an unparalleled student experience through our rich and vibrant co-curricular activities, international opportunities and student clubs. Fostering entrepreneurship continues to be a key priority of the Faculty, and we have two incubator programs that offer mentoring, networking and resources to help students take their ideas from prototype to startup. In 2015, 37 teams comprised of 109 students worked throughout the summer on their startup ideas at The Entrepreneurship Hatchery, with 13 teams of 42 students pitching their ideas at Hatchery Demo Day in September 2015. Prize-winning projects included a system that could revolutionize satellite communications in space and a telescoping hex tool that simplifies bicycle repair. Throughout the year, the Hatchery held 44 events aimed at nurturing student entrepreneurship, including a speaker series and weekly “idea markets.” The Hatchery Circle is a new forum for women to discuss entrepreneurship and innovation. A second incubator program, Start@UTIAS, encourages UTIAS graduate students to use the knowledge and competencies they have gained through their education to create startups. In 2015, it provided mentoring and funding to 15 teams, with six of those teams presenting their ideas at a pitch event in fall 2015. Our students can also nurture their passions and interests through more than 80 U of T Engineering student clubs and teams, ranging from the Skule™ Orchestra to the Blue Sky Solar Racing team, and hundreds more student activities across U of T. They can also gain recognition for the competencies they develop in these activities through the U of T Co-Curricular Record. We remain committed to listening to students, and to holding regular Dean’s Town Hall events on topics such as undergraduate research opportunities, improving assessment feedback for students and “ask us anything” sessions.

The CEIE is a cornerstone of our strategy to enhance our academic programs and innovative co-curricular opportunities and strengthen our position among the world’s leading engineering schools. When it opens in 2017, this state-of-the-art building will foster experiential learning, heighten opportunities for cross-disciplinary collaboration and offer flexible space for students clubs, sparking a new era in engineering education.

4.1 EDUCATING FUTURE ENGINEERS: YEAR 4 PROGRESS HIGHLIGHTS

4.1.1 Maintain and strengthen our high-quality education through continued review and assessment of our programs and curricula for currency, vision and relevance. Establish desired learning outcomes for graduate and undergraduate students to ensure they are well prepared as future engineers. Evolve our cyclic reviews and plan for continuous quality assessment within the new UTQAP and CEAB Graduate Attribute systems.

- Received the final report of the Dean's Task Force for Core Curriculum Review in December 2014 and appointed a working group to guide and oversee the implementation of these recommendations to improve our first-year curriculum and overall student experience
- Continued meetings of the Graduate Attributes Committee and collected data through various initiatives for analysis
- In the process of creating a common database for generating the required curriculum maps for the Canadian Engineering Assessment Board (CEAB) review and developing the documentation processes to monitor curriculum changes; reviewed the terms of reference of the Undergraduate Curriculum Committee to ensure this will occur in a systematic and organic approach

4.1.2 Further integrate professional competencies, such as global engineering, entrepreneurship, leadership and communication into undergraduate and graduate curricula. Define, assess and measure our programs and curricula successes through the UTQAP UDLEs, GDLEs and cyclic reviews and through the CEAB Graduate Attributes.

- Launched the undergraduate certificate in Communication in fall 2015
- Enhanced experiential learning opportunities with a team-based, industry-sponsored multidisciplinary design project course; to date more than 150 students have participated in 37 projects sponsored by 23 clients
- Conducted internal reviews of the Lassonde Mineral Engineering Program and the Institute for Leadership Education in Engineering (ILeap) in fall 2014

4.1.3 Enrich the quality of undergraduate academic experience by increasing flexibility in the undergraduate curriculum, continuing to develop progressive opportunities for students to pursue their professional interests, and integrating professional competencies throughout the curriculum.

- Experienced tremendous growth in minor enrolment and completion, with 31% of the 2014–2015 graduates completing an Engineering minor
- Saw particularly strong interest in the Engineering Business minor and certificate, with 29 per cent of graduates receiving one of these qualifications

- Launched new undergraduate cross-disciplinary programs in fall 2015 to strengthen opportunities for students to customize their degrees, including a minor in Nanoengineering and a certificate in Communication
- Introduced a new Engineering Science major in Robotics Engineering
- Increased Professional Experience Year (PEY) placements to 724, from 705 in 2013–2014, with 61 students completing their work terms outside Canada
- Launched the 2015 internal review of the Engineering Career Centre/Professional Experience Year (PEY) and the Cross-Disciplinary Programs Office

4.1.4 Continue to support and enhance undergraduate students' opportunities for self-directed learning and study time, and participation in the enriching extracurricular activities within our Faculty, across the University, and beyond.

- Offered four first-year courses online in fall 2015 to allow students more choice in how they access educational material: APS 160 — Mechanics, APS 162 and 163 — Calculus for Engineers I and II, and APS 164H1 — Introductory Chemistry from a Materials Perspective
- Continued lecture capture for most first-year classes to provide more flexibility to students and enable them to review lectures outside of class
- Drew more than 11,000 people to our second massive open online course (MOOC), Wind, Wave and Tides: Alternative Energy Systems

4.1.5 Enhance our instructional space to facilitate innovative teaching methods and create efficiencies on how we share space. This includes flexible interactive teaching space for substantial numbers of students, design and group project space and lecture/lab combination space.

- Enhanced teaching and design facilities and upgraded undergraduate laboratory space including:
 - the installation of a new audio-visual system in the IBBME undergraduate teaching lab to improve content delivery;
 - renovation of the Unit Operations Laboratory in the Wallberg Building to create an additional 200 net assignable square metres (NASMs) of wet lab space and increase student capacity from 48 to 60;
 - phase 2 renovations to the ECE Electrical Energy Systems Lab to install new infrastructure to expand the lab's capabilities to support a wider array of courses; and
 - addition of digital displays outside undergraduate computer labs to show the status of all labs, including course bookings, drop-in availability and open seat counts.
- Began construction in June 2015 on the Centre for Engineering Innovation & Entrepreneurship (CEIE), which will offer Technology Enhanced Active Learning (TEAL) rooms, a 500-seat auditorium featuring small-group seating and highly interactive learning and communications technology and prototyping and light fabrication facilities

- Continued to test a prototype TEAL room in the Sandford Fleming building that will inform the design of TEAL rooms in the CEIE
- Through the EIIP, supported a joint project by UTIAS and MIE to create “parallel classrooms” to allow MEng students in each program to participate simultaneously in lectures delivered from either of two locations
- Undertook a space audit of undergraduate teaching labs, with the final report expected in December 2015

4.1.6 Provide reliable, accessible, effective computing services and study spaces within and outside computer laboratories, library and classrooms to enhance efficient interactive learning and socialization where today’s student “lives.”

- Added 87 student study spaces to the Bahen Centre inventory of hallway seating
- Currently installing another 63 student study spaces in the Bahen Centre and 20 spaces in the Wallberg Building
- Renovated space in the Lassonde Mining Building for a study space and conferencing centre
- Launching a 2015 review of student computing services

4.1.7 Link the quality of student learning, the quality of their education and their improved future performance with teaching effectiveness. Continue to inspire and support the Faculty’s culture of teaching excellence and encourage Faculty members and teaching assistants to reflect upon their teaching effectiveness through enhanced feedback mechanisms. Support teaching initiatives and opportunities that will improve their professional development as educators.

- Supported through the EIIP a project to re-energize engineering mathematics instruction through improved and focused teaching techniques
- Held the third annual First-Year Instructors Day, which helps ensure consistency in the student experience and raises awareness of the various support systems that are in place (September 2015)
- Hosted the biannual Educational Technology Workshop “EdTech” to help instructors share best practices for innovative teaching and learning (May 2015)
- Garnered major teaching awards, including the President’s Teaching Award, U of T’s highest teaching honour, and the Ontario Confederation of University Faculty Associations Teaching Award
- Introduced new feedback mechanisms, including broader use of Piazza, an online platform where instructors can answer students’ questions, the use of an online anonymous feedback tool and teaching assistant coordinators for Calculus I, II and Linear Algebra
- Incorporated new training requirements for different types of tutorials and labs into teaching assistant training

4.1.8 Continue to attract and retain diverse, outstanding students from a wide range of backgrounds in order to provide an exceptional education for future global engineers and leaders. In particular, we must strive to attract more female students into our programs.

- Drew a record 10,989 undergraduate applications for the fall 2014 incoming class
- Admitted the most accomplished and diverse first-year class in our history:
 - Mean entering average of Ontario secondary school students was a record 92.4%
 - 30.6% women, the highest proportion of any entering engineering class in Canada, and 31.9% international students
- Leveraged the record number of women in our entering class to launch a targeted media campaign in early 2015 that celebrated women in engineering and drew attention to U of T's leadership in this area; this campaign won a 2015 Silver Leaf Award of Excellence in Marketing Communication from the International Association of Business Communicators
- Continued to offer robust outreach initiatives to support strategic recruitment; for example, 89% of female high school students who attended the 2015 Girls' Leadership in Engineering Experience (GLEE), an event for female high school students with offers of admission to the Faculty, subsequently accepted our offers, up from 77% in 2014
- Held the second annual Young Women in Engineering Symposium, attracting more than 70 top female high school science students from across the Greater Toronto Area (October 2015)
- Continued to increase diversity across our student body in 2014–2015:
 - 25.8% of undergraduate students and 26.7% of graduates students were women
 - 25.8% of undergraduates and 27.1% of graduate students were international students, with our study body coming from 109 countries
- Increased undergraduate recruitment efforts in South and Central America, with events in Peru, Colombia, Costa Rica, Guatemala and Brazil, to broaden the geographical diversity of our student body and increase their global outlook
- Hosted a reception in Dubai for alumni and parents of U of T Engineering students, which provided opportunities to engage with parents of current and prospective students and raise the profile of the Faculty in this region (December 2014)
- Expanded the broad-based admissions process for candidates seeking admission to our undergraduate programs in fall 2015 with videos and timed essays; this pilot project, the first of its kind among Canadian engineering schools, gives our admissions committee more comprehensive knowledge of each applicant

4.1.9 Strategically award admission scholarships to meet our student recruitment goals.

- Introduced two new entrance scholarships for international students; the U of T Engineering International Scholar Award covers the full cost of tuition (up to \$45,700) and is renewable for four years; awarded two scholarships to students from Jordan and Singapore
- Improved the visibility of our entrance scholarship program by overhauling the “Money” section of the Discover Engineering website to better communicate scholarship opportunities to prospective students; the scholarship page now includes basic tables indicating available awards, dollar amounts, and eligibility criteria
- Communicated available scholarship and financial assistance (UTAPS) opportunities and related deadlines through targeted applicant updates

4.1.10 Reduce the dwell time for MASc and PhD students and address time-to-graduation issues.

- Awarded a record number of graduate degrees in 2014–2015, with 772 students completing their degrees
- Held time to graduation to an average of 5.3 years for PhD students and 2.0 years for MASc students
- Implemented a new software tracking system in ECE to record the progress of PhD students, which will also be available for use in other departments and institutes

4.1.11 Continue to develop vibrant MEng programs and offer a larger variety of courses suitable to MEng students.

- Launched new MEng emphases in Sustainable Energy and Advanced Manufacturing, bringing the total number of areas of emphasis to 11
- Offered more than 15 graduate courses aimed at only MEng students
- Approved creation of an MEng in Biomedical Engineering, to launch in fall 2016, that will focus on medical device design

4.1.12 Increase graduate student enrolment to reach 2,000 graduate students by 2015, with particular focus on increasing PhD and MEng students and aiming to reach an average of one PhD graduated annually per faculty member. At the same time, we will endeavor to reduce our undergraduate student enrolment to 4,000 by 2015, with 25% of undergraduates consisting of international students. In fall 2010, Full-Time Equivalents (FTEs) were 4,599 undergraduate and 1,527 graduate students, a percentage ratio of 75.1% to 24.9%.

- Increased graduate students to 2,194 in 2014–2015 after surpassing our Academic Plan goal of 2,000 in 2013–2014, bringing us closer to our longer-term objective of enrolling 1.5 undergraduates for every graduate student
- Continued to participate in a consortium of top Canadian engineering schools to seek out candidates for our research-stream graduate programs
- Continued to expand enrolment in professional masters degrees to 712, up 75 per cent from five years ago, and expanded offerings in these programs
- Increased PhD enrolment to 876, up 26 per cent over the past five years
- Surpassed goal of enrolling 25% international undergraduate students, reaching 25.8%, up from 23.1% the previous year

4.2 STUDENT EXPERIENCE: YEAR 4 PROGRESS HIGHLIGHTS

4.2.1 Ensure that all our undergraduate curricula provide students with sufficient self-directed time to fully reflect on and understand the material in their program, the vision and relevance to ‘learn how to learn,’ and the advantage of taking opportunities to experience and engage in University life outside the classroom through extracurricular and co-curricular activities.

- Increased first-to-second-year retention rate in 2014 to 96.3%, from 94.6% the previous year
- Used the inverted classroom model, in which students watch lectures online prior to class, in classes such as ECE 221 — Electricity and Magnetism and CIV 235 — Civil Engineering Graphics
- Accepted 37 teams comprised of 109 students in The Entrepreneurship Hatchery’s summer program, culminating in investor pitches by 13 teams of 42 students in September 2015
- Implemented the University’s Co-Curricular Record (CCR), an official U of T document that provides students with recognition for the competences they gain through their roles on athletic teams, student government, cultural clubs, design teams and other campus organizations:
 - In 2014–2015, the CCR expanded the list of roles it recognizes from 15 to 215
 - U of T Engineering offers and supports more than 80 student clubs and teams

4.2.2 Engage more undergraduates in faculty research activities. Enhance summer opportunities for our undergraduates by expanding the Engineering Summer Internship Program (eSIP) and by increasing summer research opportunities both within the Faculty and through agreements with international institutions.

- Provided summer research opportunities to 282 undergraduate students in 2014–2015, including 64 who participated in research abroad
- Launched in 2015 a new credit course APS 299Y — Summer Research Abroad, for students who wish to receive degree credit for summer research
- Held the 2015 Undergraduate Research Day UnERD, a one-day research symposium for students to celebrate undergraduate engineering research carried out over the summer and allowing students to gain key competencies through abstract writing and collaborative networking (August 2015)

4.2.3 Enhance our students' access to electives outside technical courses.

- Signed an Interdivisional Teaching Agreement with the Faculty of Arts & Science, which includes an academic framework to enable the two Faculties to work together to achieve our educational mission for the benefit of students and faculty, and allow us to focus on pedagogy rather than funding (June 2015) — including a number of course slots guaranteed at the Faculty of Arts & Science for engineering students
- Added four complementary studies courses:
 - APS 444 – Positive Psychology for Engineers
 - APS 445 – The Power of Story
 - APS 446 – Leadership in Project Management
 - APS 343 – Foundations of Engineering Leadership

4.2.4 Enhance our undergraduate and graduate students' non-traditional educational opportunities, including international academic exchanges and internships, courses offered abroad, field courses, and credit for work in extracurricular activities such as design teams.

- Sent six students and one faculty member to Peking University in Beijing, China through the Global Educational Exchange (Globex) program for an intensive, three-week program that exposed them to new ideas, research, people and culture
- Welcomed 64 exchange students from universities around the world and sent 94 U of T Engineering students to 26 partner institutions in Europe, Asia, Australia, India, Mexico, Turkey and Israel
- Welcomed 83 new students in fall 2014 through Brazil's *Ciência sem Fronteiras* program (formerly Science without Borders), bringing the total number of students the Faculty has hosted through this program since 2012 to 490 — enrolment per session for all students was 260 in September 2014 and 78 in January 2015
- Enhanced our partnership with Technion Israel Institute of Technology for graduate student and postdoctoral fellow exchanges and accelerated joint research initiatives,

supported by a \$1 million gift to U of T Engineering from alumnus Lyon Sachs (IndE 4T9)

- Offered guidance, tools and resources through The Entrepreneurship Hatchery to 37 teams comprised of 109 students who wanted to develop startups, with 13 teams of 42 students pitching their ideas at Hatchery Demo Day in September 2015

4.2.5 Continue to inspire the Faculty's culture of teaching excellence and support teaching initiatives that improve student experience, support their connections with course content, increase in-class engagement and strengthen students' understanding of course relevance.

- Received recommendations from the Dean's Task Force for Core Curriculum Review in December 2014 and appointed a working group to guide and oversee the implementation of these recommendations to improve our first-year curriculum and overall student experience
- Held the third annual First-Year Instructors Day, which helps ensure consistency in the student experience and raises awareness of the various support systems that are in place (September 2015)
- Piloted a TEAL room and inverted classroom models in several courses
- Through the Engineering Instructional Innovation Program (EIIP), supported several projects, including one to re-energize engineering mathematics instruction through improved and focused teaching techniques

4.2.6 Promote extracurricular activities through communications, faculty mentoring and suitable space and facilities.

- Continued to develop plans for versatile student club space on the lower level of the Centre for Engineering Innovation & Entrepreneurship, which will include storage, fabrication spaces and meeting rooms
- Stream-lined the process for student club funding by creating the Centralized Process for Student Initiative Funding (CPSIF) which allows student groups to apply to various funding resources from within the Faculty of Applied Science & Engineering in a single application
- Held third annual Pink Shirt Day to raise awareness about bullying and discrimination, including a photo booth where people recorded statements about diversity

4.2.7 Actively engage and support students in their unique academic and non-academic experiences as soon as they enter our Faculty, so they can thrive throughout their studies.

- Offered a range of academic supports, such as:
 - Success 101, a summer workshop offered free-of-charge to newly admitted undergraduates that teaches diverse styles of learning, time management, studying and note-taking;

- the First-Year Foundations program, which helps students sharpen their technical skills, become familiar with the campus, meet future classmates and gain valuable advice from current students and professors;
- embedded counsellors who provide guidance and identify students who may benefit from extra support;
- Peer-Assisted Study Sessions (PASS), led by highly successful upper- year students; and
- Supports for international students including international student transition advising, online chats from June to September for international students to ask questions and receive assistance, and the International Foundation Program, which allows academically strong students to gain conditional admission as non-degree students while they complete intensive English-language training and the Engineering Strategies and Practice course series.
- Connected students with programs offered by the Centre for International Experience, including:
 - iConnect, an intercultural mentorship program; and
 - Step Up, a week-long, residential pre-orientation program that prepares international students for their studies at U of T with the Engineering First-Year Office providing engineering-specific input to Step Up.
- Held send-off events in Calgary and Istanbul, Turkey, where alumni and current students welcomed newly admitted students and their parents to U of T Engineering

4.2.8 Engage Master of Engineering (MEng) students to improve the quality of their experience.

- Engaged MEng students with graduate student associations reaching out to involve them in social and professional development opportunities
- Offered MEng-only orientations in many departments to meet specific needs of professional graduate students
- Hosted a welcome event for new MEng students in September 2015, which attracted more than 150 students

4.2.9 Enrich graduate students' academic life and build a stronger sense of community among graduate students across the Faculty.

- Welcomed first cohort in the collaborative program in Engineering Education (EngEd), a partnership with the Ontario Institute for Studies in Education (OISE)
- Offered the Prospective Professors in Training program, which gives PhD candidates who are interested in careers in academia the opportunity to design courses and research programs, develop effective academic curriculum vitae, teaching dossiers and research statements, and prepare for academic job interviews