LIBRARY SUPPORT FOR Graduate Studies in Engineering (MASc, MEng, PhD, GDip)

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Summary and Recommendations

Overall, the library provides good support for graduate students in Engineering.

Collections:

Access to the broad literature related to engineering and computing is strong, with excellent e-journal, monograph, and index coverage. Library participation in national and provincial purchasing consortia results in better collections than would be expected at comparable, less well-connected institutions. The acquisition of e-books is rapidly replacing print, facilitating convenient desktop access. Access to standards is improving. With the ongoing rapid growth in Guelph's graduate engineering programs, the library has increased the acquisition of materials in mechanical engineering and various aspects of computer science & engineering.

The greatest challenges that engineering presents for library collections include the very high cost of biomedical/biotech and materials science resources, especially journals; and the difficulty in obtaining on-demand access to full suites of standards from bodies such as ISO and CSA. New journal subscriptions are added in response to demand and as budgets permit, and the library will subscribe to individual standards from TechStreet in response to faculty requests.

Services:

Beyond the collection, the library provides extensive services for engineering graduate students: Information Literacy librarians conduct guest lectures in select courses and offer individualized consultations. The Research and Scholarship team assists with advanced data, publishing, copyright, and methodological support. Learning and Writing specialists provide guidance on a variety of academic skills and offer English-as-an-additional-language support.

Perhaps the greatest challenge in supporting engineering graduate students is ensuring they are aware of library services and encouraged to use them. A recent survey indicated that supervisor support is the key factor in pursuing professional skills development for 75% of graduate students. We continually promote library services through various channels, but find that word of mouth is the most powerful referral source. As graduate student numbers increase, we continue to explore the best ways to maximize our reach. One area for possible development is the introduction of more online guides specifically tailored to engineering, as heretofore our focus has been on developing resources for undergraduate courses.

Another major challenge is meeting the rising demand for learning support services. In 2017-18, we provided more than 5,000 individual consultations, and more than 1,500 students registered on waiting lists. Many of our graduate offerings, including *Dissertation Boot Camp* and *Brain Food* workshops, are regularly oversubscribed. Support for English-as-an-additional-language students is also in high demand, with the number of participants in EAL programs tripling from 582 in 2016-17 to 1,532 in 2017-18. As the international student population continues to grow, we are looking for ways to increase program capacity.

Library Support: Collections

Journals

The library almost exclusively acquires online journals, providing access to more than 55,000 titles across all disciplines. The engineering collection is strong, and includes most major society publishers. Coverage of associated disciplines including chemistry, computer science, environmental science, food science, mathematics, physics, and various life sciences is very strong. Students can access nearly complete journal suites, in many cases back to the first volume, from publishers such as:

- American Chemical Society
- Am. Inst. Chemical Engineers (via Wiley)
- Am. Soc. Agricultural and Biological Engineers (ASABE)
- Am. Soc. Civil Engineers (ASCE)
- Am. Soc. Mechanical Engineers (ASME)
- Annual Reviews
- Assoc. Computing Machinery (ACM)
- Elsevier
- IEEE & IET
- Institute of Physics (IOP)
- Nature
- Royal Society of Chemistry
- SAGE
- Society for Industrial and Applied Mathematics (SIAM)
- Springer
- Taylor & Francis
- Wiley

Where gaps exist, it is generally for publishers to which the library subscribes to select titles rather than complete 'bundles.' Notable publishers in this category include the American Institute of Physics, Mary Ann Liebert, Nature specialty journals, and World Scientific. Society publisher gaps include ICE, IMechE, SAE, and SPIE. The library adds new subscriptions in response to evolving demand, as budgets permit.

The university has access to most of the high impact factor journals relevant to engineering and related disciplines, according to Clarivate's *Journal Citation Reports (JCR)* database (2017). By subject category:

JCR Subject Category	Guelph Access
Agricultural Engineering	13/14
Applied Mathematics	23/25
Automation & Control Systems	49/50
Biotech. & Applied Microbiology	25/25
Comp. Sci., Artificial Intelligence	23/25
Comp. Sci., Cybernetics	21/22
Comp. Sci., Hardware	25/25
Comp. Sci., Information Systems	22/25
Comp. Sci., Interdisciplinary	24/25
Comp. Sci., Software Engineering	25/25
Comp. Sci., Theory & Methods	24/25
Energy & Fuels	48/50
Engineering, Biomedical	24/25
Engineering, Chemical	25/25
Engineering, Civil	24/25

JCR Subject Category	Guelph Access
Engineering, Electrical	25/25
Engineering, Environmental	25/25
Engineering, Industrial	23/25
Engineering, Manufacturing	24/25
Engineering, Mechanical	49/50
Engineering, Multidisciplinary	45/50
Environmental Sciences	24/25
Food Science & Technology	50/50
Geosciences, Multidisciplinary	48/50
Green & Sustainable Sci. Tech.	30/33
Instruments & Instrumentation	48/50
Materials Science	48/50
Robotics	22/26
Soil Science	25/25
Water Resources	25/25

Engineering Fields

Biological and Biomedical Engineering

The graduate program in biological engineering (and undergraduate biomedical engineering) benefits from the university's longstanding broad focus on the life sciences. As such, journal and book collections are very strong in foundational disciplines including biochemistry, microbiology, molecular biology, and toxicology. Applied research areas such as agriculture and food science are also very well represented. With emerging research frontiers in fields such as bioinformatics, biotechnology, applied genetics/genomics, biofuels, and biomaterials, the library is continually strengthening collections in these areas. Notable acquisitions include works from publishers such as:

- American Society for Microbiology e-books
- Elsevier: Biochemistry, Genetics & Molecular Biology; Environmental Science; Immunology & Microbiology; Toxicology & Pharmaceutical Science collections
- Morgan & Claypool *Colloquium* Series on Biotechnology
- Wiley reference works such as the Kirk-Othmer Encyclopedia of Chemical Technology and Ullmann's Encyclopedia of Industrial Chemistry

Environmental and Water Resource Engineering

The university's emphases on biological and environmental sciences, which have long received strong support from the library, complement environmental and water resource engineering programs, particularly in subject areas such as agriculture, ecology, geography, and microbiology. Areas of attention include sustainable development, green energy, and ecosystem remediation. Due to the absence of formal academic programs in earth sciences or geology, these subjects have historically been somewhat neglected by the library. Moving forward, increasing focus is being placed on areas such as mathematical modeling of the environment, pedology, groundwater modeling, quaternary geology, erosion over short and long time scales, and climate change mitigation. Recent acquisitions include:

- American Water Works Association- Standard Methods for the Examination of Water & Wastewater database
- CRC Press Environmental Science & Engineering e-books
- Journal of Environmental Informatics
- Springer Chemistry & Materials Science e-books
- Wiley: Environmental Chemistry and Earth Sciences e-books

Computer Engineering & Engineering Systems and Computing

Computing programs across the university are rapidly growing: the graduate field in computer engineering is expanding, as is the undergraduate program in computer science; a Master's program in cybersecurity & threat intelligence is getting underway; and there is a new Centre for Advancing Responsible and Ethical Artificial Intelligence. As a result, the library is redoubling its efforts to build relevant collections in support of learning and research in all aspects of computing theory, software, and hardware. Emerging areas of focus include quantum computing, nanoscale electronics, automation and control systems, robotics, and complex system modeling, design and management. Traditional areas

that are receiving closer attention include applied mathematics, engineering design, and various programming languages and methods. Notable recent acquisitions include:

- ACM e-books
- CRC Press: various e-books in Computer Science & Engineering
- IEEE-Wiley eBooks library 2017-2019
- Institution of Engineering and Technology (IET) e-books 2016-2018
- LinkedIn Learning (formerly Lynda.com)
- Morgan & Claypool *Synthesis* Digital Library of Engineering and Computer Science
- Springer Computer Science collection 2019

Mechanical Engineering

This field is broad in scope, so all of the above-mentioned resources are applicable to some extent in mechanical engineering. The graduate program is experiencing growth, and with it the intensity of library collection development. Expanding areas of acquisition include mechatronics, advanced manufacturing technologies (especially in the agri-food sector), renewable energy, and materials science. Recent purchases of note include:

- American Chemical Society (ACS) Symposium Series e-books
- ASME Journals, e-books and conference proceedings
- CRC Press Energy and Clean Technology netBase
- Elsevier Agricultural, Biological, and Food Sciences e-books
- ASHRAE Standards

Search Tools to Access the Literature

Access for the various fields of engineering is best achieved through a systematic search of the many indexes and journal databases to which the library subscribes, including:

- ACM Digital Library
- Agricultural & Environmental Science Collection (ProQuest)
- Biological Science Collection (ProQuest)
- Engineering Village (Compendex)
- GeoBase
- GreenFILE
- IEEE Xplore
- Inspec
- MathSciNet
- Medline/PubMed
- SciFinder (Chemical Abstracts)
- Web of Science

Technical Standards

The library provides full-text access to engineering standards from a variety of organizations, including complete packages from ASHRAE, ASTM, and IEEE, as well as the American Water Works Association's *Standard Methods for the Examination of Water & Wastewater*. Upon request, the library will consider subscribing to single standards from organizations such as CSA or ISO via the TechStreet platform.

Library Support: Student Learning

The library offers various services to help graduate students succeed, by several specialized teams including Learning and Curriculum Support (L&CS), Access Services, and Research and Scholarship (R&S). These teams deliver a range of services related to academic research and writing, information and digital literacies, scholarship and publishing, time management, professional and ethical behaviour, numeracy, data, and technical skills.

Different service models are used based on student and faculty needs, including:

- Customised in-class guest lectures
- One-on-one or small group consultations to discuss individual curricular or research needs
- In-library programming on popular library topics
- Support for faculty seeking to integrate academic skills development and assessment in their courses
- Development of point-of-need online learning objects such as library guides and videos.

Learning Services

Learning Specialists work with faculty to develop graduate students' academic skills through:

- In- or out-of-class workshops on topics such as critical reading, working in groups, presentation skills, poster presentations, and exam preparation
- Support for assignment and assessment design
- TA training on these topics and others upon faculty request
- Customized student resources (such as an error analysis worksheet for midterms)
- Individual student consultations

Research and Information Literacy Skills

Learning and Curriculum Support (L&CS) librarians are a part of the Information Literacy (IL) team and deliver research skills and information literacy instruction to graduate students across the disciplines.

To ensure students have timely access to research help, the library provides drop-in assistance in person and online. The Research Help Desk on the library's main floor is available for same-day research support. Help is also available via the library's *Ask Us* online chat messaging service, e-mail, and by phone.

Curriculum-Integrated IL Support for Engineering

IL librarians have begun participating in SOE graduate orientations, offering an introduction to Writing Services, Learning Services, Research Support, and library resources.

M.Eng.

ENGG*6300 (Research Methods in Bioengineering) students receive information literacy instruction from a librarian who teaches a 2-hour interactive guest lecture with content closely connected to the development of a research proposal. Topics include finding relevant peer-review journal articles and critically evaluating information. Librarian involvement in this course has been consistent over the past few years and is expected to continue.

Writing Services

Writing Support for Engineering Teaching Assistants

Writing Services provides instructional support to instructors and graduate student TAs associated with ENGG*3100 (Engineering and Design III). A Writing Specialist teaches an interactive workshop to develop the knowledge, skills, and confidence for providing effective feedback when grading student projects. Writing Services' involvement in this course has been consistent over the past few years and is expected to continue.

General Writing Support for Engineering

The Writing Services team provides guidance on all aspects of the writing process. Writing specialists provide targeted support for graduate-level skills, such as organizing and structuring projects; getting started with a thesis or major research paper; navigating topic development; writing a literature review; improving written drafts; and publishing and presenting research. They provide expertise in academic integrity and citation; writing for specific disciplines (such as the 5-part *Writing in the Sciences* series); and effective use of grammar and style (the 2-day *Writing Tune-up* workshop). The team also coordinates major in-library events to support graduate students' writing through *Dissertation Boot Camp*, a weeklong program designed to help develop effective writing skills and thesis writing habits; and *Brain Food*, a series of workshops that teach effective ways to approach research, writing, time management, and data analysis.

English as an Additional Language (EAL)

Writing Services also offers continuing support for students with English as an additional language (EAL) through in-person or online consultations. These focus on writing, speaking, reading, and listening skills. EAL students can participate each summer in a 4-day *EAL Graduate Writing Camp*. Instructors can also access curricular support and resources from our EAL Specialist.

Digital Literacy and Digital Media Skills

Many faculty members are exploring a variety of avenues for embedding digital media and communication technologies into their teaching and course deliverables. New models of pedagogy focus on empowering students to learn not just through consumption of information, but as creators of new information and media.

To support this emerging form of student learning, the library has launched the Media Studio, which supports the development of digital literacies in students and faculty from within the curriculum. Models of support include:

- Consulting with instructors to create digital assignments that align with course outcomes and are pedagogically sound. Examples of assignment formats and topics include podcasts, infographics, digital storytelling, animated videos, live-action videos, digital citizenship, and social media identity.
- Providing in-class instruction on digital media topics such as digital storytelling; podcast, infographic, animated video, and live-action video creation; digital citizenship and social media identity; understanding Canadian copyright in relation to digital media creation; finding Creative Commons-licensed images and videos; iterative and design thinking.
- Appointments in the Media Studio, where students and faculty can work with staff to access digital technologies for filming, recording, and editing.
- Online library help guides to support digital skills development.

Scholarship and Data Services

The library's Research & Scholarship (R&S) team provides a variety of services in support of graduate student research activities.

R&S helps develop student data literacy and research skills: the collection and extraction of research data, cleaning, analysis and visualisation, and best practices for research data management throughout the full data lifecycle. The team assists with publishing activities such as guidance about authors' rights and copyright, open access publishing, measuring research impact, and creating researcher IDs and scholarly profiles. Students can also get help with specific research tools such as NVIVO, Dataverse, Qualtrics, and others.

R&S is home to the library's Data Resource Centre (DRC), where students can get assistance in accessing health, demographic, and geographic data sets from licensed, open, and government sources. Students can make an appointment with a data analyst to received one-on-one support with accessing data sets and using data analysis tools for their assignments.

R&S librarians and staff collaborate directly with faculty to integrate these services into their courses, and to develop workshops, classroom visits, and point-of-need learning objects. R&S serves graduate students directly through drop-in help in the Scholars Studio on the second floor of the library, and through one-on-one consultations and in-library programming.

Accessibility Services

Library Accessibility Services (LAS) is a part of the library's Discovery and Access (D&A) team. LAS provides services, spaces and technologies to help students registered with Student Accessibility Services meet their accessibility needs. LAS is housed in the Access Lab, where students can book quiet space for study and access accessibility specialists, who coordinate alternative format materials, training on adaptive software programs including Kurzweil, Jaws, and others, and lend accessibility equipment such as digital recorders, smart pens, and tablets.

Ask Us Desk

The library's Ask Us Desk is the library's main service location. It is often a first point of contact for students entering the building. Open from 8:00AM to 2:00AM during the academic year, it is one of the only campus services available to students outside of business hours.

The Ask Us desk provides a variety of access services, including circulation; help with library accounts; interlibrary loan and intercampus borrowing services; circulation of the Course Reserves collection; management of media bookings and group study rooms; computer and printer troubleshooting; quick reference help; and triage to events or other library service points. Help is available in-person and via phone or e-mail.

Library Services Used by Graduate Engineering Students

NOTE: Data cover the 2017-18 academic year. Data are not usually collected at the departmental level, so in many cases data are reported at the College level.

Student Consultations

Service	# of Participants
EAL	293
Learning	13 – CEPS graduate students
Research	4
Writing	571 – CEPS graduate students, mostly Engineering, including 84 Masters, 253 PhD, 22 "other"

Guest lectures: Learning, Research, and Writing Skills

Date	Course	Type of Session	# students
Fall 2017	ENGG*6300	Research & Citation Management	14
F17 & W18	TA Training	ENGG*3100: Grading Design projects and Lab Reports (2 sessions)	8

Appendix – McLaughlin Library Overview

TUG (TriUniversity Group): The libraries of the Universities of Guelph, Waterloo, and Wilfrid Laurier collaboratively manage:

- Primo: shared catalogue of over 7 million TUG holdings
- InterLibrary Loan: Students can obtain items quickly and efficiently

Consortial memberships

Approximately 54% of resources are obtained through consortia (OCUL/CRKN).
OCUL (Ontario Council of University Libraries) operates:

- Scholars Portal, an online library containing
  - 600,000+ e-books
  - 48m+ articles from 20,000+ journals
  - over 1m Open Access (OA) articles from over 2,000 OA journals
- Scholars GeoPortal (geospatial data discovery tool)
- <odesi>: over 3,535 datasets for the social sciences
- Dataverse: a repository for research data
- OLRC - Ontario Library Research Cloud, a 350TB storage network
- ASK A LIBRARIAN: provides students with real-time research assistance through chat
- OCUL Information Resources Committee - for collaborative subscriptions & purchases

CRKN (Canadian Research Knowledge Network)

- In 2017 University of Guelph participated in a total of 42 subscriptions managed by CRKN, including journals from major publishers such as Elsevier, Sage, Wiley-Blackwell, Taylor & Francis, Oxford, Cambridge

Library Collections and Space

	2015-16	2016-17	2017-18
Expenditures on Acquisitions	$8,246,731	$8,223,406	$8,425,320
Library Holdings			
Print Books	909,092	914,657	898,544
E-Books	613,862	669,186	708,085
E-Journals	N/A	59,113	59,120
Archives [linear meters]	9,200	9,200	9,250
Library Building Use			
Hours Open Per Week (term)	111	111	111
Hours Open Per Week (exams)	126	126	126
# Student Study Seats	3,088	3,088	3,088
Daily visitors on busiest days	12,816	13,330	12,969
Annual visits	1,504,000	1,545,100	1,444,905

Student Access to Expertise

	2015-16	2016-17	2017-18
Librarians at Guelph	29	31	31
Professionals	24	23	23
# Learning Commons Professionals	11	11	11
Support Staff	56	54	54
# Reference/Instructional Questions Answered			
In person	12,698	14,881	14,372
online	4,015	3,692	3,414
consultations	6,191	5,598	6,956
TOTAL	*22,904*	*24,171*	*24,742*
# sessions	2,112	2,055	2,136
# students	37,461	43,347	49,023
Library Accessibility Services			
requests for alternate format texts	979	1,017	1,169
consultations with library staff	574	603	572
Participation in Learning Commons Programs			
Students in Supported Learning Groups	3,932	3,925	N/A
Students in Student Athlete Mentorship Program	281	315	295

Online Student Support

	2015-16	2016-17	2017-18
Library Web page views	2,609,000	2,765,000	2,951,365
Views of Library “How To” YouTube videos	26,675	41,891	90,099
Course/Subject Guides (LibGuides) Page Views	68,514	147,599	195,149
WrIteOnline.ca (launched September 2015)			
sessions	15,958	50,682	61,769
users	9,523	32,578	44,416