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U of T Engineering provides students with unparalleled opportunities to collaborate across disciplines, customize their degrees to suit their interests, and enrich their education through experiential learning. Our robust curricular and co-curricular programming — from certificates and minors to internship and entrepreneurship opportunities — enable students in all years to complement their technical knowledge with crucial competencies in engineering design, teamwork, leadership, entrepreneurship and communication. As a result, our graduates are versatile, creative and prepared to innovate and lead in the increasingly complex and challenging global economy.

Building meaningful professional experience is a key element of our students' engineering education and development. Our Professional Experience Year (PEY) internship program, the largest of its kind in Canada, enables undergraduates to apply their knowledge in the workplace, strengthening their professional networks while earning a competitive salary. In 2016–2017, a total of 734 students participated in PEY, 65 of them in placements outside of Canada.

Engineering students are at the heart of the University's thriving entrepreneurial ecosystem. The Entrepreneurship Hatchery, which will have a new home in the forthcoming Centre for Engineering Innovation & Entrepreneurship (CEIE), is a startup accelerator that pairs intensive mentorship opportunities with resources to help students and faculty take their ideas from concept to marketable product. It includes the Hatchery Nest summer program and the new Hatchery LaunchLab, which supports research-based startups led by graduate students and faculty.

As the world demands more dynamic and thoughtful creators, innovators and problem solvers capable of addressing the most complex global challenges, an education in leadership has never been more important. The Institute for Leadership Education in Engineering (ILead), which draws on expertise from several disciplines, including engineering, education, social science and business, enables our students to build confidence and key leadership competencies. In 2016–2017, ILead engaged more than 2,300 students through its suite of courses and co-curricular activities.

These cross-disciplinary, team-building and experiential-learning initiatives are woven throughout our academic programs, research and co-curricular activities. Together, these opportunities nurture the whole engineer, enabling our students to become the engineering leaders and innovators of tomorrow.

Undergraduate Engineering Minors and Certificates, Complementary Courses and Inter-Divisional Collaboration

Our minors and certificates — from Robotics & Mechatronics to Engineering Leadership — enable undergraduate students from any discipline to collaborate with each other based on shared goals and interests, and to hone their technical and professional competencies in their chosen areas of focus. Students must complete six half-courses to earn a minor, and three half-courses for a certificate. Engineering students may also complete minors through the Faculty of Arts & Science in areas such as economics, math, sociology, philosophy, history and music. For the second year in a row, more than half of the 2017 undergraduate graduating class completed at least one minor or certificate, and 34% completed an Engineering Business minor or certificate.

In 2016–2017, we offered the following minors and certificates:

Minors

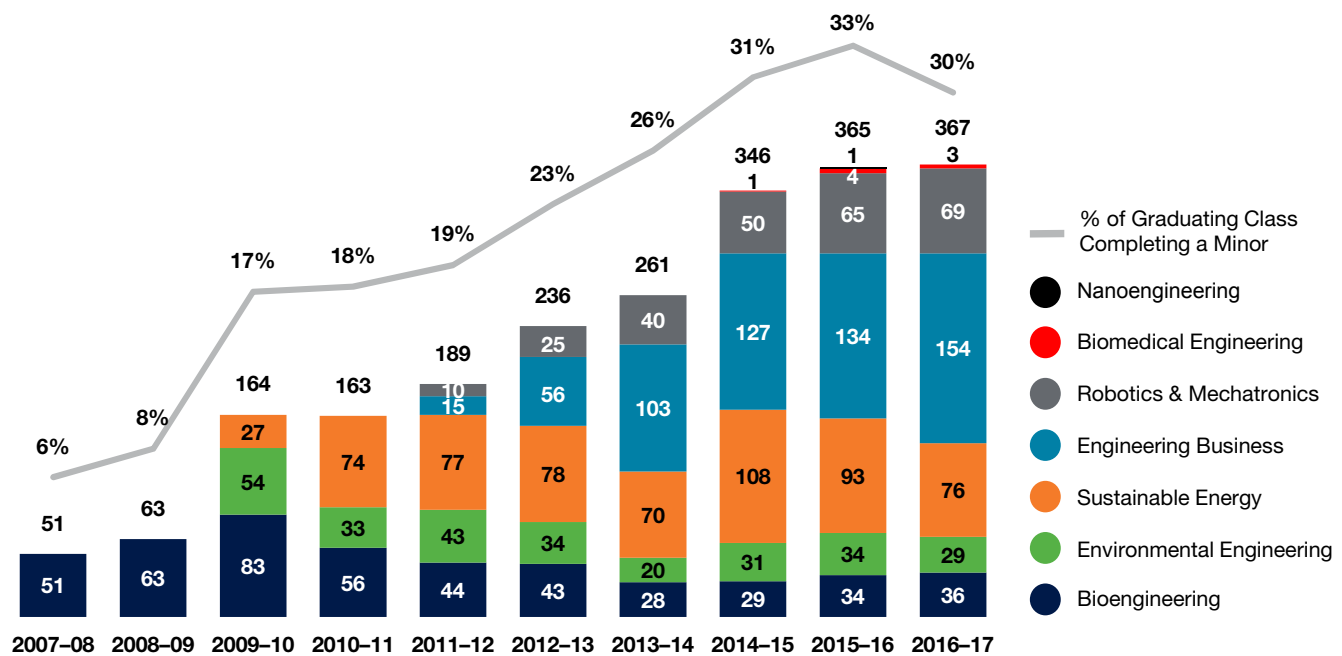
- Bioengineering
- Biomedical Engineering
- Engineering Business
- Environmental Engineering
- Nanoengineering
- Robotics & Mechatronics
- Sustainable Energy

Certificates

- Communication
- Engineering Business
- Engineering Leadership
- Entrepreneurship, Innovation & Small Business
- Global Engineering
- Mineral Resources
- Nuclear Engineering
- Renewable Resources Engineering

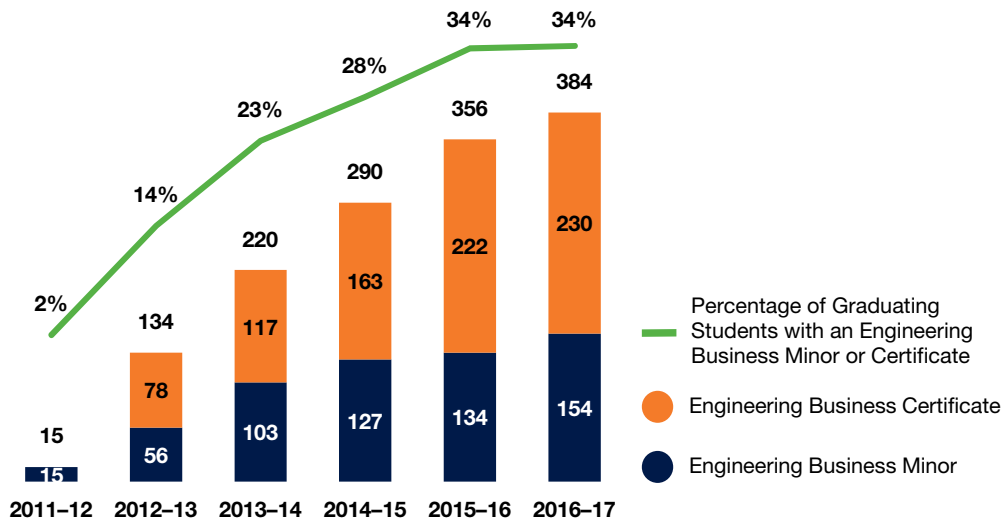
In 2017–2018, we will broaden our offerings by launching a new minor in Advanced Manufacturing and a new certificate in Forensic Engineering.

Figure 4.1a Number of Students and Percentage of Graduating Class Completing an Engineering Minor, 2007–2008 to 2016–2017



Data and highlights in this chapter are presented for the period from August 2016 to July 2017.

Figure 4.1b Students Graduating with an Engineering Business Minor or Certificate, 2011–2012 to 2016–2017



Undergraduate Design and Research

We embed engineering design throughout our undergraduate curriculum, enabling students in all years to work with external partners on developing solutions for practical challenges, as well as building and testing prototypes and developing competencies in teamwork, leadership and effective communication.

All first-year students take engineering design courses: Praxis I and II are for students in Engineering Science, while Engineering Strategies and Practice I and II are for students in our TrackOne and core programs.

In 2016–2017, Praxis students were challenged to improve daily life in communities around the Greater Toronto Area. Designs presented at the Praxis showcase in April 2017 included:

- an adaptive seat for sailboats (in conjunction with the Disabled Sailing Association of Ontario);
- an innovative wheelchair to reduce pressure sores (in conjunction with Kensington Gardens Residential Home); and
- diagnostic methods for a rare form of infant epilepsy (in conjunction with U of T’s Faculty of Medicine).

In their final year, all engineering undergraduate students undertake design challenges as part of their capstone

courses. Students may take discipline-specific capstone courses, or enrol in APS490 Multidisciplinary Capstone Design Project (MCP) through the University of Toronto Institute for Multidisciplinary Design & Innovation (UT-IMDI). In just four years since MCP’s inception, more than 350 students from across the Faculty have collaborated on 78 projects for 38 industry clients.

In 2016–2017, 24 student teams worked with industry clients such as Bombardier Aerospace, Defence Research & Development Canada, Drone Delivery Canada, Guycan Ltd., NASA Ames Research Center, Pratt & Whitney Canada, the Royal Bank of Canada and United Steelworkers. Projects presented at the annual MCP Showcase in March 2017 included:

- a UAV compartment for automated payload deployment;
- a web-based physiological monitoring system for soldiers in the field;
- a modular solar-powered water filtration system;
- ergonomic seating for sub-orbital microgravity flight;
- a carbon dioxide-based self-sustaining chemical production process for a Mars space mission;
- a mobile wave farm for enhanced power generation.

The Innovation, Hammers & Nails program connects students at the Institute of Biomaterials & Biomedical Engineering (IBBME) with clinicians, nurses, staff and fellows to design engineering solutions to challenges identified by experts at the Hospital for Sick Children. This initiative is available to undergraduate and graduate students through a range of courses and degree programs, including the BME498 Biomedical Systems Engineering Design course and the MHSc clinical internship. In 2016–2017, a total of 26 students and six IBBME faculty and SickKids researchers were involved in six BME498 projects, including developing wireless electrodes to enable intraoperative neuromonitoring, and designing an expandable trocar device to enable instruments to be more easily inserted during keyhole surgeries.

Undergraduates across all years have rich opportunities to engage in research that advances the frontiers of engineering, both within the Faculty and around the world. Through the Engineering Science Research

Opportunities Program (ESROP), first- and second-year Engineering Science students work with faculty members each summer on research-based collaborations. In August 2016, undergraduates across all programs presented their summer research findings at the Undergraduate Engineering Research Day (UnERD). This annual event featured 116 poster and podium presentations on topics such as biocompatible polymers that can be used to 3D-print scaffolds for lab-grown human tissues, improving chemical constructs that act as contrast agents for magnetic resonance imaging (MRI) scans, and new systems to efficiently grow large quantities of microalgae that could be used as food supplements or converted into fuel.

U of T Engineering students also have opportunities to conduct research abroad through programs administered by the Division of Engineering Science and U of T’s Centre for International Experience. Partner institutions include the National University of Singapore, Hong Kong University of Science & Technology and University of Stuttgart.

Figure 4.2a Undergraduate Participation in Summer Research Opportunities, 2010 to 2017

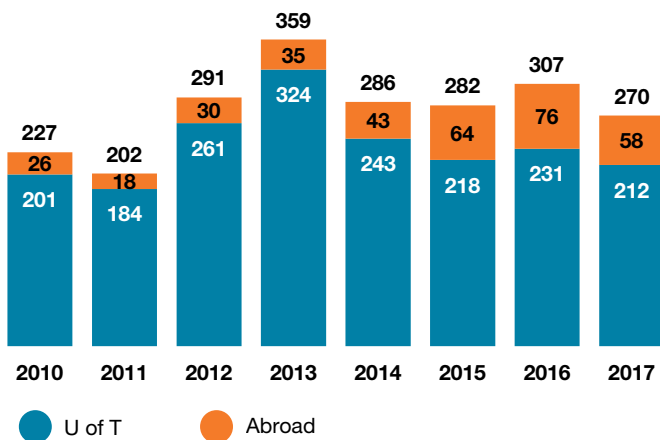


Figure 4.2b Undergraduate Participation in Summer Research Opportunities, by Academic Area, 2017

Research Participation:	U of T	Abroad	Total
ChemE	17	9	26
CivE & MinE	24	2	26
ECE	32	1	33
EngSci	90	32	122
MIE	30	13	43
MSE	15	1	16
Other	4	0	4
Total	212	58	270

Engineering Leadership

ILead prepares students to maximize their impact as engineers, innovators and leaders by providing transformative curricular and co-curricular learning opportunities that develop competencies for success. ILead also conducts academic and industry-focused research and outreach to engineering leadership educators and engineering-intensive enterprises.

In fall 2016, ILead hosted the inaugural meeting of the National Initiative on Capacity Building and Knowledge Creation for Engineering Leaders (NICKEL). The first-of-its-kind conference on engineering leadership education was attended by close to 40 professors and instructors from engineering schools across Canada, as well as representatives from industry and Engineers Canada.

ILead offered five undergraduate and seven graduate courses in 2016–2017, in areas ranging from leadership in project management to positive psychology for engineers to the science of emotional intelligence. New graduate courses in 2016–2017 included APS1029 The Science of Emotional Intelligence and its Applications, and APS1030 Engineering Careers: Theories and Strategies to Manage Your Career for the Future. As part of the Faculty's strategy to broaden students' competencies and prepare them for leadership, ILead will launch a complementary studies course, APS447 The Art of Ethical and Equitable Decision-Making, in winter 2018.

MEng students can count these courses toward the Entrepreneurship, Leadership, Innovation & Technology (ELITE) certificate, while undergraduate students can earn credits toward the Minor in Engineering Business or the Certificate in Engineering Leadership. Demand for these courses was strong: overall enrolment reached 477 students and many courses had significant waiting lists.

ILead also actively partners with faculty to offer team-based learning and leadership curriculum in numerous courses. In 2016–2017, ILead integrated 21 lectures and workshops into courses across the Faculty, including:

- APS490 Multidisciplinary Capstone Design Project;
- MIE350 Design and Analysis of Information;
- APS111 Engineering Strategies and Practice 1;
- ASP100 Orientation to Engineering;
- CHE230 Environmental Chemistry;
- MIE191 Mechanical and Industrial Engineering Seminar;
- MIE315 Design for the Environment.

Engineering students also have opportunities to hone their leadership competencies through ILead's innovative co-curricular programs:

- **Leadership Labs** are highly experiential workshops ranging from evening sessions on project management, team conflict, public speaking, team culture, emotional intelligence and feedback to full-day labs on teamwork development and workplace readiness. In 2016–2017, ILead offered 24 co-curricular labs that reached 734 students, and also delivered 17 labs as part of core courses that reached 2,369 students. Students who attend four Leadership Labs are eligible for recognition on their Co-Curricular Records. These labs also provided work experience for five students who were trained as co-facilitators.
- **The Game** is a year-long cohort program that challenges student teams to hone their leadership competencies by developing solutions to large-scale social problems. The program, which begins in September and culminates in a project showcase in March, attracted seven teams in 2016–2017. The areas of focus this year included reducing residential electricity usage, improving recycling behaviours at U of T, navigating mental health services on campus for ESL students, reimagining educational supports for underrepresented communities in Toronto, and improving bicycle safety.
- The **ILead Summer Fellowship** is a 16-week program for highly engaged engineering students who want to increase the impact of their student organization and their leadership competencies. The program includes strategies for organizational development, peer learning and individual coaching. ILead had 11 summer fellows in 2016.
- In summer 2016, ILead launched the Faculty-wide **Summer Leadership Program**. The eight-week course provided the initial cohort of 53 summer research students with opportunities to better understand their strengths and values, gain new perspectives on engineering and its impact on society, and be part of a vibrant and diverse community.
- In spring 2017, ILead offered a series of **PhD Career Development Workshops** to support engineering PhD candidates and post-docs with career aspirations outside of academia. A full pilot program will launch in fall 2017.

Student Entrepreneurship

U of T Engineering is committed to providing rich curricular and co-curricular opportunities for students to develop the technical and entrepreneurial competencies they need to bring their ideas to the marketplace.

Curricular Programs

Undergraduate students can complement their technical studies with our popular Engineering Business Minor or Certificate, or a Certificate in Entrepreneurship, Innovation & Small Business. Courses in the ELITE emphasis prepare MEng students to lead in business and entrepreneurial activities.

The Entrepreneurship Hatchery

One of two in-house accelerators, The Entrepreneurship Hatchery, which will have a new home in the CEIE, provides mentoring, networking, and financial and other resources to enable our students to develop and launch businesses. Established in 2012, the Hatchery nurtures a culture of entrepreneurship within the U of T community through a comprehensive suite of programs and services, including weekly Idea Markets, the Hatchery Speaker Series, Accelerator Weekend and the Hatchery Hackathon.

Hatchery Nest

Student teams inspired to launch their own startups can apply to the Hatchery Nest, a rigorous summer program that offers access to funds, 3D printers and fabrication facilities, lab space and the opportunity to engage with an experienced mentor. In 2016, the Hatchery Nest received 137 applications and accepted 52 teams, 14 of which competed at the Hatchery Demo Day in September, where they pitched their startups to investors and the U of T community. The Hatchery Nest has launched 55 startups since it began five years ago.

Hatchery LaunchLab

Established in fall 2016, the Hatchery LaunchLab provides support for graduate student and faculty-led research-based startups. Teams benefit from enriched support, including legal counsel, accounting and marketing services, an advisory board comprised of experts in technical and business development, as well as mentors with experience in the industries in which the startups hope to compete and funding for an extended incubation period of one to two years. The goal is to enable these teams to sustain themselves while they complete the steps necessary to provide proof-of-concept for their technology and attract investment from venture capitalists. Ten teams applied to Hatchery LaunchLab's initial cohort and three were accepted:

- **Aurorem** — Provides lighting solutions that mimic the spectrum of natural sunlight, with the goal of improving the physical and mental health of people who work indoors.
- **Trexo Robotics** — Builds robotic exoskeletons that could be used to ease physiotherapy treatment for children with cerebral palsy or other physical disabilities.
- **SensOR** — Aims to help surgeons gain greater control over tools that are remotely or robotically operated. The company has created a thin film that easily wraps around any surgical instrument and translates physical force into data that can be easily visualized.

Start@UTIAS

Start@UTIAS, the second Faculty accelerator, was established in 2014 with a \$1-million donation from entrepreneur Francis Shen (EngSci 8T1, UTIAS MASc 8T3). It provides UTIAS graduate students with mentoring, networking, seed funding and other resources to translate the knowledge and competencies they have gained through their education into successful startups.

Professional Experience

U of T Engineering’s internship programs enable undergraduate students to enhance their technical and professional competencies and gain valuable work experience before they graduate.

The Professional Experience Year (PEY) program is the largest optional paid internship of its kind in Canada and a key part of our Faculty’s commitment to experiential learning. It enables undergraduates who have completed their second or third year of study to enhance their technical competencies, build meaningful work experience and strengthen their professional networks. PEY students immerse themselves in engineering practice with companies ranging from startups to major multinational corporations. During this period, which lasts 12 to 16 months, they are full-time employees, with a competitive salary. PEY internships allow students to gain greater insights into workplace operations and make larger contributions than in the shorter co-op placements that many engineering schools offer.

In 2016–2017, 734 undergraduates — including 66% of students from the previous year’s third-year class — participated in the PEY program. Sixty-five students secured international placements, and more than 325 employers hired PEY students, ranging from startups such as EventMobi to large multinational corporations such as Apple, Deloitte, IBM and Tesla Motors. The average annual salary for engineering PEY students in 2016-17 was \$47,000, with individual salaries ranging as high as \$88,000.

Students may also choose to participate in the Engineering Summer Internship Program (eSIP), a paid, four-month summer internship that is open to second- and third-year U of T Engineering undergraduates. Similar to a traditional co-op placement, the program provides students with work experience and prepares them to be competitive for future opportunities, including the PEY internship program.

To enhance student success in the recruitment process, eSIP offers intensive and interactive development through a series of large- and small-group workshops and individual career counselling appointments. In summer 2016, 30 students secured eSIP opportunities with employers such as the Toronto Transit Commission, Geomechanica Inc., Amphenol Canada Corp., BlueCat and Temporal Power Ltd.

The Engineering Career Centre (ECC) provides services to all students throughout the academic year to help them prepare applications, succeed in job interviews and make a positive impact in the workplace. The ECC is currently reinvigorating and strengthening its programming through initiatives, partnerships and stakeholder engagement. In 2016, we appointed a new Academic Director to oversee this transformation. A new Executive Director is expected to join the ECC in the coming year.

Figure 4.3a PEY Internship Placements for Engineering Undergraduates with Percentage Participation from Previous Third-Year Class, 2007–2008 to 2016–2017

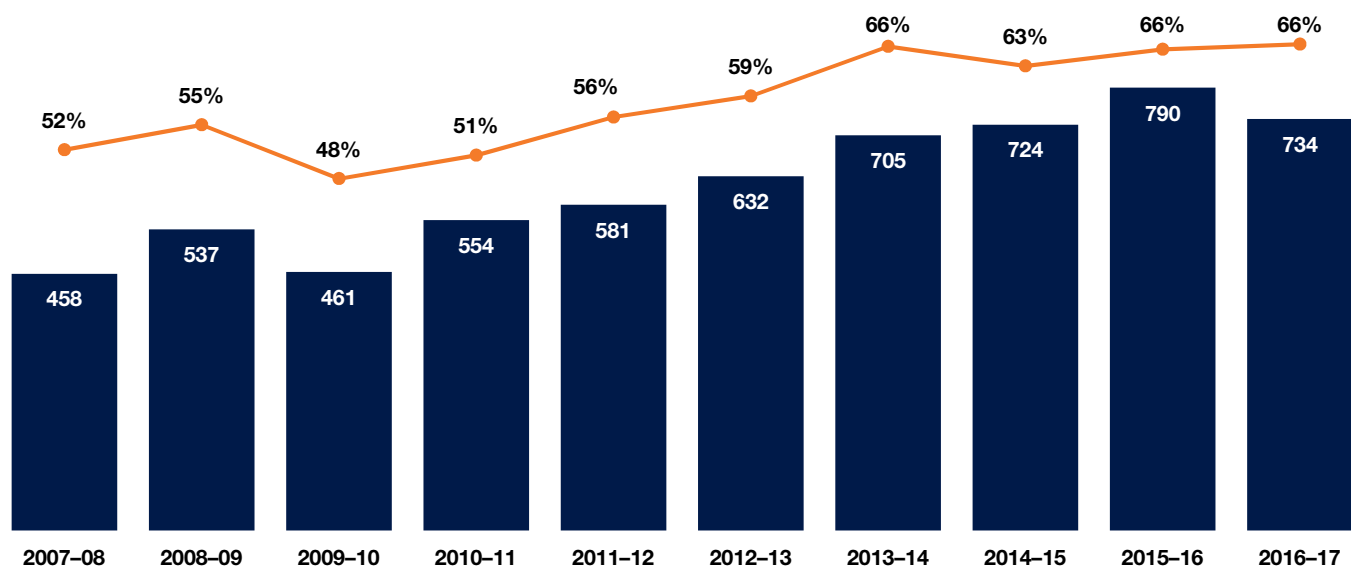


Figure 4.3b **Canadian and International PEY Internship Placements for Engineering Undergraduates, 2007–2008 to 2016–2017**

	Canadian Placements	U.S. Placements	Other International Placements	Total PEY Placements
2007–08	427	23	8	458
2008–09	490	31	16	537
2009–10	426	24	11	461
2010–11	530	11	13	554
2011–12	547	26	8	581
2012–13	592	24	16	632
2013–14	644	36	25	705
2014–15	663	42	19	724
2015–16	711	50	29	790
2016–17	669	49	16	734

Figure 4.3c **PEY Employers, 2008–2009 to 2016–2017**

PEY Employers who Hired Engineering Students	
2008–09	193
2009–10	158
2010–11	185
2011–12	221
2012–13	241
2013–14	304
2014–15	317
2015–16	310
2016–17	337

Engineering Communication

The Engineering Communication Program (ECP) is a hub for teaching, research and professional communication in engineering best practices. It provides support to all students, enabling them to develop professional communication competencies. ECP programming is integrated into courses across the curriculum from first to fourth year, and also includes writing and communication workshops and one-to-one tutoring. In 2016–2017, 868 students received communication support through the tutoring service, an increase of 4% from the previous year. The ECP also coordinates the undergraduate Certificate in Communication, which launched in 2015–2016. The certificate leverages the suite of humanities and social sciences electives that have been offered by ECP faculty since 2008.

The ECP engages five teaching-stream faculty members, 21 sessional lecturers and writing instructors, and 11 teaching assistants in its programming. It also supports two internship programs that are specifically designed to enable undergraduate students to develop the competencies and experience they need for the workplace: PEY and eSIP.

The ECP continues to develop our Professional Language Support for multilingual students. In 2016–17, we piloted the Diagnostic English Language Needs Assessment for all incoming first-year students to enable us to better understand their language challenges and provide additional workshops and tutoring.

Student Clubs and Teams

Our students nurture their passions and interests through close to 100 U of T Engineering student clubs and teams, ranging from the Skule™ Arts Festival to the Blue Sky Solar Racing team, as well as hundreds of student activities across U of T. Students can document these activities in the U of T Co-Curricular Record (CCR), an official document that recognizes competencies gained through athletic teams, student government, cultural clubs, design teams and other campus organizations. In 2016–2017, 70 new positions were recognized by the CCR.

In 2016–2017, 100 undergraduate and graduate engineering student initiatives received \$360,174 through the Engineering Centralized Process for Student Initiative Funding, an increase of \$110,908 over the previous year. *(Please see Appendix B for a full list of student clubs and teams.)*