2

The exceptional quality of our research- and professional-stream graduate programs and outstanding global reputation for engineering research and education continue to attract graduate students in strong numbers. Overall enrolment in our professional (MEng and MHSc) and research-stream (MASc) master's programs increased by 8% from the previous year, bringing our graduate student cohort, including PhD candidates, to 2,365.

We continue to enhance and broaden our MEng offerings, which enable practicing engineers to gain specialized technical knowledge and develop leadership and other professional competencies that will advance their careers. In fall 2016, we launched two new programs — an MEng in Biomedical Engineering and an emphasis in Aerial Robotics — and we will add to our robust curriculum in fall 2017 with new emphases in Forensic Engineering, and Analytics. Demand for our MEng programs was particularly strong in 2016–2017, with applications from international and domestic students each growing by more than 10%.

Multidisciplinary collaboration remains a priority for U of T Engineering. In fall 2017, we will expand our research-stream curriculum with a cross-Faculty Collaborative Master's Specialization in Psychology and Engineering (PsychEng) for Mechanical & Industrial Engineering MASc students and psychology MA students in the Faculty of Arts & Science.

U of T Engineering attracts competitive applicants from across Canada and around the world to our MASc programs. Events, such as Graduate Research Days and a nationwide recruitment tour held in partnership with some of the country's top engineering schools, have enabled us to draw more domestic applicants to our research-stream programs.

Building on the success of the Prospective Professors in Training program, which prepares PhD candidates for the next step in their academic careers, we will launch a parallel program in fall 2017 to support PhD students who will pursue careers in industry and other non-academic settings.

Enrolment

As our programs continue to attract top students from across Canada and around the world, graduate enrolment increased in both size and diversity in 2016–2017. A total of 2,365 students pursued graduate degrees, up 4.7% from the previous year and 67.6% from a decade ago.

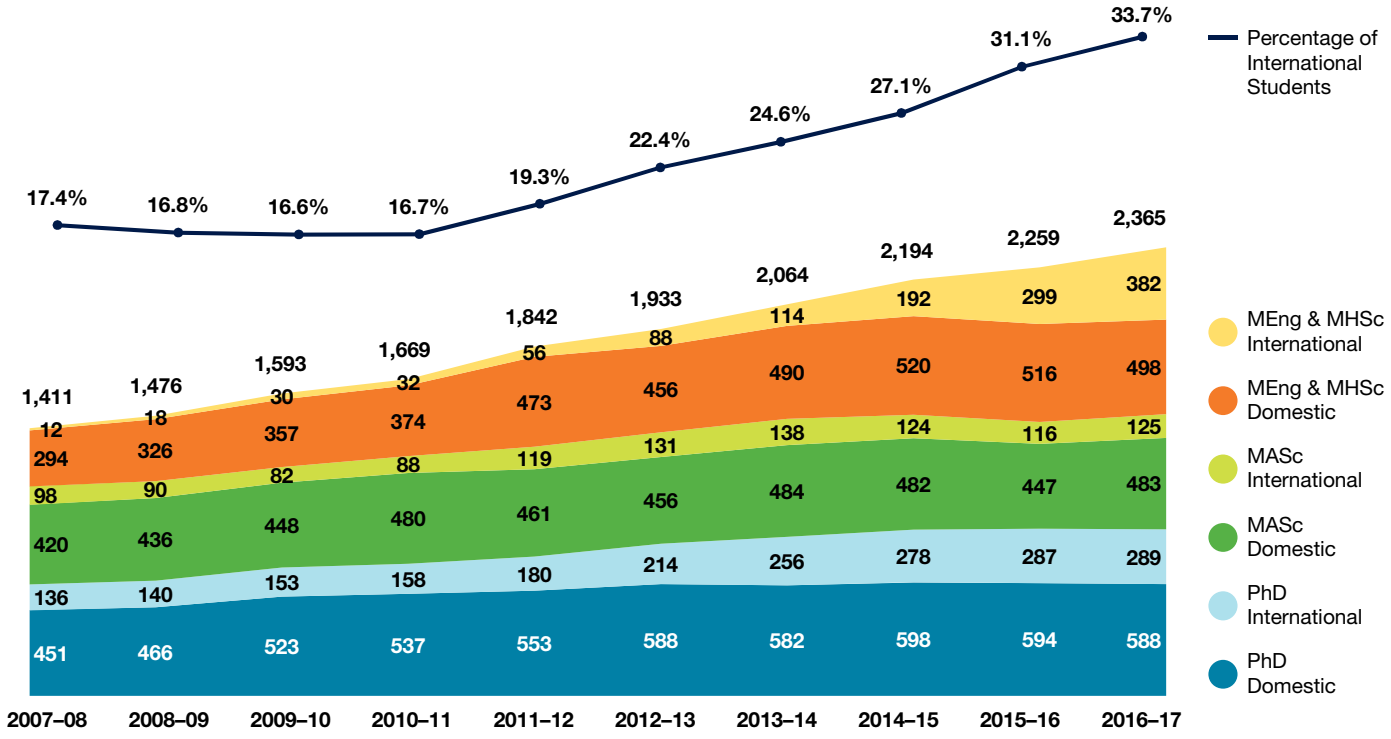
We increased the proportion of graduate students in our overall student body from 23.8% to 32.9% in the past 10 years, bringing us closer to our Academic Plan goal of 40% graduate students and 60% undergraduates, and strengthening our position as a leader in research-based and professional graduate education.

Shown in Figure 2.1b, women accounted for 26.1% of our graduate student population, a proportion that is expected to rise over the next few years as the proportion of women in undergraduate engineering programs continues to grow. In 2016, women comprised 40.1% of our entering undergraduate cohort and 30.0% of our overall undergraduate population, expanding the future pool of women applicants for graduate studies. The proportion of international graduate students rose to 33.7% from 31.1% one year ago.

The total number of students pursuing professional master's degrees increased to 880 in 2016–2017, up 8% from the previous year and more than two-and-a-half times the enrolment of a decade ago. MEng and MHSc students now comprise 59% of all U of T Engineering master's students on a full-time equivalent basis.

As with our professional master's programs, enrolment in our research-stream master's program increased 8% over the previous year, while PhD enrolment remained steady.

Figure 2.1a **International and Domestic Graduate Students by Degree Type, with Percentage of International Students, 2007–2008 to 2016–2017**



Data in this chapter are presented by academic year (September to August) unless otherwise noted. Highlights are from June 2016 to July 2017.

Note 2.1a: Student counts are shown as of November 1.

Figure 2.1b **Graduate Students by Degree Type and Gender with Percentage of Women Students, 2007–2008 to 2016–2017**

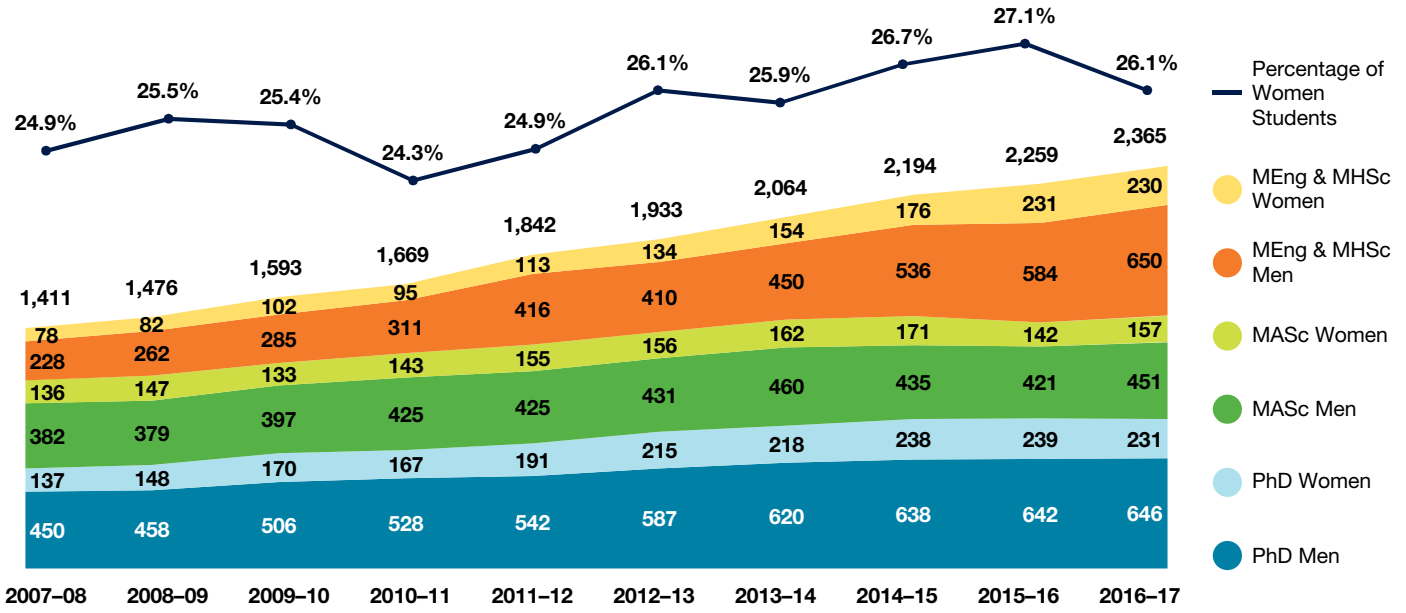


Figure 2.1c **Graduate Student Enrolment by Full-Time Equivalent (FTE) and Headcount (HC) by Academic Area, 2007–2008 to 2016–2017**

		UTIAS	IBBME	ChemE	CivE	ECE	MIE	MSE	Total
2007–08	FTE	105.0	115.0	150.0	183.3	438.1	227.3	71.2	**1,289.9**
	HC	105	115	157	212	478	270	74	**1,411**
2008–09	FTE	122.9	140.0	167.8	184.0	415.4	237.1	82.8	**1,350.0**
	HC	125	140	179	219	442	284	87	**1,476**
2009–10	FTE	130.6	153.0	209.1	200.2	421.5	284.3	70.4	**1,469.1**
	HC	132	153	221	238	453	320	76	**1,593**
2010–11	FTE	140.9	168.0	195.4	212.6	403.0	339.2	68.5	**1,527.6**
	HC	143	168	208	256	431	391	72	**1,669**
2011–12	FTE	143.2	199.0	202.3	229.8	437.7	382.6	68.2	**1,662.8**
	HC	146	199	217	276	479	454	71	**1,842**
2012–13	FTE	146.7	208.3	193.2	243.3	504.8	387.2	68.2	**1,751.7**
	HC	153	209	203	279	565	453	71	**1,933**
2013–14	FTE	162.1	219.0	209.9	290.5	509.8	436.2	90.9	**1,918.4**
	HC	167	219	219	322	556	488	93	**2,064**
2014–15	FTE	182.4	228.0	238.0	293.1	531.5	511.2	80.3	**2,064.5**
	HC	188	228	245	312	577	563	81	**2,194**
2015–16	FTE	143.2	241.0	253.0	299.4	591.5	532.9	79.0	**2,140.0**
	HC	146	241	260	326	637	570	79	**2,259**
2016–17	FTE	178.2	269.0	245.0	306.3	577.0	580.3	92.3	**2,248.1**
	HC	181	269	252	335	619	616	93	**2,365**

Note 2.1b: Student counts are shown as of November 1.
Note 2.1c: A difference between FTE and HC exists only when discussing part-time students. At U of T Engineering, MEng candidates are the only graduate students who can pursue their studies on a part-time basis.

Figure 2.1d **Comparison of MASc and MEng/MHSc Full-Time Equivalent Enrolment Trends, 2007–2008 to 2016–2017**

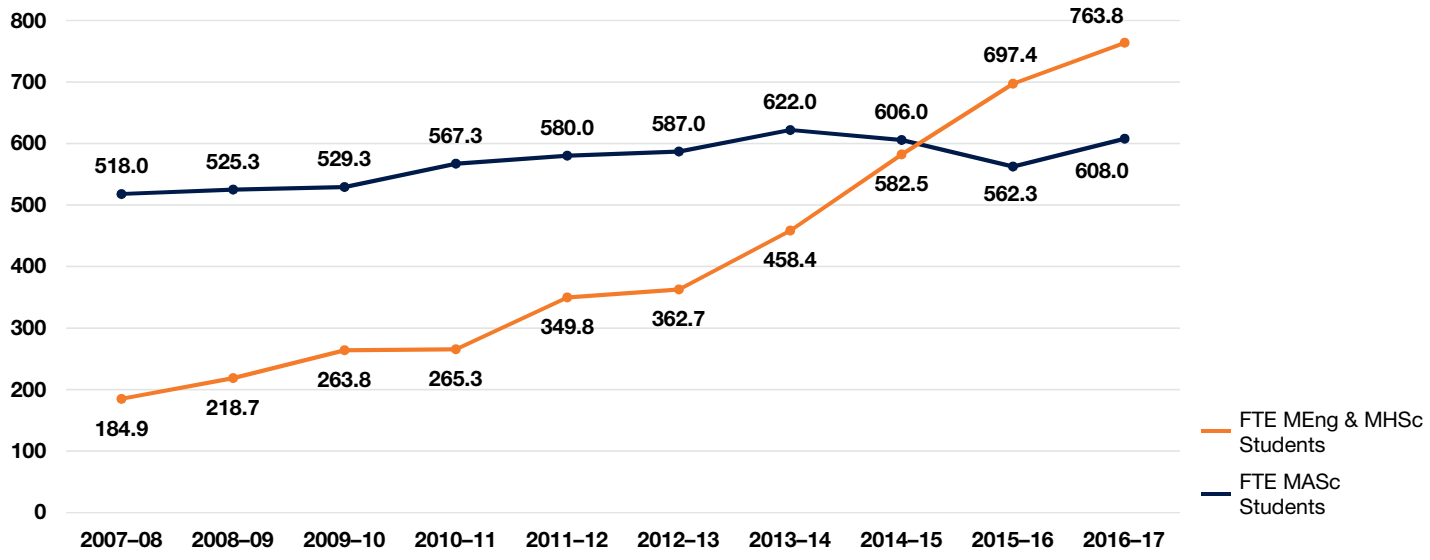
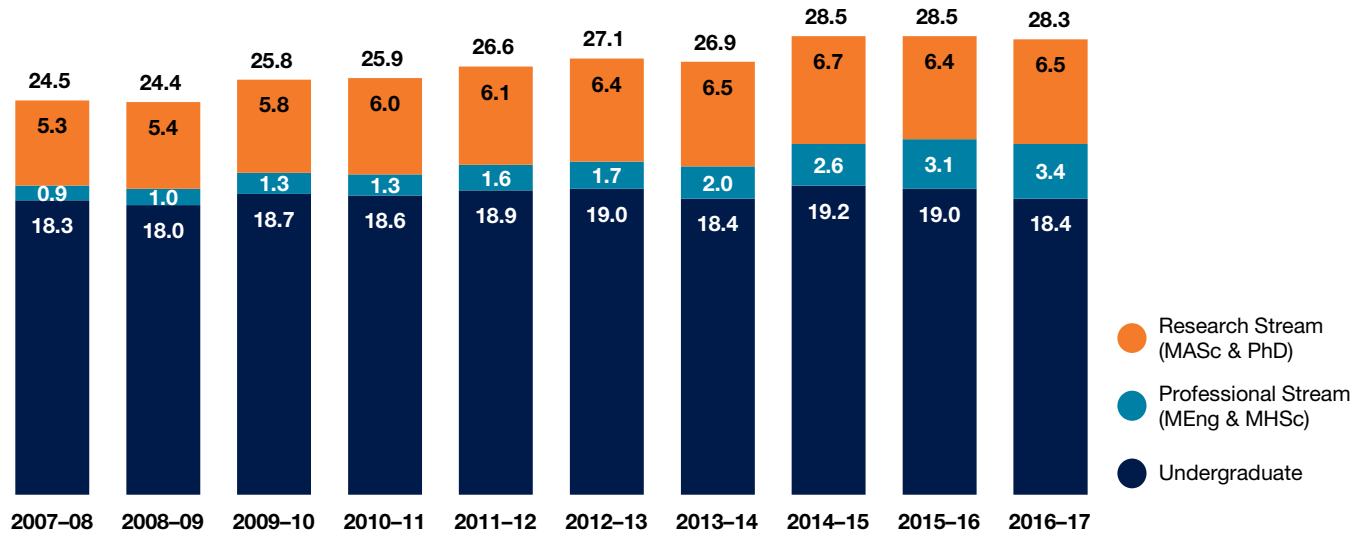


Figure 2.2a **Undergraduate and Graduate Full-Time Equivalent Students per Faculty Member, 2007–2008 to 2016–2017**



Note 2.2a: To allow more accurate comparisons, undergraduate FTEs are determined by counting each part-time student as 0.3 FTE.

Figure 2.2b **Ratio of Undergraduate to Graduate Full-Time Equivalent Students, 2007–2008 to 2016–2017**

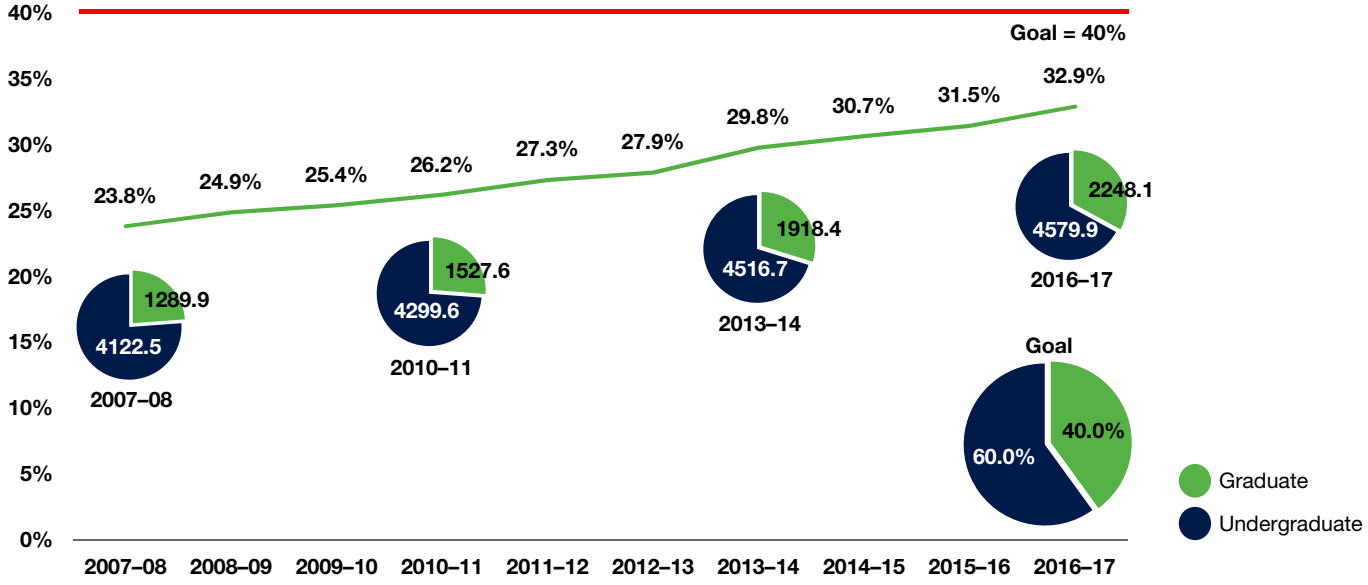
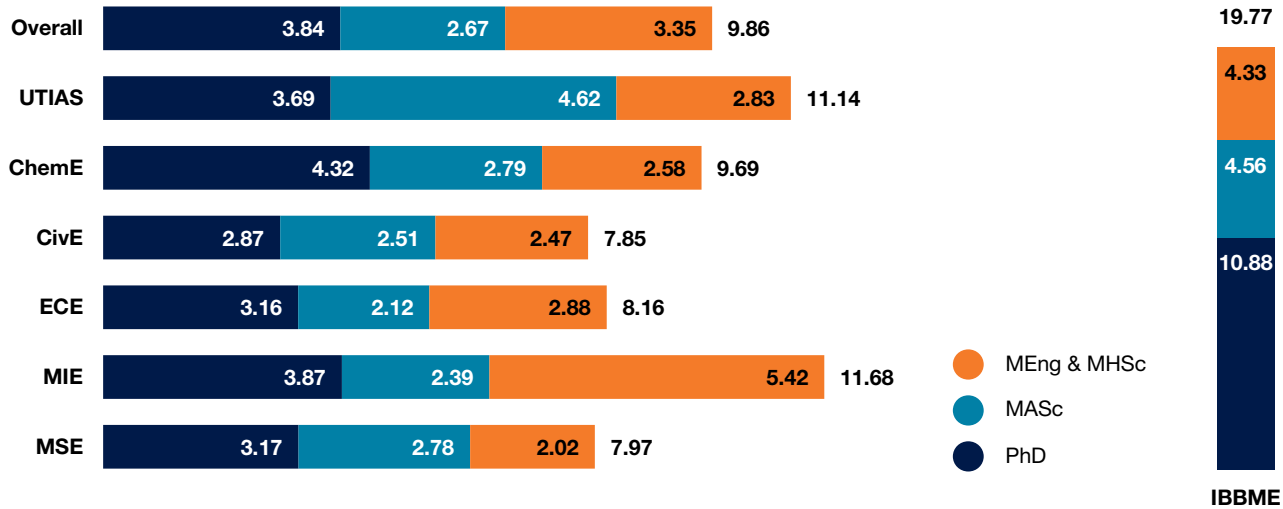


Figure 2.2c **Full-Time Equivalent Graduate Students per Faculty Member by Academic Area and Degree Type, 2016–2017**



Note 2.2b: Students on Professional Experience Year internships are not included in this count.
Note 2.2c: Some students in IBBME are supervised by faculty members from the Faculties of Medicine and Dentistry and affiliated hospitals, as well as from other departments within U of T Engineering. Because the ratio includes only faculty with a budgetary appointment in IBBME, comparisons with other Engineering departments are not possible. For that reason, this figure shows IBBME in a visually distinct way. In cases of inter-departmental supervision within the Faculty, PhD and MASc students are assigned 100% to their primary supervisor's department.

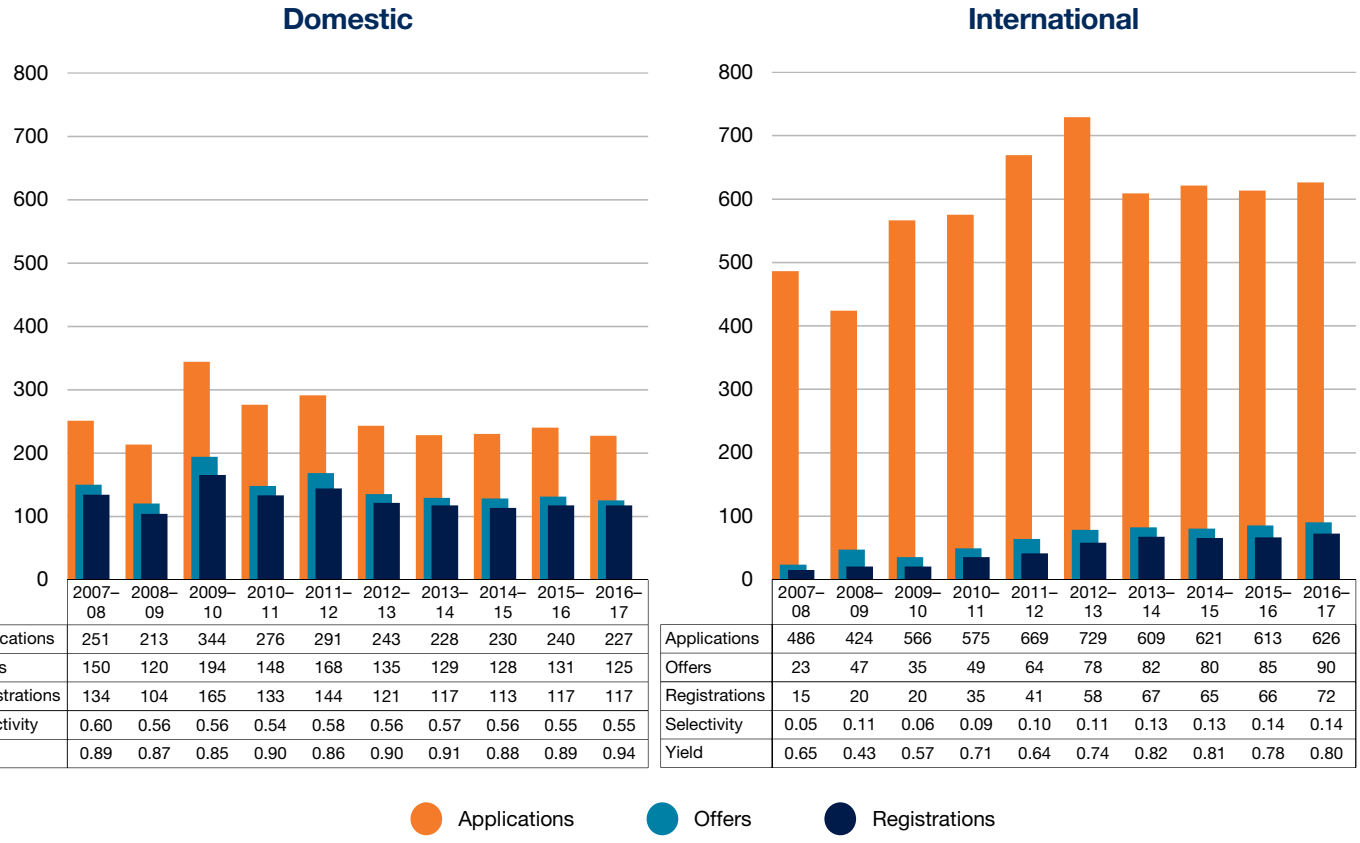
Recruitment and Admissions

The increase in graduate applications in 2016–2017 reflects both the growing demand for MEng programs that offer practicing engineers advanced technical and professional competencies, and rising interest from international students.

Applications to our MEng program from both international and domestic candidates increased by more than 10% compared with 2015–2016. International students made up 44% of new registrations, up from 41% the previous year and just 8% a decade ago. Domestic applications to our MASc programs rose 6%, while overall MASc enrolment increased 8%, a favourable response to our enhanced offerings and national recruitment efforts.

Applications to our PhD programs and registrations remained consistent with 2015–2016. The number of students who have fast-tracked from their MASc programs into PhD programs has remained steady over the past four years, ranging from 36 to 43 students per year. The number of students who entered PhD programs directly after completing their undergraduate degrees has risen for the second consecutive year to 15 in 2016–2017 — three times what it was two years ago — and the number of departments that now offer direct-entry PhD admission rose from three to five.

Figure 2.3 Applications, Offers, Registrations, Selectivity and Yield of PhD Students, 2007–2008 to 2016–2017



	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	251	213	344	276	291	243	228	230	240	227
Offers	150	120	194	148	168	135	129	128	131	125
Registrations	134	104	165	133	144	121	117	113	117	117
Selectivity	0.60	0.56	0.56	0.54	0.58	0.56	0.57	0.56	0.55	0.55
Yield	0.89	0.87	0.85	0.90	0.86	0.90	0.91	0.88	0.89	0.94

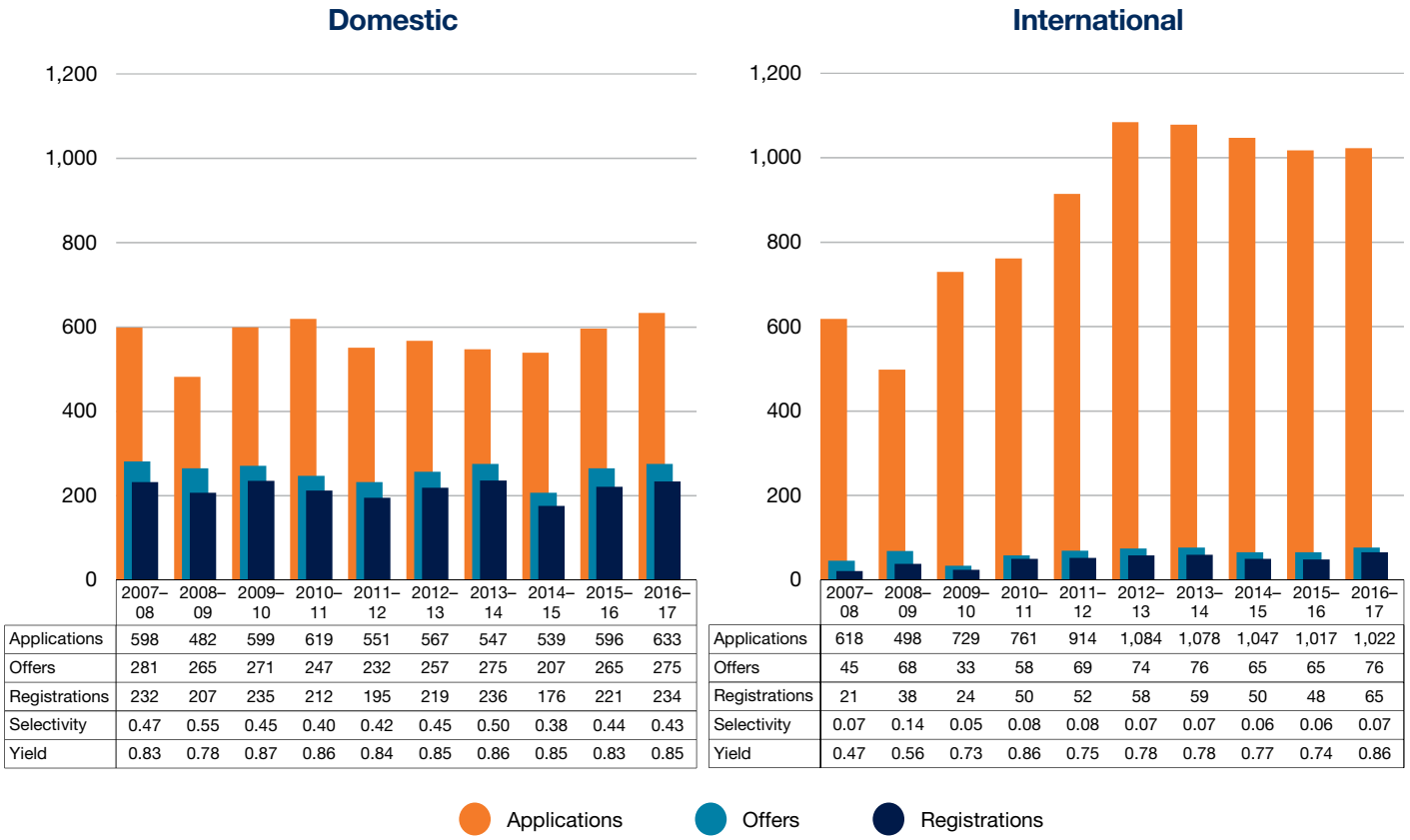
	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	486	424	566	575	669	729	609	621	613	626
Offers	23	47	35	49	64	78	82	80	85	90
Registrations	15	20	20	35	41	58	67	65	66	72
Selectivity	0.05	0.11	0.06	0.09	0.10	0.11	0.13	0.13	0.14	0.14
Yield	0.65	0.43	0.57	0.71	0.64	0.74	0.82	0.81	0.78	0.80

Note 2.3: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada. Students who have fast-tracked from MASc programs into PhD programs are counted in this figure as applications, offers and admissions. This is a change from previous annual reports.

Once again we undertook a number of strategic initiatives to encourage the top students from across Canada to apply to our research-stream programs:

- We held the U of T **Graduate Engineering Fair** and six similar events across the country in partnership with Canada's leading engineering schools: University of Alberta, McMaster University, University of British Columbia, Queen's University, McGill University and University of Waterloo.
- In February 2017, we hosted 139 of the top students from across Canada at our third **Graduate Research Days**. This event enables students to learn more about our programs, discover the innovative research being conducted by our faculty members and graduate students, and meet prospective supervisors.

Figure 2.4 Applications, Offers, Registrations, Selectivity and Yield of MASc Students, 2007–2008 to 2016–2017



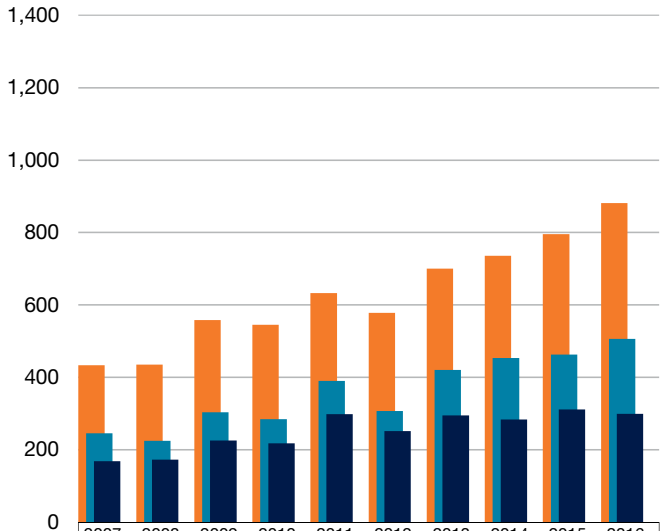
Domestic	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	598	482	599	619	551	567	547	539	596	633
Offers	281	265	271	247	232	257	275	207	265	275
Registrations	232	207	235	212	195	219	236	176	221	234
Selectivity	0.47	0.55	0.45	0.40	0.42	0.45	0.50	0.38	0.44	0.43
Yield	0.83	0.78	0.87	0.86	0.84	0.85	0.86	0.85	0.83	0.85

International	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	618	498	729	761	914	1,084	1,078	1,047	1,017	1,022
Offers	45	68	33	58	69	74	76	65	65	76
Registrations	21	38	24	50	52	58	59	50	48	65
Selectivity	0.07	0.14	0.05	0.08	0.08	0.07	0.07	0.06	0.06	0.07
Yield	0.47	0.56	0.73	0.86	0.75	0.78	0.78	0.77	0.74	0.86

Note 2.4: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

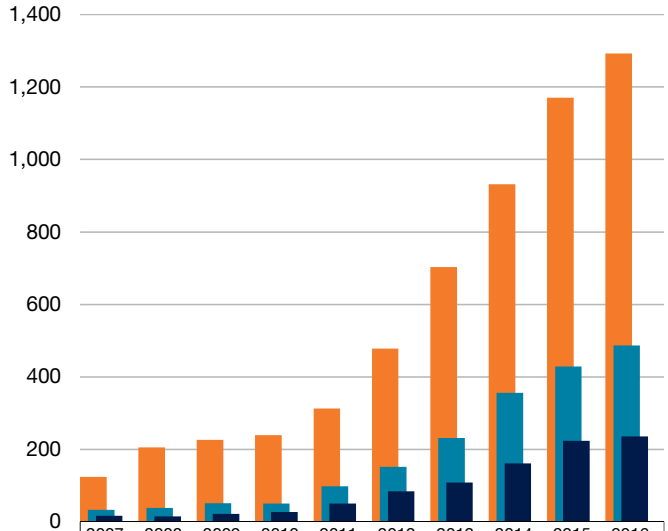
Figure 2.5 **Applications, Offers, Registrations, Selectivity and Yield of MEng and MHSc Students, 2007–2008 to 2016–2017**

Domestic



	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	433	435	558	545	632	578	700	735	795	881
Offers	245	224	303	284	390	306	420	453	462	506
Registrations	168	172	225	217	298	251	294	283	311	299
Selectivity	0.57	0.51	0.54	0.52	0.62	0.53	0.60	0.62	0.58	0.57
Yield	0.69	0.77	0.74	0.76	0.76	0.82	0.70	0.62	0.67	0.59

International



	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Applications	124	205	226	239	312	478	703	931	1,170	1,292
Offers	33	38	51	50	98	151	231	356	428	486
Registrations	16	15	22	27	50	84	108	161	223	235
Selectivity	0.27	0.19	0.23	0.21	0.31	0.32	0.33	0.38	0.37	0.38
Yield	0.48	0.39	0.43	0.54	0.51	0.56	0.47	0.45	0.52	0.48

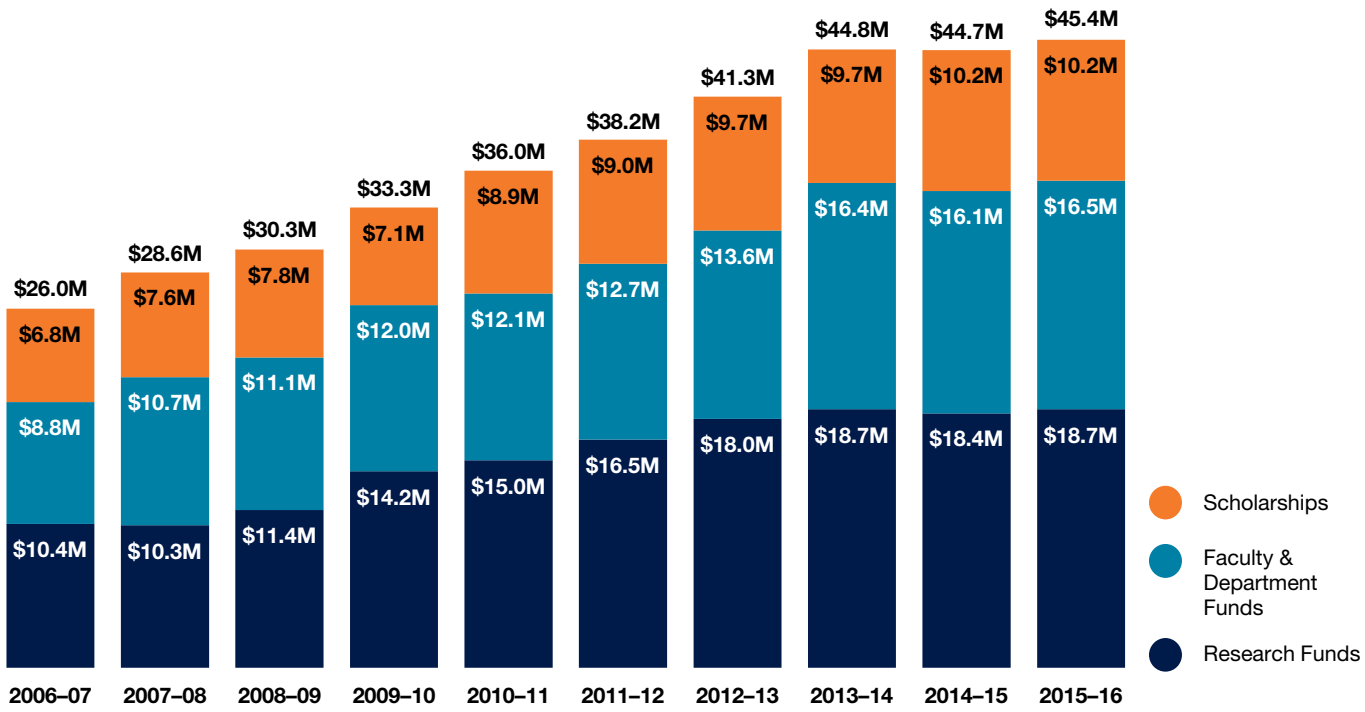
Note 2.5: Student counts are shown as of November 1. Selectivity = offers ÷ applications and represents the proportion of applicants who were offered admission. Yield = registration ÷ offers. Domestic students are defined as citizens (living in Canada or abroad) or permanent residents of Canada.

Funding

Overall graduate student funding for 2015–2016 (the last year for which we have data) increased 1.6% over the previous year. Total scholarship funding, including the Natural Sciences and Engineering Research Council of Canada (NSERC), Ontario Graduate Scholarships (OGS), other external scholarships and a variety of U of T scholarships, remained at $10.2 million. NSERC funding has remained constant since 2006-2007.

In fall 2017, we will increase the minimum stipend for MASc and PhD students. MASc students will receive a minimum of $15,500, an increase of $500 per year, and in fall 2018 they will receive a minimum of $16,000. PhD candidates will receive a minimum of $17,000 per year, up from $15,000. However, most students earn more than the minimum as a result of scholarships and teaching assistantships, so the average engineering graduate student stipend for those in the funded cohort is approximately $25,000 per year.

Figure 2.6a **Graduate Student Funding by Category, 2006–2007 to 2015–2016**



Note 2.6a: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Figure 2.6b **Graduate Student Funding by Category and Academic Area, 2015–2016**

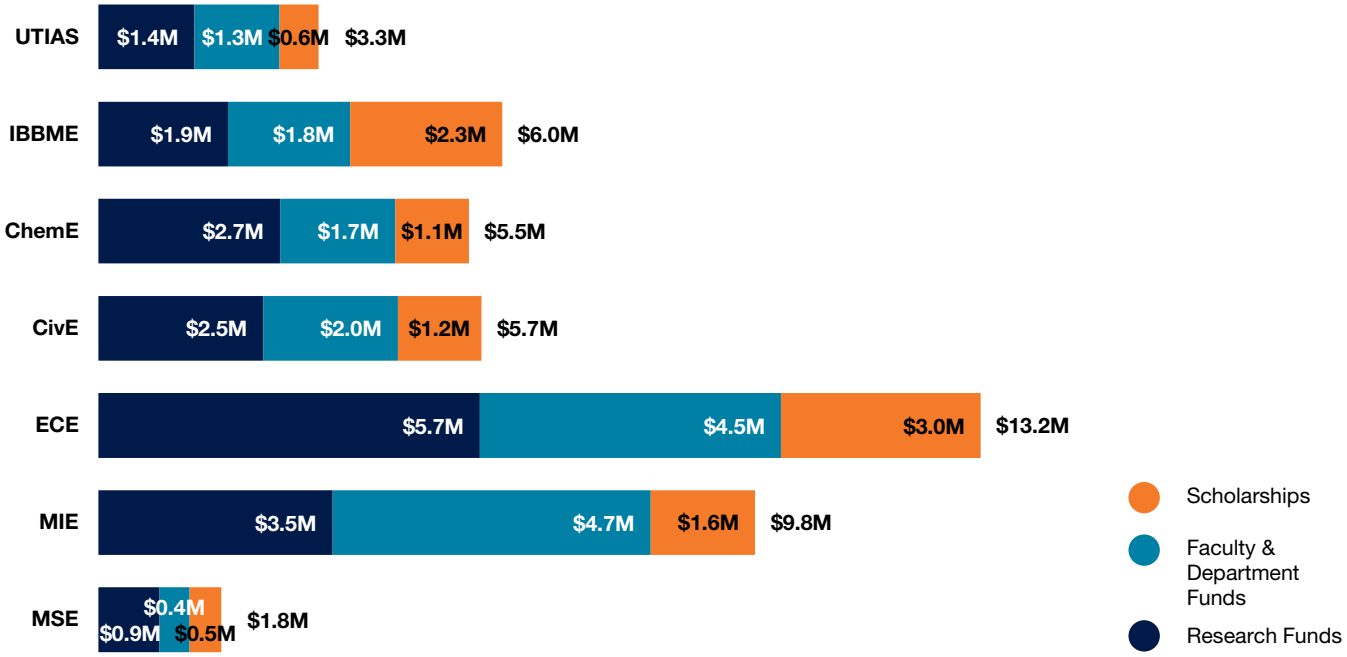
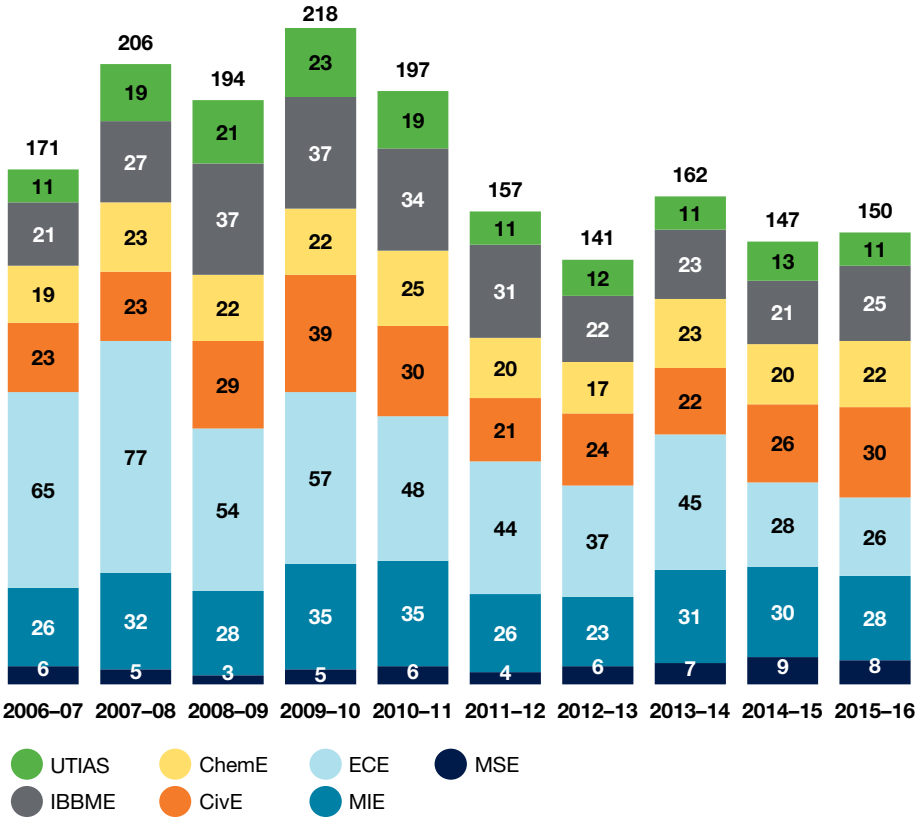


Figure 2.7a **Total External Graduate Student Scholarships by Source, 2006–2007 to 2015–2016**

	NSERC	OGS	External-Other	Total
2006–07	$3,228,150	$1,088,332	$31,100	$4,347,582
2007–08	$3,827,494	$930,000	$68,167	$4,825,661
2008–09	$3,737,157	$868,332	$111,770	$4,717,259
2009–10	$4,393,513	$853,334	$203,167	$5,450,014
2010–11	$4,396,617	$1,036,675	$179,580	$5,612,872
2011–12	$3,765,883	$1,593,328	$256,860	$5,616,071
2012–13	$3,374,183	$1,583,333	$285,501	$5,243,017
2013–14	$3,759,671	$1,236,666	$582,170	$5,578,507
2014–15	$3,488,447	$1,336,670	$877,587	$5,702,704
2015–16	$3,315,223	$1,223,331	$926,787	$5,465,341

Note 2.6b: Data were obtained from the new Student Accounts Reporting Cube. Data for previous annual reports were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.
Note 2.7a: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Figure 2.7b **Number of NSERC Graduate Student Award Recipients by Academic Area, 2006–2007 to 2015–2016**



Note 2.7b: Data from 2009–2010 onward were obtained from the new Student Accounts Reporting Cube. Data for prior years (and for all years in previous annual reports) were obtained from the Graduate Student Income Reporting Cube. For more information, see Data Sources.

Graduate Studies Completion

Degrees awarded increased 4% over the previous year, while the number of MEng degrees increased by 15%. The number of women who earned degrees increased 18% between 2016 and 2017 and more than 165% in the past decade.

Figure 2.8a **Number of Students Fast-Tracked from MASc to PhD by Academic Area, 2007–2008 to 2016–2017**

	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
UTIAS	2	8	6	5	2	5	6	10	1	3
IBBME	8	5	12	8	5	8	8	12	14	8
ChemE	4	7	11	4	8	7	14	8	5	7
CivE	4	5	3	2	5	2	3	1	5	5
ECE	2	0	1	6	4	2	4	5	4	3
MIE	8	7	7	6	6	6	5	2	8	13
MSE	2	3	1	3	7	1	3	4	2	2
Total	**30**	**35**	**41**	**34**	**37**	**31**	**43**	**42**	**39**	**41**

Figure 2.8b **Number of Direct-Entry PhD Students by Academic Area, 2008–2009 to 2016–2017**

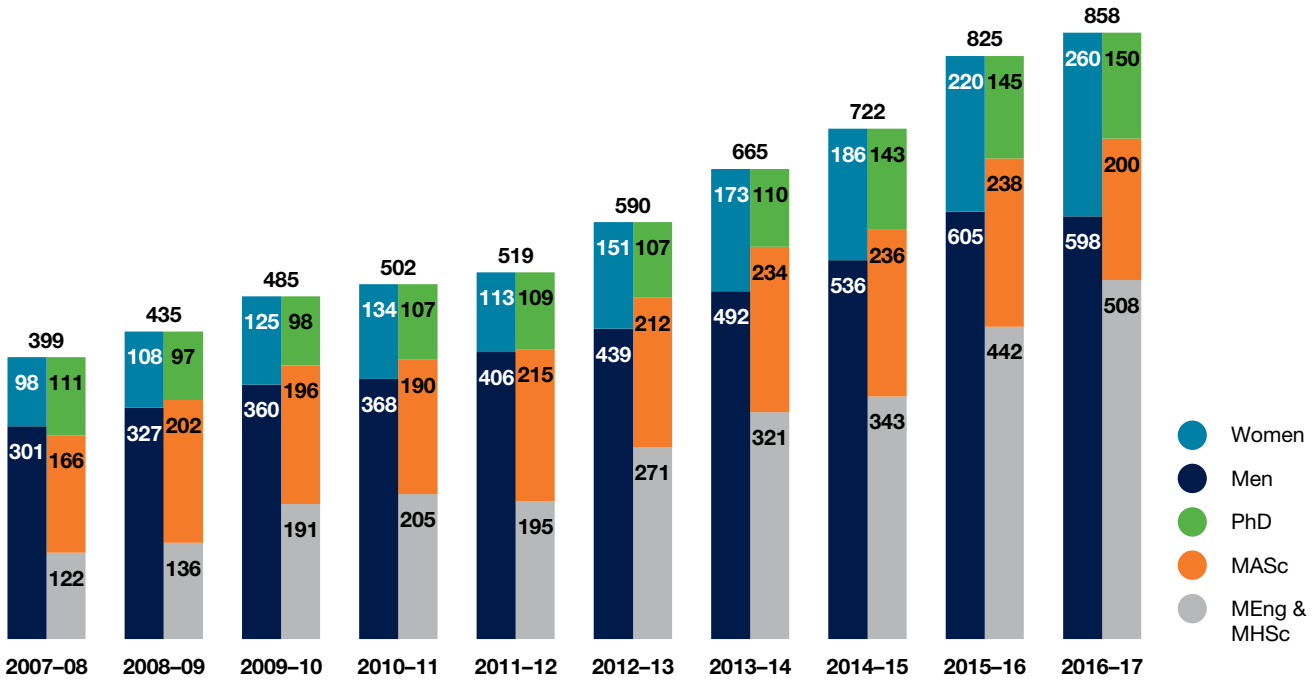
	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
IBBME	1	6	6	5	5	7	3	5	7
ChemE				1				5	1
CivE									1
ECE							2	2	2
MIE				1	1				4
Total	**1**	**6**	**6**	**7**	**6**	**7**	**5**	**12**	**15**

Note 2.8a and b: For counting purposes, the academic year is from May to April.

Figure 2.9 **Time to Completion for PhD, MASc, MEng and MHSc Students, 2007–2008 to 2016–2017**

	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
PhD	4.7	4.7	4.7	5.3	5.0	5.3	5.2	5.3	5.3	5.3
MASc	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MEng & MHSc (FT)	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0
MEng (ExtFT)								1.3	1.7	1.7
MEng (PT)	2.0	2.3	2.3	2.3	2.0	2.0	2.0	2.0	2.0	2.3

Figure 2.10 **Graduate Degrees Awarded by Degree Type and Gender, 2007–2008 to 2016–2017**



Enriching the Graduate Student Experience

We continue to strengthen curricular and co-curricular offerings to ensure our graduate students receive the most rigorous and comprehensive preparation possible, whether they aspire to a career in academia, industry or other fields.

Our professional master's programs enable students to gain specialized technical knowledge and develop leadership and other professional competencies to advance their careers. MEng students apply through one of seven departments and institutes and can select from among a growing number of optional emphases, including Aerial Robotics and Forensic Engineering.

The Entrepreneurship, Leadership, Innovation & Technology in Engineering (ELITE) emphasis continues to be the most popular of these emphases. In 2016–2017, 137 students completed an ELITE emphasis, an increase of 10% over the previous year. We expanded our ELITE curriculum to include two new courses in 2016–2017:

- APS 1038 Strategic Sustainability Management for Business and Products
- APS 1040 Quality Control for Engineering Management

We launched an MEng in Biomedical Engineering in fall 2016 with an initial cohort of seven students. The innovative program focuses on biomedical device design and requires students to undertake applied design challenges as well as a four-month internship. In winter 2017, we piloted an MD-MEng dual-program stream to enable MD students to complete both degrees in parallel. Nine students participated in the initial cohort.

New initiatives for 2017–2018:

- **Cross-Faculty Collaborative Master's Specialization in Psychology and Engineering (PsychEng)** – The collaborative specialization will involve the Department of Mechanical & Industrial Engineering and the Department of Psychology in the Faculty of Arts & Science, and will facilitate and promote applied research at the intersection of engineering and psychology.
- **MEng emphasis in Forensic Engineering** – This emphasis will recognize specialized work by graduate students in areas related to forensic engineering, including assessment of deterioration in infrastructure, product quality and product failure, and procedural practice improvement as a result of investigations. The direct impact of forensic engineering is to improve engineering design practices and the revision of codes and standards to improve public safety.
- **MEng emphasis in Analytics** – This emphasis will provide students with techniques and strategies to translate large data sets into useful insights for sectors, including manufacturing, transportation, banking and health care.
- Part-time option to the **MEng in Biomedical Engineering**, which will be made available to U of T medical students and those who are currently employed full-time. It is expected to attract the interest of current professionals in the biomedical industry and to promote linkages with industry as well as cross-Faculty interactions among classmates.

We are also developing a PhD Career Development Program, a complementary program to our Prospective Professors in Training (PPIT) program that will support PhD candidates with career aspirations outside of academia. The program will be piloted through the Institute for Leadership Education in Engineering (ILead) in fall 2017 and will include workshops and seminars on topics such as transferable skills for the non-academic workplace and professional networking.

(To read more about programs that enrich the graduate student experience, please see Chapter 4: Cross-Faculty Education and Experiential Learning.)

Figure 2.11 **ELITE Emphases Awarded, 2008–2009 to 2016–2017**

	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
AeroE		1	2		7	2	4	11	1
ChemE		2	12	11	17	8	20	20	18
CivE	3	11	13	11	9	12	12	24	22
ECE		3	3	3	22	32	22	14	28
MIE		7	19	20	26	36	39	50	53
MSE			1	1	4	6	11	5	15
Total	**3**	**24**	**50**	**46**	**85**	**96**	**108**	**124**	**137**

Selected Graduate Student Highlights

Stem cell-based gene test predicts patient risk in acute myeloid leukemia

Stanley W.K. Ng (IBBME PhD candidate) led the development of a new, rapid gene expression test that could help clinicians determine the best management for patients with acute myeloid leukemia (AML). The standard treatment for AML is intensive chemotherapy, however it is difficult to predict whether a patient will respond well or might do better with novel therapies offered by clinical trials. The current genetic tests used to estimate patient risk level typically take weeks to arrive. By contrast, Ng's test makes it possible to accurately predict a patient's response to chemotherapy within 24 to 48 hours of diagnosis. The test is the result of a collaboration between U of T's Faculties of Applied Science & Engineering and Medicine, the Princess Margaret Cancer Centre in Toronto, and leukemia clinics in France, Germany and the Netherlands.

HEQCO report shows success of ILead-developed team effectiveness tool

Patricia Sheridan (MechE 0T9, MASc 1T1, ChemE PhD candidate), who will join the Faculty as an Assistant Professor in summer 2017, has designed, built and tested a web-based tool to help students improve their communication, relationship-building and team problem-solving competencies in large classroom environments. The tool, called the Team Effectiveness Learning System (TELS), invites students to assess their own performance and that of their teammates at critical junctures. It then delivers detailed individual and team feedback to students, as well as instructors, to gain a better understanding of how they can support both individual students and teams to ensure their success. A study by the Higher Education Quality Council of Ontario (HEQCO) found that TELS was effective at helping students understand their strengths and weaknesses, as opposed to open, unstructured feedback opportunities, which often only highlight what a student already does well. Sheridan's research, supervised by Professors Doug Reeve and Greg Evans (both ChemE), is part of the Collaborative Program in Engineering Education.

U of T Engineering doctoral students receive $150,000 Vanier Scholarships

Four graduate students working to improve drug delivery to tumours using lasers, customize tissues to repair hearts damaged by disease or injury, optimize the distribution of automated external defibrillators in cities, and increase data download speeds have won Vanier Canada Graduate Scholarships for 2017. Worth $50,000 per year for three years, Vanier Scholarships are awarded by the Government of Canada to doctoral students at Canadian universities who demonstrate excellence in three areas: academics, research impact and leadership.