Sheridan College Institute of Technology and Advanced Learning
1430 Trafalgar Road
Oakville ON L6H 2L1
(905) 845-9430

February 2017

Submission:
Bachelor of Engineering
(Electrical Engineering)

Applying for Ministerial Consent Under the *Post-secondary Education Choice and Excellence Act, 2000*

The Secretariat
Postsecondary Education Quality Assessment Board
900 Bay Street
23rd Floor, Mowat Block
Toronto, ON M7A 1L2

Tel.: 416-325-1686
Fax: 416-325-1711

E-mail: peqab@ontario.ca

1. Introduction

1.1 College and Program Information

Full Legal Name of Organization:
Sheridan College Institute of Technology and Advanced Learning

URL for Organization Homepage (if applicable):
http://www.sheridancollege.ca/

Proposed Degree Nomenclature:
Bachelor of Engineering (Electrical Engineering)

Location
Davis Campus, 7899 McLaughlin Road, Brampton, Ontario L6Y 5H9

Contact Information:
*Person Responsible for this Submission:**
Name/Title: Dr. Melanie Spence-Ariemma, Vice-Provost
Full Mailing Address: 1430 Trafalgar Road, Oakville, Ontario, L6H 2L1
Telephone: (905) 845-9430 x4226
E-mail: melanie.spence@sheridancollege.ca

Name/Title: Joan Condie, Dean, Centre for Teaching and Learning
Full Mailing Address: 1430 Trafalgar Road, Oakville, Ontario, L6H 2L1
Telephone: (905) 845-9430 x2559
E-mail: joan.condie@sheridancollege.ca

Site Visit Coordinator (if different from above):**
Name/Title: Ashley Day, Coordinator, Program Review and Development Services
Full Mailing Address: 1430 Trafalgar Road, Oakville, Ontario, L6H 2L1
Telephone: (905) 845-9430 x5561
E-mail: ashley.day@sheridancollege.ca

1.2 Table of Contents

1.3 Executive Summary

Alignment with Government Strategy

Government Investment

The priority of Ontario's provincial government is its commitment "to build a competitive business environment, driven increasingly by innovative, low-carbon industries that support growing the economy and creating good jobs," as emphasized by Premier Wynne's Speech from the Throne on September 12th, 2016. In response to rapid changes in technology and globalization, Ontario's economy continues to be reshaped. Such economic shifts have prompted the provincial government's focus on innovation that thrives on initiative, creativity, education, and the skills of its people (Business Growth Initiative, 2016), with significant investments in innovation and R&D, including the commercialization and adoption of new disruptive technologies.

Success in building the workforce of tomorrow involves a clear government approach that ties skills development to Ontario's economic priorities, including explicit links between provincial growth sector strategies and provincial training programs (Ontario Government, 2016). Emphasis must be placed on the preparation and development of a workforce which has the skills to navigate and thrive in our changing economy. Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, indicates that, "in a future of rapid technological change and widespread automation, the determining factor or crippling limit to innovation, competitiveness, and growth is less likely to be the availability of capital than the existence of a skilled work force… Businesses will increasingly have to work with educators and governments to help education systems keep up with the needs of the labour market." (Globe and Mail, 2015)

Ontario has already reported a 12 percent shortage in the skilled workforce, particularly in the financial, transportation, services, and industrial/consumer manufacturing sectors, with more than 75 percent of respondents citing challenges securing employees with highly-specialized skills, particularly in areas such as power engineering, mechatronics, mobile software development and engineering, among others. Of the 90 large Canadian private-sector employers surveyed, 93 percent indicated that such gaps will have a moderate to significant impact on their business and investments (Aon Hewitt and Business Council of Canada, 2016, p. 11).

In response, the Ministry of Advanced Education and Skills Development, on September 19th 2016, announced the expansion of engineering degrees at colleges, acknowledging that engineers are critical in contributing to the skilled workforce of Ontario. Thus, supporting the expansion of engineering degree programs provides further opportunities for graduates to acquire the knowledge and skills that are in demand among Ontario's employers (Deb Matthews, Minister of Advanced Education and Skills Development, 2016). The proposed Electrical Engineering degree addresses Ministry directives and employment demands, filling the skills gaps that currently exist in the field through a learning approach that is innovative, experiential, and hands-on, with industry collaborations.

Government Directives

The development of the proposed Electrical Engineering degree, with specializations in Mechatronics and Power and Energy, aligns Sheridan with provincial growth sectors in Advanced Manufacturing and Clean Energy. The federal and provincial governments, as well as industry, have already made significant investments in these areas, and will continue to do so.

Sheridan's Strategic Mandate Agreement

The proposed degree is in complete alignment with Sheridan's Strategic Mandate Agreement (2014-2017). The SMA lists Engineering as an area of institutional strength and as a proposed area for growth.

Labour Market Demand

Recognition of the need for increased graduates from engineering degrees, specifically from Ontario colleges, is timely as, according to the Engineers Canada Report (2015), it is forecasted that the Canadian economy will produce about 1,800 jobs for electrical and electronic engineers annually over the next five years (p. 9), with 65 percent of these openings driven by replacement demand, particularly in Ontario.

Canadian universities grant about 2,000 electrical engineering degrees annually. Of this, only 1,100 new graduates enter the electrical engineering occupation. It is likely that the remaining 900 graduates secure employment in non-engineering careers, by choice, or by necessity, as industry has identified a practical applied skills gap in new engineering graduates. This gap has been identified by the Conference Board of Canada (2013), reporting that, "while the data show that, in the aggregate, there is presently no economy wide labour shortage in Ontario, there is strong evidence of skills gaps in industries and occupations that make up a large share of total employment in the province" (p. 5).

Industries in engineering, infrastructure, energy and utilities are the most concerned about such skills shortages. Consequently, with the noted 1,800 job openings expected (Engineers Canada Report, 2015), of which 1,100 openings will be filled by new graduates, 700 positions will remain unfilled in the electrical and electronic engineering industry. It is anticipated that some of these 700 job openings will be assumed by the in-migration of electrical engineers to Canada. Nevertheless, a number of the electrical and electronic engineering positions, specifically those that require practical experience and applied knowledge, will remain unfilled. Given that manufacturing is Ontario's second-largest employer (781,000 people) and the professional, scientific, and technical services sector is fourth-largest (567,000 people), skills shortages in advanced and emerging manufacturing, where employment demands presently exist, will place pressure on industry, impacting business operations and future growth.

The disparity between the number of available jobs (1,800) and number of new graduates hired (1,100) in electrical engineering in Canada indicates that traditional engineering education is not preparing sufficient numbers of graduates for direct entry into the electrical engineering profession. Referring to Figure 1 below, consider that

today's electrical engineer may be employed in many areas from research to field service. At the baccalaureate level, many traditional engineering schools are graduating engineering scientists, to support positions in engineering research. Although important, research is only one area of many that employ engineering graduates and makes up only a small fraction of the opportunities for electrical engineering graduates. Sheridan's proposed degree will graduate electrical engineers who have the skills to be employed throughout the spectrum, thereby closing the skills gap.

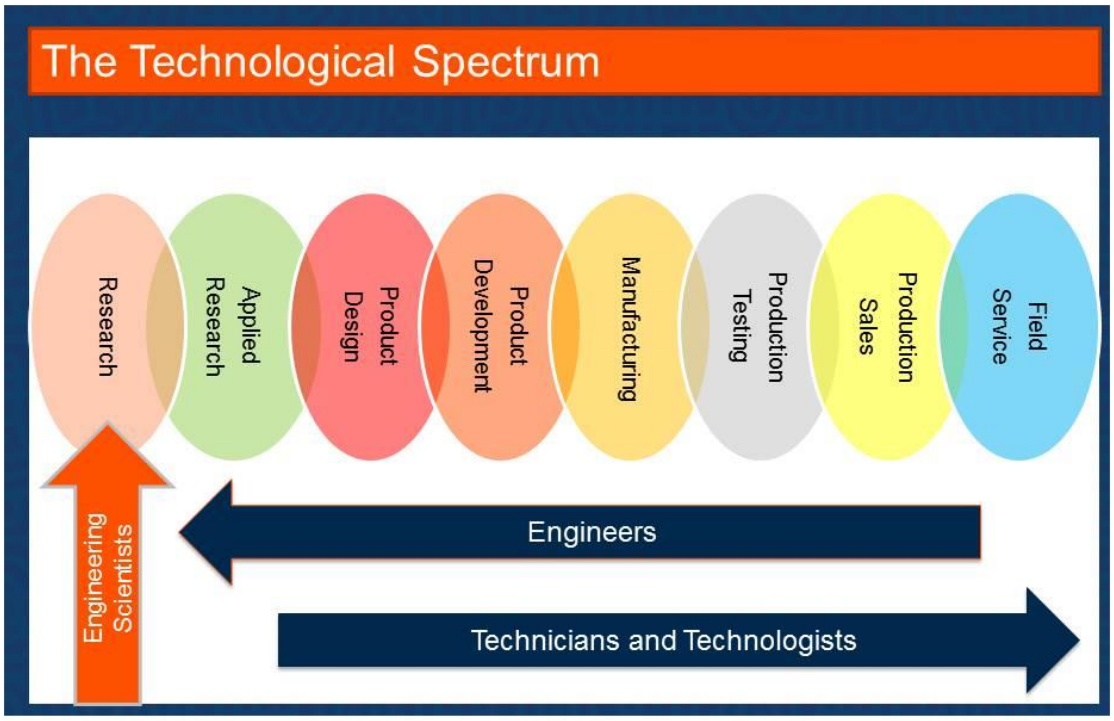


Figure 1: The spectrum of engineering employment

The challenge for industry to meet the demand for employees who possess the sought after practical applied skillset will be exacerbated with population growth in the Greater Toronto Area (GTA), projected as the fastest growing region of the province, with an anticipated population increase of over 2.8 million, or 42.9 percent, to reach almost 9.5 million by 2041. Consistent with this growth, by 2018, more than half of Ontarians aged 18 to 24 will live in the GTA, with the largest population increase occurring in the Peel, York, and Halton regions; regions which are within the geographic area of Sheridan College.

Program Description

The School of Mechanical and Electrical Engineering Technology (MEET) at Sheridan College has developed a baccalaureate level degree program in Electrical Engineering with two specialization options: Power & Energy Systems and Mechatronics. These two specializations target the two industries in Ontario with the most projected growth in the next decade: manufacturing, and energy & utilities. The Power and Energy Systems specialization is specifically targeting the utility and energy sector, which is expected to have a serious shortage in skilled personnel due to retirement and growth. The Mechatronics specialization encompasses embedded systems, automation, and robotics, which will prepare the graduates for the manufacturing and automation industries.

The proposed degree is an innovative and holistic undergraduate program featuring the development of professional, entrepreneurial, disciplinary and multi-disciplinary skills required for today's engineering workplaces. The curriculum offers an active and project-based learning environment, based on CDIO (Conceive-Design-Implement-Operate) principles, to prepare the graduates to function in engineering teams and to produce real products, processes and systems. The proposed program is enhanced with work-integrated learning experiences through internship and co-op opportunities, as well as applied research.

Throughout the proposed degree, students will learn about engineering opportunities upon graduation, in courses such as Exploring Engineering, Engineering Economics and Entrepreneurship and in the final year Capstone courses.

Sheridan's proposed Electrical Engineering program will address the skills shortage and provide a unique pathway for students into the field of electrical engineering. Sheridan's proposed degree is significantly differentiated from other electrical engineering programs offered by Ontario colleges and universities due to its CDIO model focus, active-learning structure, and small class-sizes, and we believe this differentiation will position graduates from the program extremely well professionally. The following attributes outline Sheridan's strengths in offering this proposed Electrical Engineering degree.

Creative and Innovative Engineering Education

The proposed degree is based on the CDIO model, originating at MIT, an innovative educational framework that provides students with engineering fundamentals set in the context of Conceiving - Designing - Implementing - Operating real-world systems and products, thus accelerating the student's development from entry level engineer to strong and effective contributor to the workforce from graduation. The CDIO model gives Sheridan Engineering a clear differentiator, shared with only a handful of institutions in Canada[1].

Furthermore, the proposed program is designed to close the employment skills gap by facilitating a project-based active learning environment through CDIO and the Integrated

[1] For more information on the CDIO Initiative, see http://www.cdio.org/about .

Learning Block (ILB) approach to teaching, the Capstone (applied research/industry) project, and two opportunities for real-work placement (engineering co-op and internship work term). Sheridan currently has many active industry partners and letters of support from potential employers to provide co-op and internship opportunities (included in Appendix 7 of the proposal). This program structure allows for the development of hard as well as soft skills, including technical writing, communications, and team work, among others, which Sheridan recognizes as critical for employability post-graduation.

Capacity to Deliver

Sheridan currently has a School of Mechanical and Electrical Engineering Technology as part of the Faculty of Applied Science and Technology. The proposed Electrical Engineering degree program would be supported by this already existing school and would add another credential to the current program offerings, which include electrical and mechanical engineering technician and technology diplomas, graduate certificate programs, and the new Mechatronics Board Certificate program.

The proposed degree program can be accommodated within the existing footprint and capital equipment (no major capital requirements are needed). The program has the required staffing compliment, as faculty with the required credentials (P. Eng. designations, professional affiliations, research, and publications) have been hired and engineering workspaces exist in Sheridan's Centre for Advanced Manufacturing and Design Technologies (CAMDT).

Low student ratio provides constant formative feedback, as well as applied and experiential learning opportunities that move surface learning to deep learning. Another significant differentiator is that engineering class sizes will be small, at a maximum of 48 students in classrooms and 24 students in laboratories, over the course of the degree, relative to class sizes at traditional engineering schools which can be well over 100 students.

Equity and Diversity in Engineering

Sheridan's School of Mechanical and Electrical Engineering supports diversity in a variety of ways. The City of Brampton, where Sheridan's Davis Campus is located, has a population of over 600,000 residents and is Canada's 9th largest city. It has a young and diverse multicultural mosaic, representing 209 distinct ethnic backgrounds; this diversity is reflected at Sheridan's Davis campus. Sheridan College supports community engagement and collaboration with the City of Brampton through initiative such as MakerSpace Brampton, with free programs including Coding for Girls, the Engineer-in-Residence program, and the hosting of a Mathletics event for youth in Brampton. The School has also partnered with Tetra Society to support students with disabilities, funded by the Ontario Trillium Foundation. Moreover, the school supports women in engineering, with full and part time faculty teaching in the engineering programs. We have full time female professors in electrical engineering who are role models for female students. Since March 2015 we have had a project to engage women in STEM disciplines, led by Dr. June McCombie of Nottingham University, United Kingdom. Dr. McCombie received an OBE for "services to science" in 2013 as a result of her

pioneering work in encouraging women into STEM education. We have also established a scholarship for Woman in Engineering, funded by Coca-Cola and we are in the process of establishing a Women in Engineering Club at Sheridan. Sheridan supports equal access to education and acknowledges the value that individuals from diverse backgrounds and women bring to the field of engineering.

Engineering Workspaces and Applied Research

Sheridan's CAMDT is a 40,000 square foot facility, within the School of Mechanical and Electrical Engineering Technology, housing state-of-the-art labs, including advanced manufacturing equipment and an integrated energy systems lab. In 2017, the Davis campus will be home to Engineering and Skilled Trades, with 125,000 square feet of space.

Longevity of CAMDT has been assured by financial commitments from Sheridan and nearly $7 million dollars from project partners: $2.5 million from the City of Brampton, $2.9 million from the Ministry of Economic Development and Trade's Strategic Skills Investment Fund, and over $1.5 million in cash and in-kind support from business and industry. CAMDT continues to build capacity for applied research and industry projects and secure funding. Most recently, Siemens Canada provided an academic grant of $22 million dollars in software licenses. Sheridan was recently ranked by *Research Infosource* as the #1 college in Ontario and 6th in Canada for total research income and was also ranked as the #1 college in Canada for number of completed research projects.

Industry Support and Partnerships

Sheridan has shown leadership in developing partnerships with industry employers and has formed long-term industry partnerships with Siemens, ABB Robotics, Cimetrix, and Hatch, some of the largest engineering and technology companies. Recently, Sheridan has signed Memorandums of Understanding with both Siemens Canada and Hatch Limited. These agreements include investments, training, and equipment commitments to enrich Sheridan engineering programs and expand the opportunities for students in research, engineering internships and project based learning. The proposed program has received strong support from government, post-secondary institutions, and industry.

1.4 Program Abstract

The School of Mechanical and Electrical Engineering Technology (MEET) at Sheridan has developed a baccalaureate degree program in Electrical Engineering (B. Eng.) with two specialization options: Power & Energy Systems and Mechatronics. This is an innovative and holistic undergraduate degree featuring the development of professional, entrepreneurial, disciplinary and multi-disciplinary skills required for today's engineering workplaces.

The curriculum offers an active and project-based learning environment based on CDIO[2] principles, preparing graduates to function in engineering teams to produce real products, processes, and systems. The degree is targeted to provide graduates employability in two Ontario sectors (energy & utilities and manufacturing) through its specializations. The proposed program is enhanced with work-integrated learning through internship and co-op experiences, as well as applied research.
Sheridan's Electrical Engineering degree meets the curricular requirements of the Canadian Engineering Accreditation Board for intended future accreditation (accreditation will be pursued once the program has the requisite graduates). Graduates of the proposed Electrical Engineering degree program will be prepared to enter the engineering job market directly upon graduation, or to pursue graduate studies. Following accreditation, graduates of the program will also be eligible for licensing as a Professional Engineer (P. Eng.), after fulfilling their practical experience requirements.

[2] CDIO (Conceive-Design-Implement-Operate) is an educational framework developed through a collaboration of top tier engineering schools in USA, Europe, Canada, UK, Africa, Asia, and New Zealand intended to combine engineering education with experiential learning to best prepare graduates for industry demands in engineering fields. For further information refer to cdio.org.

Section 2: Degree Level Standard

2.1 Depth and Breadth of Knowledge

Mathematics and Sciences

The backbone of the Electrical Engineering curriculum is the mathematics sequence. In addition to studying linear algebra, calculus, and integral calculus in *Linear Algebra*, *Calculus 1,* and *Calculus 2* courses in the first year, students further develop critical thinking and analytical skills necessary for the discipline by studying subjects in differential equations, numerical methods, and statistics in subsequent courses, such as *Differential Equations, Numerical Methods*, and *Statistics and Quality*.

The students in the proposed program complete a general chemistry course (*Introduction to Chemistry for Engineers*), and a two-course sequence of physics, namely *Fundamental of Physics 1* (modern mechanics) and *Fundamental of Physics 2* (electricity and electromagnetics, thermodynamics), with strong experimental laboratory components. These science courses lay the foundation for understanding many of the major fields in the electrical engineering discipline, as well as developing interdisciplinary perspectives and exploring how electrical engineering fields may intersect with related disciplines.

Fundamentals of Engineering

In addition to the chemistry and physics courses, students complete 3 fundamental courses in engineering: *Exploring Engineering*, *Engineering Design and Problem Solving*, and *Computer Programming*. These courses are mandatory and common to all engineering disciplines.

These courses lay the foundation for critical understanding of key engineering concepts, engineering design, and problem solving methodologies, which enhance the learning in core courses in Electrical Engineering and courses in a specialized technical option. Furthermore, the fundamental concepts and general non-discipline specific topics covered in these courses develop the ability to learn and apply from inter-disciplinary fields of study.

Electrical Engineering Core Courses

The core of the proposed program is a set of Electrical Engineering courses with a balance of engineering science and design, knowledge and skills, and organized primarily in three main curriculum stems:

- Circuits and Devices (4 courses)
- Signals and Systems (5 courses), and
- Software and Hardware Engineering (5 courses)

These courses are designed to develop depth and breadth of knowledge and critical understanding in major fields of electrical engineering with respect to their key concepts, methodologies, current practices, theoretical approaches and assumptions. These areas of knowledge and critical understanding build the ability to solve complex

engineering problems, with creative options relevant to one or more of the major fields in electrical engineering.

Specialization Courses

Further to the electrical engineering core courses, the students specialize by completing 8 courses that make up a technical elective sequence in the final 2 years of the degree program. They may specialize in either Power & Energy Systems or Mechatronics. This develops considerable breadth from the core Electrical Engineering program, while permitting the depth and specialization in an area of the students' technical interests.

The specialization courses start early in year 3 (term 5) of the program to build depth and breadth of knowledge and cover current advances and research methodologies in each of the specialized disciplines.

Graduates of the Power & Energy Systems specialization will have the knowledge and skills to provide environmentally responsible and economically sustainable solutions for electrical energy generation, transmission, distribution, and usage. The eight courses in this specialization cover fundamentals of electrical power generation and transmission, power conversion technology, power system analysis and control, power distribution system design, and smart grid, as well as fundamentals of energy systems and alternative energy sources, for the analysis, modelling, design, development, and operation of sustainable electrical power and energy systems.

The Mechatronics specialization will give the students the depth and breadth of knowledge in the modern interdisciplinary field of Mechatronics, which combines the elements of mechanical, electrical, computer, and control engineering. The eight specialized courses will provide the students with understanding and critical thinking skills from interdisciplinary perspectives to solve complex modern engineering problems. The eight courses in the Mechatronics specialization cover the fundamentals of embedded system software and hardware, embedded system application and design, Micro-electromechanical Systems (MEMS), kinematics and robotics, fundamentals of mechatronics, and modeling/simulation/design of mechatronic systems.

Engineering Design Content

Since the proposed program is designed based on CDIO principles within a project-based learning environment, engineering design is very much an integral part of the curriculum, and courses in the proposed program include significant design content. Starting from the first exposure to the rudiments of engineering design in the first year courses, such as *Exploring Engineering* and *Engineering Design and Problem Solving*, the proposed curriculum facilitates project-based learning by incorporating a BUS structure and integrated learning blocks (ILB). In this structure, learning blocks of two or more concurrent courses in the same semester are inter-connected to form a subject for an engineering design project. The BUS structure begins in the first year and continues every year to provide four-cycles of engineering design project opportunities, through which the students will develop ability and skills to gather, review, evaluate and interpret information to identify problems and provide creative solutions. The students will also be

able to compare the merits of alternative designs and solutions to propose socially responsible and economically sustainable solutions.

The Capstone project courses in the fourth year (term 7 and 8) are intended to enhance and showcase engineering design ability and skills, acquired by the students in their earlier course work. The courses provide a realistic design experience with opportunities for applied research. Student teams address a significant design problem, often drawn from industry, and are expected to proceed through the entire design process from problem formulation to prototype fabrication or other proof of concept. Students must consider appropriate engineering standards, realistic constraints supported by economic analysis and, where appropriate, environmental impact.

Complementary Studies

Complementary courses like *Engineering in Society: Health & Safety*, *Engineering Economics and Entrepreneurship*, and *Engineering Internship* introduce and teach students engineering professionalism and ethics, engineering economics, as well as current practices in the global engineering profession and technical communication. In addition to the mandated *Composition & Rhetoric* course, students explore and develop breadth of knowledge outside of the subject of engineering, through seven elective courses selected from 5 subject areas including Humanities, Social Science, Global Culture, Mathematics and Science. These courses develop the ability to apply learning from areas outside the engineering discipline and complement their engineering knowledge and skills.

2.2 Conceptual & Methodological Awareness/Research and Scholarship

The proposed degree program meets PEQAB degree-level standards for conceptual and methodological awareness/ research and scholarship, through laboratory and class assignments of core courses and specialization courses, the BUS structure and Integrated Learning Blocks (ILB's), and Capstone Project courses with applied research opportunities. Courses in the proposed curriculum are designed to develop an understanding of methods of enquiry and creative activity of research and scholarship in the fields of electrical engineering.

Laboratory and Class Assignments

At the most basic level, students will complete laboratory and/or class assignments in each course to learn and demonstrate their knowledge of facts, concepts, principles, theories, definitions, and the skill of reporting that information accurately. This will enable the students to evaluate the appropriateness of different approaches to solving problems, using well established ideas and techniques within the fields of electrical engineering.

The students will be required to answer clearly-defined research questions, identify different research methodologies, learn research techniques, and consider the ethics of

research. They will also be required to practice the general steps and procedures for carrying out a research project.

BUS Projects

As a core component of the program, the BUS structure and ILB's (Integrated Learning Blocks) provide opportunities to exercise engineering design and research methodologies in order to devise and sustain arguments and solve problems. Students will engage in a gradual, structured approach of learning how to demonstrate the skills of comprehension and application of their newly gained knowledge. The competencies include formulating their own research questions, within a broad research topic and area, illustrating how the concepts in the research question guide the research strategy, applying the aspects of a general research methodology to a new yet standard situation, explaining how general procedures are used in a specific research project, and describing and commenting on particular aspects of current research or equivalent advanced scholarship.

Capstone Projects Courses

Capstone Project courses in the fourth year (terms 7 and 8) will complete the training in research competency and the students will use and advance beyond what they know to work with ideas in new non-routinized ways, to generate original ideas and/or to create and attach value to ideas. The students will also investigate the literature to find precedents and unique approaches to both traditional and emerging engineering problems.

They will build on necessary engineering skills including analysis, modeling, simulation, design and evaluation, and translate what they have learned to apply to new situations and implement creative solutions. They will analyze the results of their experience and research in relation to their prior learning. The students will evaluate the strengths and weaknesses of approaches and methods developed. They will also be able to analyze and comment on the methodology and findings of other research and equivalent scholarship comparable to their own.

Applied Research and Industry Projects

The highest order competency is represented by the final year Capstone Project courses, where the students are engaged in applied research projects in collaboration with industry partners. To complete this project, the students will have mastered the lower and medium level research competencies and will learn how to manage client expectations, negotiate scope and change orders, track budget, report research results, maintain effective communication with both the team and client, and deal with tighter timelines than strictly academic projects require.

2.3 Communications Skills

The proposed program meets PEQAB degree-level standards for communication skills through teaching personal and interpersonal skills in a collaborative project environment in the BUS structure, breadth electives, and real world experiences in co-op and internship opportunities.

Graduates of the proposed program will have strong communication skills and will be able to perform as effective team members and leaders. The proposed program not only includes courses that focus on teaching and developing communication skills, such as Composition and Rhetoric, but the curriculum is also founded on a project-based environment with the BUS structure, where the students are engaged in collaborative projects, acquiring social competencies such as teamwork and communication skills in authentic learning situations.

Technical writing, oral presentation and negotiating skills are developed by the students as they progress through the 4 yearly BUS projects and by the final year students will have strong communication skills. They will learn to work well in teams with students, learning with faculty members, and collaborating with industry partners to solve real-world engineering problems, and, in doing so, they will develop negotiating, networking and communication skills through presentations, proposals, and report writing. The industry partners and sponsors may not be engineers and the students will need to communicate with them in the language of business and non-technical profession, while communicating with their peers and professors in the language of the engineering profession. The BUS structure will assess teamwork and leadership skills, specifically the student's ability to operate in a team environment. Professors will look at how the students contribute to the team, and how they interact with team members to organize the team and assign roles and responsibilities.

The physical environment for the program includes learning spaces, such as flexible classrooms and seminar rooms. These workspaces, which are different from traditional classrooms, provide the opportunity for social learning, in settings where students can learn from each other and interact with several groups. Such competencies are best developed in workspaces that are student-centered, user-friendly, accessible and interactive. CDIO engineering workspaces provide for conceptual development and reflection, digitally-supported design, and systems integration, as well as testing and operation.

Students will continue to develop their communication skills during the 4 month mandatory internship after the second year, as well as in the optional 8 to 16 month engineering co-op work term. As they are placed in a real world environment, the students will learn the importance of communication skills in the engineering profession, and will be given opportunities to exercise their communication skills in various forms.

2.4 Application of Knowledge

The degree has been structured to increase the depth of knowledge and complexity of assessments as the student progresses through their four years of study. Many courses will engage the students in laboratory experiments, research methodologies and BUS projects, and will assess their ability to investigate complex engineering problems though experimentation, data collection, analysis, and interpretation.

The proposed program will challenge the students to apply and communicate their knowledge in every year of the program, as they move through the 4 cycle BUS structure. They will have to use a range of established techniques to initiate and undertake critical evaluation of arguments, assumptions, abstract concepts, and information. When employing the BUS structure and project based learning approaches, learning is no longer purely subject based. They will have to analyze situations, drawing upon prior learning from outside the engineering sphere.

Each year, the BUS projects will increase in complexity and depth and breadth of knowledge, as students will develop critical thinking skills to solve these multi-faceted problems. This learning will culminate in the Capstone courses in the final year of study, where the students will be engaged in complex engineering projects, which are industry or applied research projects mentored by a Professional engineer. As a result of this capstone experience, graduates will have utilized implementation, analytical thinking, problem solving, and interpersonal skills which will be assessed by faculty mentors.

The assessment procedure aims to determine the student’s ability to implement an engineering design specification and to produce documentation based on best practices. The developmental assessment that occurs during the process of the course will examine the delivered product and formal documentation. The key objective of the BUS project is to learn to approach product/process development in an efficient way.

The graduates, after completing four BUS and Capstone projects, will have the ability to use their knowledge and critical thinking skills to solve complex, multi-disciplinary engineering problems.

Students will make critical use of scholarly reviews and primary sources through case study analysis in core courses and specialization courses as well as through BUS projects, where literature reviews may be used to investigate design methodologies.

2.5 Professional Capacity/Autonomy

The students will develop the qualities of initiative, personal responsibility and accountability throughout the curriculum. They will be challenged to examine their projects within the context of the world and the society the projects serve.
The co-op and internship work terms will expose students to professional attributes in the engineering workplace such as working effectively with others and helping them better understand the roles and responsibilities of the professional engineer in society.

They will be able to analyze the impact of their engineering solutions in a global, economic, societal and environmental context. The work terms will give students the understanding of personal responsibility and accountability to their colleagues and supervisors.

To complement the work terms, students will complete courses throughout their years of study that will also emphasize these skills. In particular, students will take the course *Engineers in Society: Health and Safety,* which teaches environmental sustainability, and engineering design courses, starting with *Exploring Engineering* in the first year (term 1), and continuing in *Engineering Design and Problem Solving* to the final year *Capstone Project Courses*, where students will learn about the roles and responsibilities of engineers. They will examine the professional standards and requirements to exercise social responsibility.

The course *Exploring Engineering* in term 1 provides a framework to the students for the practice of engineering. This framework is a broad outline of the tasks and responsibilities of an engineer, and the use of disciplinary knowledge in making decisions and executing those tasks. Students engage in the practice of engineering through problem solving and simple design exercises, individually and in teams. The course also includes personal and interpersonal skills (knowledge, skills, and attitudes) that are essential at the start of a program to prepare students for more advanced product, process, and system building experiences. Students will participate in small team exercises to prepare them for larger development teams. This course aims to stimulate student interest and strengthen their motivation for the field of engineering, by focusing on the application of relevant core engineering disciplines.

As well, students will have the opportunity to exercise initiative and be accountable to their team members and faculty mentors. They will be challenged to read widely and bring that learning back into the classroom and labs. They will be asked to find the social context for their engineering work and projects.

The capstone courses will ask the students to consider their design not only from a functionality perspective, but the design criteria will include the additional requirement that the student considers the impact of their product or process in a global, economic, societal and environmental context.

The proposed curriculum, based on the CDIO Initiative, is an integrated curriculum. Although still organized around disciplines, it has skills, active learning, and hands-on projects richly interwoven (thoroughly integrated) into the various courses. This approach provides what is called “enduring understanding”, which is the anchor for a subject or course and provides the framework for the student to think from fundamentals to analysis of a problem or design.

The term “design-implement (build) experiences” denotes the range of engineering activities central to the process of developing new products and systems. A CDIO

curriculum has design-implement experiences, including at least one at a basic level and one at an advanced level.

Design-implement (build) experiences are structured and sequenced to promote early success in engineering practice. Increasingly complex experiences provide a solid foundation upon which to build a deeper conceptual understanding of disciplinary skills. This gives students opportunities to make connections between the technical content they are learning and their professional and career interests. This foundation will stimulate interests for career development and additional personal growth.

2.6 Awareness of Limits of Knowledge

The engineering students will be continuously confronted by the limits of their own knowledge throughout the program. The BUS projects will keep each student group working within their own “zone of proximal development”, that is working in a context that is just beyond their own sphere of competence. This will ingrain a continuous need to learn more, to be daily confronted with a sense of marginal competence that requires inquiry and peer support.

Even when the students have achieved the degree outcomes they will recognize the importance of continued life-long learning to maintain competence and growth in their field as well as the societies and world around them.

Students and graduates of the proposed program will learn to address gaps in knowledge and skills through multimodal inquiry and consultation with others. The students will observe professional engineers (faculty, employers and industry partners) actively engaged in research, learning and professional practice. They will see first-hand the need for and the value of life-long learning to remain competitive and competent in their profession.

Section 3: Admission, Promotion and Graduation Standard

The major criterion for admission to the first year of the Electrical Engineering program is the average achieved in the final year of secondary school. Although all students entering the program from high school will be admitted to the common first year, applicants will be asked to indicate the specialization option since this is helpful in allocating resources. There is no guarantee that a specialization will be offered if there is not enough interest.

Applicants who do not meet the requirements from secondary school will be considered upon successful completion of two terms post-secondary education, including pre-requisites. In the School of Mechanical and Electrical Engineering, students who have completed the two or three year engineering technician/technologist program may be admitted to the proposed Electrical Engineering degree with a block transfer. Applicants from other schools and Faculties at Sheridan or from other postsecondary institutions will be considered for admission to the year for which they qualify. Academic performance is the criterion for admission. Credit is given for completed courses that correspond in content to courses of the program to which the applicant is admitted. Credit transfer from other institutions and course equivalency for Sheridan course credits are assessed as per Sheridan policy. Admission is often limited by capacity of the school. Through the PLAR (Prior Learning Assessment and Recognition) process students may receive credit for their prior learning. Prior learning will be assessed according to course or program outcomes.

3.1 Admission Requirements for Direct Entry

	Program Admission Requirements
Academic	Ontario Secondary School Diploma or equivalent, including the following required courses: • English, Grade 12 (ENG4U) *plus* • Mathematics, Grade 12 (U) (MHF4U) Functions and Relations, minimum 70% • Calculus and Vectors (MCV4U), minimum 70% • Physics, Grade 12 (U) or • Chemistry, Grade 12 (U) *plus* • Two additional Grade 12 credits at the U or M level • Minimum 70% overall average or • Two semesters of postsecondary education, including required courses with a minimum 70% overall average, and 70% in each Math course.

	Program Admission Requirements
Applicant Selection	• Eligible applicants will be selected on the basis of their previous academic achievement (the average of their six highest senior-level credits, including required courses) Applicants who do not meet the admission requirements for this program will be assessed and advised individually and may be considered for other related programs.

3.2 Admission Policies and Procedures for Mature Students

Sheridan's Admission Policy defines a mature student as an applicant who has reached the age of 19 on or before the start of the program and who does not have an Ontario Secondary School Diploma, or equivalent.

To be considered for admission to **Ontario College Bachelor's Degree or Collaborative College-University Degree Programs**, an applicant must have the minimum of one of the following in addition to any identified program prerequisites:

- Ontario Secondary School Diploma (OSSD) or equivalent plus Grade 12 English ENG4U or equivalent including required courses, with a minimum 65% overall average. Some programs require 65% in each course;
- Two semesters of postsecondary education including required courses with a minimum 65% overall average. Some programs require 65% in each course;
- Criteria established by articulation agreements; and/or
- International credentials equivalent to the minimum credential entrance requirements as determined by the College.

3.3 Promotion and Graduation Requirements

Sheridan's policy and procedures for Promotion and Graduation are designed to:

- be consistent with the learning outcomes for the program, and
- ensure a minimum level of demonstrated achievement as evidenced by the Grade Point Average (GPA)

The process for calculating the Grade Point Average (GPA) is defined within the Sheridan Academic Standing Policy and Procedure. Students are required to achieve a minimum GPA in professional (core) courses of 2.5 for both promotion and graduation. They are required to achieve a minimum GPA in courses outside the professional field of study (non-core courses) of 2.0 for both promotion and graduation. The overall minimum GPA for graduation from the program is 2.4.

Students who do not achieve the minimum GPA requirements for their program of study but are above the academic suspension threshold will be placed on academic probation.

Students who are continuing in their program while on Academic Probation must meet specific GPA requirements. Those students who do not meet the GPA requirements of Academic Probation at the end of the term will be placed on academic suspension for two consecutive terms.

Students who have met the specific Program Term GPA requirement(s) but not the minimum Program Cumulative GPA requirement(s) for graduation will be issued a graduation warning. Once the minimum Program Cumulative GPA requirement(s) have been met the student will return to Good Standing.

Academic Suspensions will not be issued to students in their first semester following admission.

Students in a Degree Program and whose Program Term GPA and Program Cumulative GPA falls below 2.0, will receive an Academic Suspension (SP) from the program for two consecutive terms.

3.4 Advanced Standing Policies and Requirements

Sheridan is committed to creating accessible pathways for current and future students. The Advanced Standing Policy is intended to support student mobility within the postsecondary educational system. Students may apply to receive advanced standing for specific Sheridan course(s) based on the successful completion of similar courses at other recognized postsecondary institutions, subject to meeting applicable Sheridan policies.

Candidates must have achieved a minimum of a C grade in the course that is being considered for advanced standing, or the minimum pass for the course for promotion within the program, whichever is higher.

Courses considered for advanced standing must have been completed within five years prior to the request, except with the permission of the Dean or designate of the respective School.

3.5 Degree Completion Pathways

We recognize pathways opportunities into this degree will be severely limited. This is due to extensive reach-back requirements that arise from limitations imposed by the degree accreditation process.

The Bachelor of Engineering in Electrical Engineering will offer the following admission pathways:

- 3-year Technologist Advanced Diploma program graduates (one of MTCU 60509, 65613, or 65203) to follow degree completion pathway
- 2-year Technician Diploma program graduates (one of MTCU 50509, 55613, or 55203) to follow degree completion pathway
- International and internationally-trained students who have an acceptable advanced diploma or a degree in Electrical Engineering and seek a Canadian qualification, provided they complete any course work required to address any gap in their prior learning.

See Section 4.8

Section 4: Program Content Standard

4.1 Professional Advisory Council

The following is a list of Ad Hoc Professional Advisory Council members:

Name	Field	Related Credential(s)	Position	Employer
Matthew Xie	Manufacturing	P.Eng., MBA, FEC	President	Lake Harbour Co.
Mohinder S. Grover	Electrical Power Systems	Ph.D., P.Eng. FEC	Senior Quality Engineer	Candu Energy Inc.
Milan Graovac	Electrical Power Systems	Ph.D. P.Eng.	Senior Research Associate	CAPE, University of Toronto
Lars-Eric Sjoberg	Energy Systems	B.Eng. MBA	COO	RenTekNik Group Inc.
Remy Fernandes	Electrical Power Systems	MBA	Former President & CEO	Hydro One Brampton
Joaquin E. Moran	Energy Systems	Ph.D., P.Eng.	Researcher	Hatch Ltd.
Armen Baronian	Electrical Power Systems	Ph.D.	Utility Inverter Specialist	Eaton Industries (Canada) Company
Paul Kuner	Power System Asset Management	P.Eng.	Reliability Engineer	Enersource
Alex Mihailidis	Biomedical Engineering	Ph.D. P.Eng.	Associate Professor	University of Toronto
Exequiel Rarama	Embedded Systems	B.Eng.	Product Development Manager	Alcohol Countermeasure Systems Corp.
Brian B. Park	Embedded Systems	B.A.Sc. P.Eng.	Technical Manager	Magna Electronics
Andrew Yan	Electrical Power Systems	Ph.D. P.Eng.	Special Studies Manager	Hydro One Networks Inc.
Chris Kerr	Electrical Power Systems	B.E.Sc.	Supervisor, Long-Term Planning	Toronto Hydro
Ben Hazlett	Electrical Power Systems	M.E.Sc. P.Eng.	Supervisor, LRT Project Management	Hydro Ottawa
Derrick Klotz	B. Eng.	Embedded Systems	Application Engineer	Freescale Semiconductor
John Martinovic	B. Eng. P. Eng.	Energy management	Industry Technology Advisor	NRC

4.1.1 Professional Advisory Council Minutes

B. Eng. (Electrical Engineering) Ad Hoc Professional Advisory Council
Thursday, October 23, 2014 ~ Room C318, Davis Campus

Present: Armen Baronian, Remy Fernandes, Milan Graovac, Mohinder Grover, Ben Hazlett, Chris Kerr, Andrew Yan, Jon Berge, Subir Ghosh, Nigel Johnson, Paul Kemp, Nazrul Khan, Jonathan Kim, Stefan Korol, Alex Levchenko, Weijing Ma, Todd Mander, Zohreh Motamedi, Farhang Sahba, John Ferguson, Farzad Rayegani, Matthew Rempel

Regrets: Paul Kuner, Alex Mihalidis, Joaquin Moran, Brian Park, Exequiel Rarama, Lars-Eric Sjoberg, Matthew Xie, Amin Ghobeity, Dan Mashatan

MINUTES OF THE MEETING

1.	Meeting started at 5:23pm with a presentation by Farzad Rayegani regarding shaping an ideal engineering school based on the CDIO framework. Included in the presentation was an overview of the skills gap report by the Conference Board of Canada.
2.	Jonathan Kim presented on the development of the proposed B. Eng. Electrical degree program.
3.	Attendees broke out into groups to explore and validate program level critical performance statement and learning outcomes as well as to explore and validate discipline level learning outcomes and discuss knowledge, skills and attitudes associated with them. Attendees were asked to write down their comments on the breakout sheets and appoint someone from each team to present/share their feedback.
4.	Feedback gathered from the groups are as per attached.
5.	The next PAC meeting was announced --- Thursday, November 6th.
6.	Having no other matters to discuss, the meeting was adjourned at 7:32 p.m.

B. Eng. (Electrical Engineering) Ad Hoc Professional Advisory Council
Thursday, November 6, 2014
Room C328, Davis Campus

Present: Armen Baronian, Milan Graovac, Mohinder Grover, Ben Hazlett, Chris Kerr, Paul Kuner, Alex Mihalidis, Joaquin Moran, Brian Park, Exequiel Rarama, Lars-Eric Sjoberg, Andrew Yan, Jon Berge, Shaun Ghafari, Ramin Ghalati, Amin Ghobeity, Subir Ghosh, Nigel Johnson, Nazrul Khan, Jonathan Kim, Stefan Korol, Alex Levchenko, Weijing Ma, Todd Mander, Dan Mashatan, Zohreh Motamedi, Farhang Sahba, John Ferguson, Farzad Rayegani

Regrets: Remy Fernandes, Matthew Xie, Paul Kemp, Matthew Rempel

MINUTES OF THE MEETING

1.	Meeting started at 5:08 pm with Farzad Rayegani providing a brief overview of the CDIO framework which he presented during the first ad-hoc PAC meeting on October 23rd.
2.	Jonathan Kim then followed with a statement of the purpose of the second meeting which is to present an overview of the conceptual program map for the proposed B.Eng. Electrical degree program.
3.	Jonathan Kim called for the review and adoption of the minutes from the previous meeting. Having no objections, it was moved by Shaun Ghafari and seconded by Weijing Ma that the minutes from the previous meeting be adopted. A unanimous vote was cast in favour of passing the motion.
4.	Jonathan Kim presented the degree development plan, highlighting the unique programming of core courses for the two streams. Jon Berge and Alexander Levchenko each provided an overview of the specialized courses for Power/Energy Option and Mechatronics Option, respectively. The presentation slides used are herewith attached.
5.	Attendees broke out into groups to explore and validate conceptual program map structure with two specializations. They were asked to provide comments and to present/share their feedback.
6.	Feedback gathered from the discussion groups are as per attached.
7.	The next PAC meeting was announced --- Thursday, November 20th.
8.	Having no other matters to discuss, the meeting was adjourned at 7:21 p.m.

B. Eng. (Electrical Engineering) Ad Hoc Professional Advisory Council
Thursday, November 20, 2014 ~ Room C328, Davis Campus

Present: Armen Baronian, Remy Fernandes, Milan Graovac, Mohinder Grover, Ben Hazlett, Paul Kuner, Brian Park, Exequiel Rarama, Andrew Yan, Jon Berge, Ramin Ghalati, Amin Ghobeity, Subir Ghosh, Nigel Johnson, Nazrul Khan, Jonathan Kim, Stefan Korol, Alex Levchenko, Weijing Ma, Todd Mander, Dan Mashatan, Zohreh Motamedi, Farhang Sahba, John Ferguson, Iain McNab, Matthew Rempel

Regrets: Chris Kerr, Alex Mihalidis, Joaquin Moran, Lars-Eric Sjoberg, Matthew Xie, Shaun Ghafari, Paul Kemp, Farzad Rayegani

MINUTES OF THE MEETING

1.	Meeting started at 5:08 pm with Jonathan Kim introducing Iain McNab (Dean, FAST) to the group. Iain thanked the PAC members for their time and involvement in keeping programs relevant to meet industry needs.
2.	Jonathan Kim then followed with a statement of the purpose of the third meeting which is to explore and validate the differentiating factors and to bring forward 3 motions to support: a. Critical Performance Statement b. Program Learning Outcomes c. Conceptual Program Map
3.	Jonathan Kim called for the review and adoption of the minutes from the previous meeting. Having no objections, it was moved by Mohinder Grover and seconded by John Ferguson that the minutes from the previous meeting be adopted. A unanimous vote was cast in favour of passing the motion.
4.	Jonathan Kim presented an overview of the differentiating factors. He also pointed out that Sheridan will be running all the courses with smaller class sizes (24 students per class). The presentation slides used are herewith attached.
5.	Attendees broke out into groups to explore and validate differentiating factors. They were asked to provide comments and to present/share their feedback.
6.	Feedback gathered from the discussion groups are as per attached.
7.	The following motions were acted upon by the group: a. Motion to support the critical performance statement – moved by Zohreh Motamedi, seconded by Mohinder Grover. No objections were raised. Adopted. b. Motion to support the program learning outcomes – moved by Stefan Korol, seconded by Armen Baronian. No objections were raised. Adopted. c. Motion to support the conceptual program map – moved by Jon Berge, seconded by Brian Park. No objections were raised. Adopted.
8.	Having no other matters to discuss, the meeting was adjourned at 7:28 p.m.

B. Eng. (Electrical Engineering) Ad Hoc Professional Advisory Council
Thursday, April 17, 2015~Room C328, Davis Campus

Present: Armen Baronian, Remy Fernandes, Mohinder Grover, Ben Hazlett, Paul Kuner, Brian Park, Andrew Yan, Jon Berge, Joaquin Moran, Ramin Ghalati, Amin Ghobeity, Subir Ghosh, Nigel Johnson, Nazrul Khan, Jonathan Kim, Stefan Korol, Alex Levchenko, Weijing Ma, Todd Mander, Dan Mashatan, Zohreh Motamedi, Farhang Sahba, John Ferguson, Matthew Rempel, Derrick Klotz

Regrets: Milan Graovac, Exequiel Rarama, Chris Kerr, Alex Mihalidis, Lars-Eric Sjoberg, Matthew Xie, Shaun Ghafari, Paul Kemp, John Martinovic

MINUTES OF THE MEETING

1.	Meeting started at 5:04 pm with Farzad Rayegani thanking the PAC members for their time and involvement, and outlining what's ahead in terms of degree development.
2.	Jonathan Kim then followed with explaining today's agenda and purpose of the fourth meeting, which is to review and validate the course outlines developed by faculty members. He reminded that the course outlines had been distributed to PAC members for review in advance, and reported some members already submitted their feedback.
3.	Jonathan Kim called for the review and adoption of the minutes from the previous meeting. Having no objections, it was moved by Mohinder Grover and seconded by Brian Park that the minutes from the previous meeting be adopted. A unanimous vote was cast in favour of passing the motion.
4.	Jonathan Kim presented an overview of the detailed program map. He pointed out the following revisions in the program map since the last meeting: • Replacing 'Electro-Mechanical Actuators and Drivers' course in term 5 for Mechatronics specialization with 'Modeling and Simulation' due to too much overlap with 'Electric Machines' course in term 6. • Some course name changes
5.	Attendees broke out into groups to review and validate course outlines. They were asked to provide comments and to present/share their feedback.
6.	Feedback gathered from the discussion groups.
7.	The following motions were acted upon by the group: • Motion to support the course outlines developed by the faculty members for Phase 2 documentation Discussion followed and the motion was amended as:

	• Motion to support the course outlines developed by the faculty members for Phase 2 documentation, with recommendation to eliminate 'Analog Circuits' in term 5 and replace it with more practical study and in-depth applications of electronic circuits and systems. (The PAC members concluded that there is very little opportunity in Ontario for our graduates to utilize the skills and knowledge covered by 'Analog Circuit Design' course.) – moved by Armen Baronian, seconded by Derek. • The motion is approved as amended. Adopted.
8.	Having no other matters to discuss, the meeting was adjourned at 7:28 p.m.

4.2 Professional Accreditation

The proposed Electrical Engineering program has been developed following the guidelines of the Canadian Engineering Accreditation Board (CEAB). The program meets the curricular requirements of the Canadian Engineering Accreditation Board for accreditation. The proposed program has also received very strong support from the Professional Advisory Council, the members of which represent a cross-section of stakeholders in electrical engineering, specializing in the fields of Power Systems or Mechatronics. The formal accreditation assessment will occur in the fourth year of the delivery of the proposed program, in accordance with CEAB guidelines.

The licensing of Professional Engineers in Canada falls under the jurisdiction of each provincial engineering association, such as Professional Engineers of Ontario (PEO). Each provincial engineering association, in turn, is a member of the Canadian Council of Professional Engineers (CCPE). The CCPE establishes the guidelines for the professional status of degree graduates in Canada through its Canadian Engineering Accreditation Board (CEAB), which reports to the CCPE council. All member associations, such as PEO, accept the decision of the CEAB with respect to the technical preparedness of degree graduates if the program from which they graduated is “accredited” by the CEAB. Accreditation covers a five-year period or shorter if the CEAB decides on a shorter period for some reason (e.g. upgrading of laboratories required). The provincial associations then tag on their practical experience requirement (typically four years post-graduation) before licensing an applicant as a Professional Engineer (P. Eng.).

Eligibility for Professional Engineering (P. Eng.) designation and accreditation by the Canadian Engineering Accreditation Board (CEAB) are important design specifications required to overcome any perceived differentiations between college and university credentials. The program development team has ensured that the program map and its learning outcomes are in absolute resonance with academic requirements of both the accreditation bodies, in addition to those of the CDIO framework. It is essential that those two accreditations position the college and university degrees at the same level of achievement and recognition by both prospective graduates and employers alike.

4.3 Learning Outcomes

4.3.1 Degree Level

The following summary table identifies the courses that map to each competency in the Board's degree level standard.

Courses	Depth and Breadth of Knowledge	Conceptual Methodological Research & Scholarship	Communication Skills	Application of Knowledge	Professional Capacity and Autonomy	Awareness of Limits of Knowledge
Calculus 1	x	x				
Engineering in Society - Health and Safety					x	
Exploring Engineering	x	x	x		x	x
Fundamentals of Physics 1	x	x				
Linear Algebra	x	x				
Calculus 2	x	x				
Computer Programming	x	x				
Engineering Design and Problem Solving	x	x	x		x	
Fundamentals of Physics 2	x	x				
Introduction to Chemistry for Engineers	x	x				
Algorithms and Data Structures	x	x				
Differential Equations	x	x				
Electrical Circuits and Power	x	x				
Electronic Circuits 1	x	x				
Fundamentals of Digital Systems	x	x				
Electronic Circuits 2	x	x				
Fundamentals of EM Fields	x	x				
Microprocessor Systems	x	x				
Numerical Methods	x	x				
Signals and Systems 1	x	x				
Signals and Systems 2	x	x				
Communication Systems	x	x				
Embedded Software Fundamentals		x	x	x	x	
Modeling and Simulation		x	x	x	x	
Electric Power Generation and Transmission	x	x	x	x	x	

Courses	Depth and Breadth of Knowledge	Conceptual Methodological Research & Scholarship	Communication Skills	Application of Knowledge	Professional Capacity and Autonomy	Awareness of Limits of Knowledge
Introduction to Energy Systems	x	x	x	x	x	
Statistics and Quality	x	x				
Control Systems	x	x				
Design of Digital Systems	x	x				
Electric Machines	x	x				
Embedded Application Development	x	x	x	x	x	
Kinematics and Robots	x	x	x	x	x	
Power Distribution System Design	x	x	x	x	x	
Power Electronics	x	x	x	x	x	
Capstone Project (Conceive and Design)	x	x	x	x	x	x
Engineering Economics and Entrepreneurship	x	x	x		x	
Mechatronics Principles	x	x	x	x	x	
Micro-electromechanical Systems (MEMS)	x	x	x	x	x	
Microcontroller Applications	x	x	x	x	x	
Alternative Energy Systems	x	x	x	x	x	
Power System Analysis	x	x	x	x	x	
Capstone Project (Implement and Operate)	x	x	x	x	x	x
Embedded Systems Design	x	x	x	x	x	
Mechatronics System Design	x	x	x	x	x	
Intelligent Power Systems	x	x	x	x	x	
Power System Control and Protection	x	x	x	x	x	

4.3.2 Program Level Learning Outcomes

I (concept is Introduced, but not evaluated) **T** (concept is Taught and evaluated) **U** (concept is Utilized and evaluated)

Proposed Bachelor of Engineering (Electrical Engineering)		**Term 1**					**Term 2**					**Term 3**					**Term 4**				
	Common First Two Years	Calculus 1	Linear Algebra	Fundamentals of Physics 1	Exploring Engineering	Eng in Society – Health and Safety	Calculus 2	Intro to Chemistry for Engineers	Fundamentals of Physics 2	Eng. Design & Problem Solving	Computer Programming	Differential Equations	Fundamentals of Digital Systems	Algorithms and Data Structures	Electronic Circuits 1	Electrical Circuits & Power	Numerical Methods	Signals and Systems 1	Fundamentals of EM Fields	Electronic Circuits 2	Microprocessor Systems
1	Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	**I**	**I/T**	**I**	**I/T**	**I/T**	**I**	**I**	**I**	**T**	**I**	**I**	**T/U**	**T**	**T**	**T**	**I**	**T**	**T**	**T**	**T**
2	Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.				**I/T**	**I/T**		**I**		**T**			**T**	**T**				**T**	**T**		**I**
3	Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.					**I/T**		**I**		**T**	**I**		**T**	**I**	**I**	**I**			**T**	**T**	**I**
4	Design a system, component, or process that meets regulatory and industry standards and considers health and safety risks, economic, environmental, cultural and social impacts.					**T**		**I**		**T**	**I**				**T/U**	**I**		**T**	**I**	**T/U**	
5	Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	**T**	**T**	**I**	**T**		**T**		**I**	**U**	**T**	**T**	**T**	**T**	**T/U**	**T**	**T**	**T**	**I**	**T/U**	**T**
6	Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	**I**		**I**	**I**	**T**	**I**	**I/T**	**I**	**U**		**I**		**T**	**U**			**I**	**U**	**U**	**U**
7	Communicate technical concepts and issues effectively with both technical and non-technical audiences.	**I/T**	**I/T**	**I/T**	**T**		**I**	**I/T**	**I/T**	**U**		**U**		**U**	**U**		**U**	**U**	**U**	**U**	**U**
8	Explain the roles and responsibilities of the professional engineer in society.				**I**	**T**				**T**											
9	Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety.				**I**	**T**		**I**							**I**			**T**			
10	Demonstrate ethical conduct, accountability and equity consistent with the requirements of the profession.				**T**	**T**				**T**											
11	Incorporate economics and business practices, specifically entrepreneurship and project management skills, into practices of engineering.				**I**	**I**				**T**				**I**					**I**	**I**	**I**
12	Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.				**I**	**I**				**U**					**U**			**I**	**I**	**U**	**I**

I (concept is Introduced, but not evaluated) **T** (concept is Taught and evaluated) **U** (concept is Utilized and evaluated)

Proposed Bachelor of Engineering (Electrical Engineering)		**Term 5**					**Term 6**					**Term 7**					**Term 8**		
	Power & Energy Systems Specialization	Statistics and Quality	Signals and Systems 2	Communication Systems	Electric Power Gen. and Trans.	Introduction to Energy Systems	Design of Digital Systems	Control Systems	Electric Machines	Power Electronics	Power Distribution System Design	Capstone Project (Conceive & Design)	Micro-Controller Applications	Power System Analysis	Alternative Energy Systems	Engineering Economics and Entrepreneurship	Power System Control & Protection	Intelligent Power Systems	Capstone Project (Implement & Operate)
1	Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	**T**	**T**	**T**	**T/U**	**T**	**T/U**	**T/U**	**T**	**T**	**T/U**	**T/U**	**T/U**	**T**	**T**	**T/U**	**T/U**	**T/U**	**U**
2	Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.	**I**	**T**	**T**	**I**	**I**	**I**	**T**	**T**	**T**	**U**	**T/U**	**T/U**	**T/U**	**T**		**T/U**	**U**	**U**
3	Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	**T**	**I**	**I**	**I**		**T**	**T**	**T**	**T**	**T/U**	**T/U**	**I/T/U**	**T/U**	**T**		**T/U**		**U**
4	Design a system, component, or process that meets regulatory and industry standards and considers health and safety risks, economic, environmental, cultural and social impacts.	**I**	**T**	**T**	**I**	**T**	**T**		**T**	**T**	**T**	**T/U**	**I/T/U**	**T/U**	**T**		**T**	**U**	**U**
5	Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	**T**	**T**	**T**	**U**	**T**	**T/U**	**T/U**	**T**	**T**	**T/U**	**T/U**	**T/U**	**T/U**	**T**		**T/U**	**U**	**U**
6	Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	**U**	**I**	**I**			**T/U**	**I**				**T/U**	**U**	**U**		**T**	**U**		**U**
7	Communicate technical concepts and issues effectively with both technical and non-technical audiences.	**U**	**U**	**U**	**U**						**U**	**T/U**	**U**	**U**			**U**		**U**
8	Explain the roles and responsibilities of the professional engineer in society.										**U**		**U**			**T**	**T/U**		**U**
9	Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety.	**I**	**T**	**T**	**I**	**I**		**I**	**T**	**T**		**T/U**	**U**	**T/U**	**T**	**T**	**T**	**T/U**	**U**
10	Demonstrate ethical conduct, accountability and equity consistent with the requirements of the profession.												**U**						**U**
11	Incorporate economics and business practices, specifically entrepreneurship and project management skills, into practices of engineering.	**I**					**T/U**				**T/U**	**T/U**	**U**	**T**					**U**
12	Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		**U**	**U**			**T**		**T**	**T**		**T/U**	**T/U**	**U**		**I/T/U**			**U**

I (concept is Introduced, but not evaluated) **T** (concept is Taught and evaluated) **U** (concept is Utilized and evaluated)

Proposed Bachelor of Engineering (Electrical Engineering)		**Term 5**					**Term 6**					**Term 7**					**Term 8**		
	Mechatronics Specialization	Statistics and Quality	Signals and Systems 2	Communication Systems	Embedded Software Fundamentals	Modeling and Simulation	Design of Digital Systems	Control Systems	Electric Machines	Embedded Appl. Development	Kinematics and Robotics	Capstone Project (Conceive & Design)	Micro-Controller Applications	Micro-Electro-Mechanical Systems (MEMS)	Mechatronics Principles	Engineering Economics and Entrepreneurship	Embedded System Design	Mechatronic Systems Design	Capstone Project (Implement & Operate)
1	Create sustainable solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	**T**	**T**	**T**	**T/U**	**U**	**T/U**	**T/U**	**T**	**T/U**	**I**	**T/U**	**T/U**	**T/U**	**T/U**	**T/U**	**T/U**	**T/U**	**U**
2	Solve complex problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.	**I**	**T**	**T**		**U**	**I**	**T**	**T**		**T**	**T/U**	**T/U**						**U**
3	Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	**T**	**I**	**I**	**T**	**U**	**T**	**T**	**T**	**T**		**T/U**	**I/T/U**	**T/U**	**U**		**T**		**U**
4	Design a system, component, or process that meets regulatory and industry standards and considers health and safety risks, economic, environmental, cultural and social impacts.	**I**	**T**	**T**		**U**	**T**		**T**	**T**		**T/U**	**I/T/U**		**T**		**T**	**T/U**	**U**
5	Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	**T**	**T**	**T**	**T**	**U**	**T/U**	**T/U**	**T**	**T/U**	**T**	**T/U**	**T/U**	**T/U**	**T**		**T/U**	**T/U**	**U**
6	Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	**U**	**I**	**I**			**T/U**	**I**			**U**	**T/U**	**U**			**T**			**U**
7	Communicate technical concepts and issues effectively with both technical and non-technical audiences.	**U**	**U**	**U**							**U**	**T/U**	**U**						**U**
8	Explain the roles and responsibilities of the professional engineer in society.												**U**			**T**			**U**
9	Analyze the impact of electrical engineering solutions in a global, economic, societal, environmental and public safety.	**I**	**T**	**T**				**I**	**T**			**T/U**	**U**			**T**			**U**
10	Demonstrate ethical conduct, accountability and equity consistent with the requirements of the profession.												**U**						**U**
11	Incorporate economics and business practices, specifically entrepreneurship and project management skills, into practices of engineering.	**I**					**T/U**			**T/U**		**T/U**	**U**				**T/U**	**T**	**U**
12	Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.	**T**	**U**	**U**			**T**		**T**			**T/U**	**T/U**	**T**		**I/T/U**	**U**		**U**

4.4 Course Descriptions

4.4.1 Core Courses

Course Title (Core)	Calendar Course Description
Year 1 Term 1	
Calculus 1	Students apply differentiation and integration techniques to a variety of mathematics and engineering problems, including applications in geometry and mechanics.
Engineering in Society - Health and Safety	Students integrate legal obligations and liabilities of environmental protection, with legal aspects of health and safety in the workplace.
Exploring Engineering	Students present, using different technical communication styles and graphic depictions, a simple engineering operational project of their own design and fabrication, within an engineering framework.
Fundamentals of Physics 1	Students analyze the laws of mechanics and the mechanical behaviour of single particles, systems of particles, rigid bodies, simple oscillatory systems and fluids.
Linear Algebra	Students apply concepts from linear algebra to solve systems of linear equations, evaluate eigenvalues and eigenvectors of real and complex operators, analyze lines and planes, represent linear operators using matrices and find orthogonal basis for inner product spaces.
Year 1 Term 2	
Calculus 2	Students apply single and multivariable calculus techniques to a variety of problems involving separable and linear differential equations, series expansions of functions, gradient, line and surface integrals, area, volume, centre of mass and optimization.
Computer Programming	Students create C programs using various data types, control algorithms, functions and data structures, to manage processes, such as data manipulations, decision making, memory management, and input/output data control.
Engineering Design and Problem Solving	Students evaluate the design performance by creating and analyzing supporting documentation to reflect the entire engineering design cycle for product or system development.
Fundamentals of Physics 2	Students analyze principles from wave motion, thermodynamics and electromagnetism and a variety of phenomena.
Introduction to Chemistry for Engineers	Students apply fundamental chemistry concepts to scientific and industrial applications.

Course Title (Core)	Calendar Course Description
Year 2 Term 3	
Algorithms and Data Structures	Students solve various engineering problems within the scientific computation context using appropriate data structures and algorithms.
Differential Equations	Students solve single higher order and systems of first order linear ordinary differential equations with constant coefficients and one-dimensional boundary value problems using a variety of tools.
Electrical Circuits and Power	Students apply the fundamentals of electrical measurement and the principals of electrical network analysis to DC and AC circuits consisting of linear elements.
Electronic Circuits 1	Students utilize simple circuits made of discrete electronic components.
Fundamentals of Digital Systems	Students design digital systems based upon their thorough understanding of various combinational and sequential logic circuits, performing number systems, applying Boolean algebra, utilizing digital encoder, decoder, multiplexer, de-multiplexer etc., and understanding different primitive elements of computer systems.
Year 2 Term 4	
Electronic Circuits 2	Students design various op-amp centered analog circuits, using both manual and CAD based analysis and design techniques.
Fundamentals of EM Fields	Students apply Maxwell's equations, time varying fields, plane waves, and radiation to the real world applications including transmission lines, waveguides, optical fibers, and antennas.
Microprocessor Systems	Students develop microprocessor applications using a microprocessor's instruction set, programming model, memory map and addressing modes.
Numerical Methods	Students apply numerical analysis techniques to a variety of problems in calculus, linear algebra and differential equations.
Signals and Systems 1	Students conduct basic signal processing and systems analysis through mathematically modeling the continuous and discrete signals and systems.
Year 3 Term 5	
Signals and Systems 2	Students use continuous and discrete signal processing, and system design techniques to solve practical engineering problems based on a thorough understanding of signals and systems.

Course Title (Core)	Calendar Course Description
Communication Systems	Students utilize modern communication techniques, such as Fourier transforms, analog/digital modulation techniques, and digital data and network communications.
Embedded Software Fundamentals	Students utilize embedded software development tools for implementing input-output, data transfer, and signal processing algorithms, and developing embedded applications using C language, with an understanding of the properties of real-time systems.
Modeling and Simulation	Students model and analyze various mechanical and electrical systems by using system modeling approaches, transfer functions, block diagrams, and state space methods.
Electric Power Generation and Transmission	Students apply the principles of electric power generation and transmission to the analysis of an electric power system.
Introduction to Energy Systems	Students develop system-level models of various energy conversion systems for thermo-economic analysis and environmental impact study.
Statistics and Quality	Students apply principles of probability and statistics to techniques in quality control.
Year 3 Term 6	
Control Systems	Students design control systems that meet a set of requirements based upon their understanding of control systems' functionality and use of fundamental control system analysis and design techniques to solve engineering problems.
Design of Digital Systems	Students design digital systems by describing both combinational and sequential building blocks using a descriptive language and implementing on Field Programmable Gate Arrays (FPGAs).
Electric Machines	Students apply electric machines in various electro-mechanical energy conversion systems, based on their understanding of operating principles and practical knowledge of dc machines, ac induction machines, synchronous machines, and other special types of electric machines.
Embedded Application Development	Students implement software intended to run on embedded processors hosting a real-time operating system and running with limited resources and constrained parameters.
Kinematics and Robots	Students determine rigid motion and manipulator kinematics in order to resolve the resulting equations, including those related to simple inverse kinematic problems and motion planning problems to support both

Course Title (Core)	Calendar Course Description
	the integration of sensors and the programming of an articulated robotic arm.
Power Distribution System Design	Students apply the principles of electrical power distribution engineering to design and operate electrical power distribution systems under diverse operating conditions.
Power Electronics	Students develop a conceptual design of an appropriate power-electronic system for a specified application, based on their understanding of operating principles, analysis, design, and control of various power-electronic converters.
Year 4 Term 7	
Capstone Project (Conceive and Design)	Students work in multidisciplinary teams to conceive and design open-ended engineering projects that are industrially-based and multi-disciplinary.
Engineering Economics and Entrepreneurship	Students assess the business matters for engineering projects including cost effectiveness of manufacturing products and processes, value proposition, business plans, intellectual property, marketing, and operations.
Microcontroller Applications	Students develop working control systems using a typical micro-controller's instruction set, programming model, memory map and addressing modes in both assembly code and the C programming language, following a structured programming methodology.
Mechatronics Principles	Students integrate the components of a mechatronics system and set up the interfaces among components using trans-disciplinary modeling approaches and synergic combination of simulation tools from mechanical and electrical engineering, computer science.
Micro-electromechanical Systems (MEMS)	Students utilize micro-electromechanical sensors, such as inertial, environmental, and acoustic MEMS transducers, with an understanding of their operating principles, characteristics, and specifications.
Alternative Energy Systems	Students perform system-level analysis of alternative energy systems, including the calculation of the energy harvested and converted from alternative energy sources, such as solar, wind, biomass, nuclear, geothermal, and hydro.
Power System Analysis	Students evaluate power system steady state operations, fault conditions, disturbances, transient stability, and power system economic operations.
Year 4 Term 8	
Capstone Project (Implement and Operate)	Students complete a significant engineering project that either addresses specific requirements of a specific client or provides a solution for an open-ended real world

Course Title (Core)	Calendar Course Description
	problem through a creative design process, project management, and modern manufacturing.
Embedded Systems Design	Students integrate hardware and software to implement a microcontroller-based real-time embedded system.
Mechatronics System Design	Students integrate the components of a mechatronic system with the set interfaces among components using mechatronic system design fundamentals, trans-disciplinary modeling approaches, practical mechatronic project methodologies, and core competencies in the integration of complex mechatronic systems.
Intelligent Power Systems	Students apply intelligent power systems technologies to improve the capacity and reliability of electrical networks and explain the process of electrical energy metering and the processes by which electrical energy is bought and sold.
Power System Control and Protection	Students evaluate control and protection methods and reliability considerations for the power system including transformers, generators, motors, buses, distribution systems, transmission systems, and coordination operations including communication.

4.4.2 Non-Core Courses

The breadth course elective descriptions on file with PEQAB are current.

4.5.2 Undergraduate Course Schedule 2

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Year 1 Term 1					
Calculus 1	70		4		Ph.D. Appl. Math M.Sc. Mathematics
Linear Algebra	70		4		Ph.D. Appl. Math. Ph.D. Appl. Math
Fundamentals of Physics 1	70		4		Ph.D. Appl. Math. Ph.D. Physics Ph.D. Elec. Eng. & Comp. Eng.
Exploring Engineering	84		4		Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Engineering in Society – Health and Safety	42		3		Ph.D. Elec. Eng. Ph.D. Education
Mandated Breadth: Composition and Rhetoric		42	3		M.A., Ph.D. preferred
Year 1 Term 2					
Calculus 2	70		4	Prerequisites: Calculus 1	Ph.D. Mathematics M.Sc. Mathematics
Fundamentals of Physics 2	70		4	Prerequisites: Fundamentals of Physics 1, and Calculus 1	Ph.D. Appl. Math. Ph.D. Physics Ph.D. Elec. Eng.
Computer Programming	70		4		Ph.D. Elec. Eng. Ph.D. Elec. Eng. M.Eng.Sc.
Intro to Chemistry for Engineers	70		4		Ph.D. Chem. Eng.

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Engineering Design and Problem Solving	70		4	Prerequisites: Exploring Engineering	Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Breadth Elective		42	3		M.A., Ph.D. preferred
Year 2 Term 3					
Differential Equations	70		4	Prerequisites: Calculus 2 and Linear Algebra	Ph.D. Appl. Math. M.Sc. Mathematics
Electrical Circuits and Power	70		4	Prerequisites: Fundamentals of Physics 2	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Fundamentals of Digital Systems	84		4		Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Algorithms and Data Structures	70		4	Prerequisites: Computer Programming	Ph.D. Elec. Eng. M.Eng.Sc.
Electronic Circuits 1	70		4	Prerequisites: Fundamentals of Physics 2	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Breadth Elective		42	3		M.A., Ph.D. preferred
Year 2 Term 4					
Numerical Methods	70		4	Prerequisites: Differential Equations	Ph.D. Appl. Math. M.Sc. Mathematics Ph.D. Mech. Eng.
Signals and Systems 1	84		4	Prerequisites: Differential Equations	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Fundamentals of EM Fields	70		4	Prerequisites: Fundamentals of Physics 2	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Electronic Circuits 2	70		4	Prerequisites: Electronic Circuits 1	Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Microprocessor Systems	70		4	Prerequisites: Fundamentals of Digital Systems	Ph.D. Elec. Eng. M.Eng.Sc.
Internship Prep Course	14		0		
Breadth Elective		42	3		M.A., Ph.D. preferred
4-month Internship (Mandatory)					
Year 3 Term 5					
Statistics and Quality	70		4	Prerequisites: Linear Algebra	Ph.D. Appl. Math. Ph.D. Appl. Math.
Signals and Systems 2	70		4	Prerequisites: Signals and Systems 1	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Communication Systems	70		4	Prerequisites: Signals and Systems 1	Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Power Option Electric Power Generation and Transmission	70		4	Prerequisites: Electrical Circuits and Power	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Mechatronics Option Embedded Software Fundamentals				Prerequisites: Algorithms and Data Structures	Ph.D. Elec. Eng. M.Eng.Sc.

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Power Option Introduction to Energy Systems	70		4	Prerequisites: Fundamentals of Physics 2	Ph.D. Mech. Eng. Ph.D. Elec. Eng. Ph.D. Mech. Eng.
Mechatronics Option Modeling and Simulation				Prerequisites: Numerical Methods	Ph.D. Elec. Eng. Ph.D. Mech. Eng.
Breadth Elective		42	3		M.A., Ph.D. preferred
Year 3 Term 6					
Design of Digital Systems	70		4	Prerequisites: Microprocessor Systems	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Control Systems	70		4	Prerequisites: Signals and Systems 2	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Electric Machines	70		4	Prerequisites: Electrical Circuits and Power	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Power Option Power Electronics	70		4	Prerequisites: Electrical Circuits and Power, and Electronic Circuits 1	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Mechatronics Option Embedded Application Development				Prerequisites: Embedded Software Fundamentals	Ph.D. Elec. Eng. M.Eng.Sc.
Power Option Power Distribution System Design	70		4	Prerequisites: Electric Circuits and Power	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Mechatronics Option Kinematics and Robotics				Prerequisites: Fundamentals of Physics 1	Ph.D. Ind. & Manuf. Eng. Ph.D. Mech. Eng. Ph.D. Mech. Eng.

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Optional Co-op Preparation Course	14		0		M.A., Ph.D. preferred
Breadth Elective		42	3		M.A., Ph.D. preferred
8-16 month Co-op Work term (Optional)					
Year 4 Term 7					
Capstone Project (Conceive and Design)	84		4		Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. & Comp. Eng.
Micro-Controller Applications	70		4	Prerequisites: Design of Digital Systems	Ph.D. Elec. Eng. M.Sc. Information Technology
Power Option Power System Analysis	70		4	Prerequisites: Electric Power Generation and Transmission	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Mechatronics Option Micro-Electro-Mechanical Systems (MEMS)				Prerequisites: Design of Digital Systems	Ph.D. Elec. Eng. M.Eng.Sc. Ph. D. Elec. Eng. & Comp. Eng.
Power Option Alternative Energy Systems	70		4	Prerequisites: Introduction to Energy Systems	Ph.D. Mech. Eng. Ph.D. Elec. Eng. Ph.D. Mech. Eng.
Mechatronics Option Mechatronic Principles				Prerequisites: Simulation and Modeling	Ph.D. Elec. Eng. Ph.D. Mech. Eng.
Engineering Economics & Entrepreneurship	42		3		Ph.D. Education Ph.D. Op. & Strat. Mgmt.
Breadth Elective		42	3		M.A., Ph.D. preferred

Course Name	Core Hours	Non-Core Hours	Credits	Prerequisites & Co-requisites	Highest Qualification earned & disc. of study
Year 4 Term 8					
Capstone Project (Implement & Operate)	112		5	Prerequisites: Engineering Economics and Entrepreneurship, and Capstone Project (Conceive and Design)	Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng. Ph.D. Elec. Eng.
Power Option Power System Control and Protection	70		4	Prerequisites: Power System Analysis	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Mechatronics Option Embedded System Design				Prerequisites: Micro-Controller Applications	Ph.D. Elec. Eng. M.Eng.Sc.
Power Option Intelligent Power Systems	70		4	Prerequisites: Power System Analysis	Ph.D. Elec. Eng. & Comp. Eng. Ph.D. Elec. Eng.
Mechatronics Option Mechatronic System Design				Prerequisites: Mechatronic Principles	Ph.D. Elec. Eng. Ph.D. Mech. Eng.
Breadth Elective		42	3		M.A., Ph.D. preferred
Subtotal Course Hours	**2730**	**336**	**175**		
Total Program Hours	**3066** The required breadth represents 20% of the course work of a standard Ontario college degree				

4.6 Work-integrated Learning Experience

Sheridan College has a successful program of providing students with career education curriculum and of facilitating work experiences for students through our well-established Co-operative Education & Internship Office (CEIO). The Co-op Office employs over 24 staff and partners with over 12,000 employers to provide curriculum-related work experience for students. The Co-op Office's dedicated personnel work diligently to educate certificate, diploma, and degree students on job search and career management strategies that will serve them in securing co-op work term positions and maximizing their learning during the work term.

The Co-op advisors are very experienced and are thoroughly familiar with the scope and requirements of these opportunities. In addition, Sheridan is increasingly dedicated to facilitating partnerships with industry practitioners who may want to avail themselves of our state-of-the-art facilities, with access to students during their co-op terms to work on projects at Sheridan. Such partnerships can be extremely attractive to industry, and have great benefit to our students as additional work experiences.

The Co-operative Education Model

The co-op model is based on the principle that an academic program, combined with work experience, is relevant to and desirable for effective employment preparation. Work term employment, which varies from sector to sector, allows students to acquire experience in their areas of career interest, while academic terms are devoted primarily to fundamental and theoretical studies. These practical experiences and academic studies complement one another.

The motivation, responsibility, and opportunity for insight gained through co-operative education can be of significant value to the student's future. The concept enables those with a career orientation to become full-time students of their subject, both during the academic terms and during the related work terms, within a structure of organized purpose and serious study.

The Co-op Office at Sheridan uses a competitive employment process model. While the CEIO makes every effort to assist students in gaining employment, there is no guarantee that every student will become employed through the co-op employment process. The Co-op Office is responsible for the review and approval of co-op/internship job postings, but does not assume responsibility for endorsing the companies.

4.6.1 Requirements/Options for Work Experience

This section provides details of the mandatory internship and optional co-op work term components of the proposed Bachelor of Engineering (Electrical Engineering) degree program. It also explains the possible credits for pre-graduation experience (internship or co-op work term), towards the P. Eng. designation.

Work experience in relevant industry is an integral part of Sheridan engineering education, as it provides students with real-world experience in the profession. Further,

this experience enables students to correlate classroom learning with application to industry, broadens their understanding of the types of employment available in the field, helps students discover their individual interests, and builds resume credentials.

Sheridan has a successful program of providing students with career education curriculum and of facilitating work experiences for students through the well-established Co-operative Education & Internship Office (CEIO).

The Work-integrated Learning Model

The model is based on the principle that an academic program combined with work experience is relevant to and desirable for effective employment preparation. Work term employment, which varies from sector to sector, allows students to acquire experience in their areas of career interest, while academic terms are devoted primarily to fundamental and theoretical studies. These practical experiences and academic studies complement one another. The motivation, responsibility, and opportunity for insight gained through work integrated learning can be of significant value to the student's future.

Engineering Work-Integrated Learning

The proposed Bachelor of Engineering (Electrical Engineering) program includes:

- one mandatory internship of 14 weeks (4 months) and
- one optional engineering co-op for 8 to 16 months.

Students must successfully complete the internship (a paid, full-time work term of no less than 14 consecutive weeks) in the professional field of study to qualify for graduation. The mandatory internship will normally be completed after the second year of study. It is expected that after four semesters of study, students will have the foundational knowledge to make a reasonable contribution in the workplace, with supervision.

The engineering co-op work term is optional, although highly recommended, as it builds on the student experience from the mandatory internship and may be admitted as relevant work experience for the P. Eng. designation. The engineering co-op will begin after students have completed three years of their academic program. Students who have a minimum 2.5 cumulative GPA are eligible. Students enter the co-op in an industrial or other engineering setting at the end of the third year, and then return to Sheridan to complete their final year of studies. The length of the optional engineering co-op is flexible, although students must complete a minimum 8 months of work; they may consider a longer term if they are able to continue working through the summer.

	Winter Term	Summer Term	Fall Term
			Term 1 (Year 1)
Year 1	Term 2 (Year 1)	Summer Vacation	Term 3 (Year 2)
Year 2	Term 4 (Year 2)	4-Month Internship	Term 5 (Year 3)
Year 3	Term 6 (Year 3)	8-16 Month Co-Op Work-Term	
Year 4	Co-Op Work-Term		Term 7 (Year 4)
Year 5	Term 8 (Year 4)		

Program Schedule with both mandatory internship and optional co-op work term.

	Winter Term	Summer Term	Fall Term
			Term 1 (Year 1)
Year 1	Term 2 (Year 1)	Summer Vacation	Term 3 (Year 2)
Year 2	Term 4 (Year 2)	4-Month Internship	Term 5 (Year 3)
Year 3	Term 6 (Year 3)	Summer Vacation	Term 7 (Year 4)
Year 4	Term 8 (Year 4)		

Program Schedule with only mandatory internship.

Sheridan attracts a number of co-op opportunities, but cannot guarantee a placement for every candidate. All positions must be approved by the School of MEET to ensure a meaningful engineering experience.

The placement of both the mandatory internship and optional engineering co-op term is part of a deliberate strategy to use the practical work experience as an educational tool in subsequent courses and also allow students to build relevant experience toward the P. Eng. designation. As a result of the work terms, it is believed that both third-year and fourth-year learning will be augmented by the participation in real-world projects and activities. Furthermore, ideas for the fourth-year industry capstone project may be derived from these work-integrated learning experiences in industry.

The work term schedule has been designed to avoid competition between students in the proposed degree program and those in the electronics and computer technology diploma programs currently offered. Degree program students will seek work term employment in the summer semester and diploma students in the fall and winter semesters. When it comes to 8-16 month co-op placements for degree program students, their qualifications and skillsets will definitely set them apart from diploma students.

4.6.2 Types of Work Experiences

Electrical Engineering students have opportunities to work in engineering firms in positions that are usually created specifically as internship or co-op positions. Here are a few examples from current co-op/Internship position postings in the field: Co-op Electrical Engineering, Technical Support Engineer, Electrical Engineer Co-op, Intern: Solar Design, Field Service Representative Co-Op, Electrical Engineering Co-op.

In these positions the students are placed under the supervision of the company's engineering staff to support the work of the company. This includes project and development work, support to professional engineers, and/or support to regular business operations. Students gain the lived experience of working in the real world of

working engineers. They develop insight as to how their learning will be applied in the context of a modern engineering business.

4.6.3 Plans to Develop Placement Opportunities

Through its regular interactions with Sheridan's industry partners, the CEIO believes that there is (and will be) significant demand by industry for co-op and internship students from the proposed Electrical Engineering degree program, particularly with the two specializations of Mechatronics and Power & Energy Systems.

Mechatronics jobs used to be a target position for co-op students in the Electromechanical Engineering Technology diploma program, but more recently this has been declining, as employers are now requiring more Electrical Engineering knowledge for these roles and a commitment of longer than 4 months to address training requirements. Through the proposed curriculum, students in the Mechatronics stream will allow Sheridan to fulfill this industry requirement, which is currently difficult through the existing diploma offerings.

Similarly, the Power and Energy Sector has been a strong supporter of Sheridan's diploma engineering co-op programs, but has often requested more detailed knowledge of Energy & Power Systems. The proposed degree will address this demand. Many co-op positions in the energy sector require a co-op commitment of greater than 4 months, so the co-op option will open up new opportunities for Sheridan co-op students that were previously inaccessible.

The Co-op Office has an established history of successfully placing engineering diploma and advanced diploma students. We are confident that this success can be replicated for degree students, and that students will be able to successfully complete this important degree requirement.

4.6.4 Support for Work Experience

There are four partners in the Cooperative Education and Internship Programs at Sheridan: the Co-op Office, Students, Employers, and Academic Departments. The success of the program relies upon all parties understanding their responsibilities.

The Co-operative Education and Internship Office
Currently, the Co-op Office supports 36 co-op programs at Sheridan, with students enrolled in a wide range of programs including: arts and animation, business, health, applied computing and engineering sciences.

The Co-op Office mandate is to:

- Provide the delivery and evaluation of co-op preparatory and work term curricula (e.g. career planning skills including self-assessment, résumé and cover letter preparation, job search techniques and effective interviewing skills)
- Develop job opportunities and secure potential employers
- Arrange recruiting interviews for co-op and internship students

- Provide professional career guidance to students
- Maintain co-op records
- Monitor co-op and internship work terms by visiting and/or telephoning students and employers on the job
- Support students in co-op / internship work term opportunities before, during and after their work terms to help maximize the students' whole education and career experience

The Student

Students must abide by all co-op policies and procedures. The responsibilities of the student include:

- Successful completion of co-op preparatory course
- Maintain good academic standing
- Complete all co-op work term assignments
- Exhibit professional conduct during job search and work term
- Relate classroom learning to the workplace – this benefits both student and employer
- Exercise ethical workplace conduct and represent Sheridan with a standard of conduct and performance which will further enhance the relationship between Sheridan and the employer
- Maintain employer confidentiality
- Abide by the policies and procedures of employer
- Accept constructive feedback, suggestions for improvement in a positive manner
- Resolve problems or issues that may arise in a prompt, professional manner
- Be a productive and responsible employee and take initiative as appropriate
- Advise the employer and Internship advisor of any concerns or problems with work assignments or environmental issues as soon as they arise
- Set realistic expectations and goals that will encourage self-improvement and benefit the employer

The Employer

To increase the student's productivity and facilitate learning, it is recommended that employers:

- Advise the students with regards to all issues of confidentiality in the workplace and ensure that any non-disclosure agreements are signed prior to the commencement of work
- Prepare the student's co-workers and other staff for the arrival of the student
- Provide the student with an orientation to the workplace, including an overview of the organization (e.g. mission statement, products, etc.), physical layout, relevant personnel, safety practices, and the duties or tasks expected during the work term
- Provide a supervisor for the Co-op and internship student who will oversee the student's work and discuss expectations for the work term with the student and, on a regular basis, give the student feedback on how he/she is doing, including areas of strength and areas which require improvement

The Academic Department

The Academic Department is responsible for all academic components of the co-op or Degree program. A co-op Student Advisor works closely with each Academic Program Coordinator to ensure standards are established and relevant information is shared. Because of their connections with industry, faculty members are often involved in finding potential co-op positions. They may also be asked to vet potential positions for relevance and appropriateness. Faculty help prepare students for their co-op experiences through career-related programming embedded in the curriculum. On their return from the co-op, students reflect on what they learned in the co-op experience and relate it to their curriculum through structured activities provided by faculty.

4.6.5 Work-integrated learning experience outcomes

The following chart outlines the learning outcomes for the internship, how possible job responsibilities will allow students to demonstrate these learning outcomes.

Internship Outcomes	**How work experience puts into practice the program learning outcomes**
By the end of the internship, students will have demonstrated the ability to:	*During the internship, students may perform some or all of the following types of tasks with support achievement of program learning outcomes:*
1. Apply engineering knowledge, methods and techniques by solving engineering problems using appropriate theoretical and practical engineering principles. *Note: This outcome is about assessing a student's ability to solve engineering problems (by identifying alternate solutions) and whether they have been exposed to the design lifecycle.*	This work experience outcome puts into practice the program learning outcomes #1, 2, 3. Indicators of tasks that will support achievement of the learning outcomes: • Defines potential issues or opportunities. • Collects and analyses relevant data. • Identifies alternate solutions based on feasibility, technology and economic assessments. • Develops solutions that achieve system requirements and specifications. • Selects and applies appropriate testing methodologies and techniques to verify that solutions meet specifications, codes and standards. • Implements engineering solutions. • Evaluates effectiveness of engineering solutions (i.e. practicality, constructability).
2. Use engineering technology, tools and equipment based on sound understanding of engineering principles.	This work experience outcome puts into practice program learning outcome #5.

Internship Outcomes	How work experience puts into practice the program learning outcomes
Note: This outcome addresses both the "hands-on" aspect of engineering and demonstration of internship experience, as well as the importance of using up-to-date technology, tools and equipment.	Indicators of tasks that will support achievement of the learning outcomes: • Selects relevant technology for solutions to engineering problems. • Uses, or monitors the use of, technology to solve engineering problems. • Verifies the reliability of the use of technology, tool or equipment. • Verifies the effectiveness of the use of technology, tool or equipment. • Evaluates the limitations of the technology and how it can be applied. • Understands the underlying principles behind the technology and its application.
3. Practices engineering activities holding paramount the safety, health and welfare of the public; the protection of the environment; and the safeguarding of economic interests. *Note: Reference to the public in this outcome includes oneself and colleagues.*	This work experience outcome puts into practice program learning outcomes #4 and 10. Indicators of tasks that will support achievement of the learning outcomes: • Adheres to legislations, regulations and policies within all jurisdictional levels. • Complies with all applicable codes and standards. • Assesses risks and safety concerns of engineering activities to identify hazards and potential harm. • Implements practices to protect health and safety of the public.
4. Recognize the impacts of developing engineering solutions that are based on the sound understanding of their impacts on the environment, economy and society. *Note: The word "develops" is used to highlight the fact that solutions may be proposed, but not implemented. This outcome addresses the engineering intern's responsibility to consider the*	This work experience outcome puts into practice program learning outcomes #9 and 10. Indicators of tasks that will support achievement of the learning outcomes: • Identifies the types of assessments and consultations required. • Assesses, to the extent possible, long term environmental and sustainability issues associated with engineering activities. • Assesses, to the extent possible, the economic and social impacts of engineering.

Internship Outcomes	How work experience puts into practice the program learning outcomes
social implications of engineering activities.	
5. Applies the principles of sound management when conducting engineering activities including individual work. *Note: This competency addresses the importance of proper work management practices – for projects or for individual undertakings.*	This work experience outcome puts into practice the program learning outcome #11. Indicators of tasks that will support achievement of the learning outcomes: • Conducts activities with an accurate understanding of expectations and needs. • Develops or implements schedules or budgets. • Manages the interplay of schedule, resources, quality and budget. • Manages risks. • Measures outcomes.
6. Effectively communicates engineering information verbally, graphically and in writing.	This work experience outcome puts into practice program learning outcome #6. Indicators of tasks that will support achievement of the learning outcomes: • Tailors communications to the audience and clarifies complex and technical information. • Presents information clearly and concisely. • Listens actively and confirms own understanding. • Prepares correspondence, reports, records, or drawings. • Keeps clear and comprehensive records of engineering decisions, and supporting documentation (e.g. design record).
7. Works effectively within the professional context to achieve societal, organizational and project goals in a collaborative manner. *Note: This outcome addresses the ability to work with diverse groups, demonstrating the respect and professionalism necessary to succeed in a professional environment.*	This work experience outcome puts into practice program learning outcome #6. Indicators of tasks that will support achievement of the learning outcomes: • Shares relevant information, key knowledge and expertise with others. • Respects contributions of other professionals and colleagues at all levels. • Offers assistance to others when needed. • Resolves difficult interpersonal situations using tact and honesty.

Internship Outcomes	How work experience puts into practice the program learning outcomes
	• Handles disagreement promptly, seeking mutually agreeable solutions. • Demonstrates sensitivity, and respect in interactions with diverse individuals and groups in ways that advance the achievement of team or organizational goals.
8. Takes actions to maintain and enhance engineering skills and knowledge. *Note: This outcome addresses the importance of keeping skills up-to-date, keeping current with the dynamic nature of engineering, and addressing any gaps though continuous learning.*	This work experience outcome puts into practice program learning outcome #12. Indicators of tasks that will support achievement of the learning outcomes: • Addresses inadequacies in knowledge and skills through further study and consultation with others. • Engages in continuous learning activities (e.g., professional readings, courses, self-study, receiving coaching or mentoring, experiential learning). • Integrates general knowledge of current events and issues to one's own engineering practice. • Keeps current with the dynamic nature of engineering (including advances in knowledge and technological advancements). • Conducts self-assessment. Develops learning plan.

4.6.6 Student Evaluation During Placement

Grading of the work term is Pass/Fail. Evaluation of the work term is based on timely submission of following documentation:

- Confirmation of Employment Report
- Employer Evaluation
- Work Term Report

The Confirmation of Employment Report is a written contract outlining the parameters of the co-op work term including roles and responsibilities, start and end dates, who will be supervising the student, and expected learning outcomes. It represents an agreement among the employer, the student, and Sheridan.

An online evaluation of the student's performance is completed by the student's supervisor at the end of the work term to review the student's progress towards overall expectations and goals, and the student's work performance in terms of behaviours, abilities, work habits and technical competencies. All students are assessed in areas

such as: interest in the work, ability to learn, quality and quantity of work, analytical and problem-solving, communications (written and verbal), interpersonal, teamwork, dependability, response to feedback, and professionalism. The employer is asked to specifically identify the student's areas of strength and areas for improvement.

At the end of the internship, the student prepares a Work Term Report. This report provides information on the company, a synopsis of duties performed, and a full description of one technical and one transferable skill enhanced or developed while on the work term. This report illustrates the understanding and experience acquired during the co-op/internship and provides an opportunity to update the student's résumé.

Employer and student reports are reviewed by Sheridan staff and a final grade of pass or fail is assigned.

CEAB Credits for Pre-graduation Experience - Obtaining the P. Eng. Designation
Based on Professional Engineers of Ontario guidelines, graduates of an undergraduate engineering program accredited by the Canadian Engineering Accreditation Board are eligible to receive credit of up to 12 months for their work experience acquired before graduation toward the required 48 months of work experience for licensing. This is not a degree requirement, only a benefit to students who have completed work experience that qualifies. To be eligible for consideration, the pre-graduation work experience must be an acceptable and verifiable engineering experience, have been gained following the half-way point in the student's studies (i.e. following completion of 50 per cent of the academic program), and be related to the student's area of study and area of practice on graduation.

Pre-graduation experience should provide students an opportunity to be licensed in fewer than the four years usually required after graduation, by exposing students to the five quality-based criteria used to assess experience: Application of Theory, Practical Experience, Management of Engineering, Communication Skills, and Social Implications of Engineering. Although all five criteria need not be fulfilled in each position, students must demonstrate substantial exposure to the application of theory and at least a reasonable exposure to the other elements.

Since skillful application of theory is the hallmark of quality engineering work, student experience must include meaningful participation in at least one aspect of these applications of theory:

1. Analysis, including scope and operating conditions, performance assessment, safety and environmental issues, technology assessment, economic assessment, reliability analysis.
2. Design and synthesis, including functionality or product specification, component selection, integration of components and subsystems into larger systems, reliability and maintenance factors, environmental and societal implications of the product or process, quality improvements.
3. Testing methods, including devising testing methodology and techniques, verifying functional specifications, new product or technology commissioning and

assessment; and implementation methods, including applying technology, engineering cost studies, optimization techniques, process flow and time studies, implementing quality control and assurance, cost/benefit analysis, safety and environmental issues and recommendations, maintenance and replacement evaluation.

4. Implementation methods, including applying technology, engineering cost studies, optimization techniques, process flow and time studies, implementing quality control and assurance, cost/benefit analysis, safety and environmental issues and recommendations, maintenance and replacement evaluation.

4.7.2 Non-Core Courses

The breadth course outlines on file with PEQAB are current.

4.8 Degree Completion

A gap analysis has been completed between the proposed Bachelor of Engineering (Electrical Engineering) program and:

1. Electrical Engineering Technician Diploma Programs (MTCU code 55613)
2. Electrical Engineering Technology Diploma Programs (MTCU code 65613)
3. Electronics Engineering Technician Diploma Programs (MTCU code 55203)
4. Electronics Engineering Technology Diploma Programs (MTCU code 65203)
5. Computer Engineering Technician Diploma Programs (MTCU code 50509)
6. Computer Engineering Technology Diploma Programs (MTCU code 60509)

Applications from colleges outside Ontario and international schools will need to be reviewed on a case by case basis to identify the pathway courses that must be taken prior to admission into year 3 of the proposed degree program. An evaluation of the student transcript and related course outlines will be required.

Designing pathways from the diploma and advanced diploma to the degree program is challenging, as learning outcomes from most of the degree program courses are not met in the diploma programs. There are major differences between the diploma and the degree program learning outcomes. In simplified terms, the technician and technology programs prepare graduates to “design”, “analyze”, “fabricate” and “test” components in an engineering system, whereas graduates of the proposed engineering degree program will “create”, “design” and “develop” engineering solutions. A set of pathway courses must be carefully designed to give the students, entering after finishing relevant diploma programs, an opportunity to continue their study with the necessary background.

The following table identifies the reach-back courses resulting from the gap analysis completed for the above-mentioned relevant MTCU programs. These courses must be taken prior to entrance into year 3 of the degree program. It will take students a minimum of two (2) to three (3) semesters to complete these courses in preparation for entry into year 3 of the proposed degree program.

In addition to the core courses, students must also complete the breadth courses according to Sheridan’s Liberal Arts and Science (Breadth) Degree Requirements Policy. The following reach-back courses must be completed by the related diploma graduates prior to commencing year 3 of the proposed Electrical Engineering program. Such students will also have to meet all breadth and internship requirements prior to graduation.

MTCU 55613 Reach back courses:	**MTCU 65613 Reach back courses:**
1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction To Chemistry for Engineers 7. Fundamentals of Physics 2 8. Algorithms and Data Structures 9. Fundamentals of EM Fields 10. Electronic Circuits 2 11. Signals and Systems 1 12. Computer Programming 13. Microprocessor Systems 14. Plus Calculus 1 if not already completed	1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction To Chemistry for Engineers 7. Fundamentals of Physics 2 8. Algorithms and Data Structures 9. Fundamentals of EM Fields 10. Electronic Circuits 2 11. Signals and Systems 1
MTCU 55203 Reach back courses:	**MTCU 65203 Reach back courses:**
1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction to Chemistry for Engineers 7. Fundamentals of Physics 2 8. Algorithms and Data Structures 9. Fundamentals of EM Fields 10. Signals and Systems 1 11. Electronic Circuits 2 12. Microprocessor Systems 13. Plus Calculus 1 if not already completed	1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction to Chemistry for Engineers 7. Fundamentals of Physics 2 8. Algorithms and Data Structures 9. Fundamentals of EM Fields 10. Signals and Systems 1
MTCU 50509 Reach back courses:	**MTCU 60509 Reach back courses:**
1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction To Chemistry for Engineers 7. Fundamentals of Physics 2 8. Fundamentals of EM Fields 9. Electronic Circuits 2 10. Signals and Systems 1 11. Plus Calculus 1 if not already completed	1. Linear Algebra 2. Calculus 2 3. Differential Equations 4. Numerical Methods 5. Composition and Rhetoric 6. Introduction to Chemistry for Engineers 7. Fundamentals of Physics 2 8. Fundamentals of EM Fields 9. Electronic Circuits 2 10. Signals and Systems 1

4.8.1 Gap Analysis

Gap analyses are provided for the program outcomes in relation to the degree program outcomes for both the diploma and the advanced diploma for Electrical Engineering (MTCU 55613/65613), Electronics Engineering (MCTU 55203/65203) and Computer Engineering (MTCU 50509/60509). The resulting determination of required pathways is presented in the proposal.

Electrical Engineering Technician Program (MTCU 55613) Gap Analysis

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	2. Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical	This gap will be resolved through the completion of the following reach-back courses: • Calculus 1 • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction To Chemistry for Engineers • Fundamentals of Physics 2 • Fundamentals of EM Fields • Electronic Circuits 2 • Signals and Systems 1

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
			• Algorithms and Data Structures
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.		Technician students are not prepared to resolve complex design and operational issues. They are not equipped to deal with all stakeholders in a divergent environment where not all players may agree on a recommended course of action.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	3. Use, verify, and maintain instrumentation equipment and systems. 4. Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person. 6. Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems	The technician is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	under the supervision of a qualified person. 7. Analyze, assemble and troubleshoot control systems under the supervision of a qualified person. 11. Install, test and troubleshoot telecommunication systems under the supervision of a qualified person. 15. Assist in commissioning, testing and troubleshooting electrical power systems under the supervision of a qualified person.		
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	9. Assist in creating and conducting quality assurance procedures under the supervision of a qualified person. 12. Apply health and safety standards and best practices to workplaces. 13. Perform tasks in accordance with relevant	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technician. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	legislation, policies, procedures, standards, regulations, and ethical principles.		
5. Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	1. Interpret and produce electrical and electronics drawings including other related documents and graphics. 3. Use, verify, and maintain instrumentation equipment and systems. 5. Install and troubleshoot static and rotating electrical machines and associated control systems under the supervision of a qualified person. 8. Use computer skills and tools to solve routine electrical related problems. 14. Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person.	Technicians are not prepared to fully assess the limitations of existing tools and technologies in relation to complex problems. Electrical Engineering Technicians lack the required breadth of electrical engineering knowledge.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	16. Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.		
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.		Technicians are prepared to participate fully as team members in collaborative and multidisciplinary settings	No skills gap is present
7. Communicate technical concepts and issues effectively with both technical and nontechnical audiences.	1. Interpret and produce electrical and electronics drawings including other related documents and graphics. 10. Prepare and maintain records and documentation systems.	Technicians are not fully prepared to draft and approve technical and non-technical reports and making presentations tailored to the needs of specialist and non-specialist audiences. They do not participate at the same level of discourse expected of a qualified engineer.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.	12. Apply health and safety standards and best practices to workplaces. 13. Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.	Technicians are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the requirement of the profession.	13. Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.	Technicians are prepared to meet the same standard of ethics and accountability as engineers, though in some cases the consequences for a lapse in behaviour may be greater for the engineer.	
11. Incorporate economics and business practices, specifically project management tools and techniques, into practices of engineering.	17. Apply project management principles to assist in the implementation of projects.	Technicians are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.
12. Develop self-leadership strategies to enhance personal and professional effectiveness		The scope and intensity of the post-graduation and lifelong learning requirements are	The need for continuous growth and development throughout a professional

Program Learning outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electrical Engineering Technician (MTCU 55613)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
that is responsive to a rapidly changing world.		somewhat greater for a professional engineer than for a technician due to the differing scope of practice.	career will be an ongoing theme across the program

Electrical Engineering Technician Vocational Program Learning Outcomes MTCU 55613:

1. Interpret and produce electrical and electronics drawings including other related documents and graphics.
2. Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles.
3. Use, verify, and maintain instrumentation equipment and systems.
4. Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person.
5. Install and troubleshoot static and rotating electrical machines and associated control systems under the supervision of a qualified person.
6. Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems under the supervision of a qualified person.
7. Analyze, assemble and troubleshoot control systems under the supervision of a qualified person.
8. Use computer skills and tools to solve routine electrical related problems.
9. Assist in creating and conducting quality assurance procedures under the supervision of a qualified person.
10. Prepare and maintain records and documentation systems.
11. Install, test and troubleshoot telecommunication systems under the supervision of a qualified person.
12. Apply health and safety standards and best practices to workplaces.
13. Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.
14. Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person.
15. Assist in commissioning, testing and troubleshooting electrical power systems under the supervision of a qualified person.

16. Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.
17. Apply project management principles to assist in the implementation of projects.

Students in the Power & Energy Systems option may seek PLAR for some year 3 courses (Machines or Distribution Systems Design) on a case by case basis.

Based on the required reach-back course load, this program may not be an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Electrical Engineering Technology Program (MTCU 65613) Gap Analysis

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	2. Analyze and solve complex technical problems related to electrical systems by applying mathematics and science principles.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical.	This gap will be resolved through the completion of the following reach-back courses: • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction To Chemistry for Engineers • Fundamentals of Physics 2 • Fundamentals of EM Fields • Electronic Circuits 2 • Signals and Systems 1 • Algorithms and Data Structures
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.	4. Design, assemble, test, modify, maintain and commission electrical equipment and systems to fulfill requirements and specifications under the supervision of a qualified person.	Technology students are not prepared to resolve complex design and operational issues. They are not equipped to deal with all stakeholders in a divergent environment where not all players may agree on a recommended course of action.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
	7. Design, install, analyze, assemble and troubleshoot control systems under the supervision of a qualified person. 11. Design, install, test, commission and troubleshoot telecommunication systems under the supervision of a qualified person. 15. Design, commission, test and troubleshoot electrical power systems under the supervision of a qualified person.		
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	3. Design, use, verify, and maintain instrumentation equipment and systems. 6. Design, assemble, analyze, and troubleshoot electrical and electronic circuits, components, equipment and systems under the supervision of a qualified person.	The technologist is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	9. Create, conduct and recommend modifications to quality assurance procedures under the supervision of a qualified person. 12. Apply and monitor health and safety standards and best practices to workplaces. 13. Perform and monitor tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technologist. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.
5. Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	1. Analyze, interpret, and produce electrical and electronics drawings, technical reports including other related documents and graphics. 3. Design, use, verify, and maintain instrumentation equipment and systems. 5. Commission and troubleshoot static and rotating electrical machines and associated	Technologists are not prepared to fully assess the limitations of existing tools and technologies in relation to complex problems. Electrical Engineering Technologists lack the required breadth of electrical engineering knowledge.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	control systems under the supervision of a qualified person. 8. Use computer skills and tools to solve a range of electrical related problems. 14. Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person. 16. Select and recommend electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.		
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.		Technologists are prepared to participate fully as team members in collaborative and multidisciplinary settings	No skills gap is present
7. Communicate technical concepts and issues	1. Analyze, interpret, and produce electrical and	Technologists are not fully prepared to draft and	This gap will be resolved through the reach-back courses and

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
effectively with both technical and nontechnical audiences.	electronics drawings, technical reports including other related documents and graphics. 10. Prepare reports and maintain records and documentation systems.	approve technical and non-technical reports and making presentations tailored to the needs of specialist and non-specialist audiences. They do not participate at the same level of discourse expected of a qualified engineer.	during years 3 and 4 of the degree experience.
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.	12. Apply and monitor health and safety standards and best practices to workplaces. 13. Perform and monitor tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.	Technologists are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the	13. Perform and monitor tasks in accordance with relevant legislation,	Technologists are prepared to meet the same standard of ethics and	

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electrical Engineering Technology (MTCU 65613)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
requirement of the profession.	policies, procedures, standards, regulations, and ethical principles.	accountability as engineers, though in some cases the consequences for a lapse in behaviour may be greater for the engineer.	
11. Incorporate economics and business practices, specifically project management tools and techniques, into practices of engineering.	17. Apply project management principles to contribute to the planning, implementation, and evaluation of projects.	Technologists are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.
12. Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		The scope and intensity of the post-graduation and lifelong learning requirements are somewhat greater for a professional engineer than for a technologist due to the differing scope of practice.	The need for continuous growth and development throughout a professional career will be an ongoing theme across the program.

Electrical Engineering Technology Vocational Program Learning Outcomes MTCU 65613:

1. Analyze, interpret, and produce electrical and electronics drawings, technical reports including other related documents and graphics.
2. Analyze and solve complex technical problems related to electrical systems by applying mathematics and science principles.
3. Design, use, verify, and maintain instrumentation equipment and systems.

4. Design, assemble, test, modify, maintain and commission electrical equipment and systems to fulfill requirements and specifications under the supervision of a qualified person.
5. Commission and troubleshoot static and rotating electrical machines and associated control systems under the supervision of a qualified person.
6. Design, assemble, analyze, and troubleshoot electrical and electronic circuits, components, equipment and systems under the supervision of a qualified person.
7. Design, install, analyze, assemble and troubleshoot control systems under the supervision of a qualified person.
8. Use computer skills and tools to solve a range of electrical related problems.
9. Create, conduct and recommend modifications to quality assurance procedures under the supervision of a qualified person.
10. Prepare reports and maintain records and documentation systems.
11. Design, install, test, commission and troubleshoot telecommunication systems under the supervision of a qualified person.
12. Apply and monitor health and safety standards and best practices to workplaces.
13. Perform and monitor tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.
14. Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person.
15. Design, commission, test and troubleshoot electrical power systems under the supervision of a qualified person.
16. Select and recommend electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.
17. Apply project management principles to contribute to the planning, implementation, and evaluation of projects.

Students in the Power & Energy Systems option may seek PLAR for some year 3 courses (such as Electric Machines, Electrical Power Generation and Transmission or Distribution Systems Design) on a case by case basis.

Based on the required reach-back course load, this program may not be an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Electronics Engineering Technician Program (MTCU 55203) Gap Analysis

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	2. Analyze and solve routine technical problems related to electronics engineering by applying fundamental concepts of mathematics and science.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical	This gap will be resolved through the completion of the following reach-back courses: • Calculus 1 • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction to Chemistry for Engineers • Fundamentals of Physics 2 • Algorithms and Data Structures • Fundamentals of EM Fields • Signals and Systems 1
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental		Technician students are not prepared to resolve complex design and operational issues.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
impact, and economic assessments.		They are not equipped to deal with all stakeholders in a divergent environment where not all players may agree on a recommended course of action.	
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	3. Apply appropriate troubleshooting techniques to electronic circuits or systems and perform test procedures. 7. Analyze and troubleshoot logic and digital circuits, as well as embedded microprocessor-based and microcontroller-based systems, including assembly and high-level language programs. 8. Analyze and troubleshoot circuits consisting of passive components by applying appropriate measurement techniques. 9. Analyze and troubleshoot circuits consisting of low power, high power, active and electromechanical	The technician is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
	components, and analog integrated circuits. 10. Analyze and troubleshoot control systems. 11. Troubleshoot, maintain and repair analog and digital communication systems.		
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	4. Assemble, modify, test and troubleshoot electronic circuits, equipment and systems in accordance with job requirements, functional specifications and relevant standards, with guidance as required. 6. Provide justification for the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements, and functional specifications. 12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces.	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technician. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	13. Assist in implementing and conducting quality control and quality assurance programs and procedures.		
5. Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	1. Analyze, interpret, modify and prepare electrical and electronics drawings, layouts and reports, with guidance as required. 5. Maintain and repair electronic equipment and systems in accordance with relevant operational guidelines.	Technicians are not prepared to fully assess the limitations of existing tools and technologies in relation to complex problems.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	13. Assist in implementing and conducting quality control and quality assurance programs and procedures.	Technicians are prepared to participate fully as team members in collaborative and multidisciplinary settings.	No skills gap is present
7. Communicate technical concepts and issues effectively with both technical and nontechnical audiences.		Technicians are not fully prepared to draft and approve technical and non-technical reports and making presentations tailored to the needs of specialist and non-specialist audiences. They do not	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
		participate at the same level of discourse expected of a qualified engineer.	
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.	12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces. 14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.	Technicians are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the requirement of the profession.	14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.	Technicians are prepared to meet the same standard of ethics and accountability as engineers, though in some cases the consequences for a lapse in behaviour may be greater for the engineer.	
11. Incorporate economics and business practices, specifically project		Technicians are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electronics Engineering Technician (MTCU 55203)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
management tools and techniques, into practices of engineering.			
12. Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		The scope and intensity of the post-graduation and lifelong learning requirements are somewhat greater for a professional engineer than for a technician due to the differing scope of practice.	This gap will be resolved during years 3 and 4 of the degree experience. The need for continuous growth and development throughout a professional career will be an ongoing theme across the program.

Electronics Engineering Technician Vocational Program Learning Outcomes MTCU 55203:

1. Analyze, interpret, modify and prepare electrical and electronics drawings, layouts and reports, with guidance as required.
2. Analyze and solve routine technical problems related to electronics engineering by applying fundamental concepts of mathematics and science.
3. Apply appropriate troubleshooting techniques to electronic circuits or systems and perform test procedures.
4. Assemble, modify, test and troubleshoot electronic circuits, equipment and systems in accordance with job requirements, functional specifications and relevant standards, with guidance as required.
5. Maintain and repair electronic equipment and systems in accordance with relevant operational guidelines.
6. Provide justification for the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements, and functional specifications.
7. Analyze and troubleshoot logic and digital circuits, as well as embedded microprocessor-based and microcontroller-based systems, including assembly and high-level language programs.
8. Analyze and troubleshoot circuits consisting of passive components by applying appropriate measurement techniques.

9. Analyze and troubleshoot circuits consisting of low power, high power, active and electromechanical components, and analog integrated circuits.
10. Analyze and troubleshoot control systems.
11. Troubleshoot, maintain and repair analog and digital communication systems.
12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces.
13. Assist in implementing and conducting quality control and quality assurance programs and procedures.
14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.

Based on the required reach-back course load, this program may not be an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Electronics Engineering Technology Program (MTCU 65203) Gap Analysis

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	2. Analyze and solve technical problems related to electronics engineering by applying principles of advanced mathematics and science.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical	This gap will be resolved through the completion of the following reach-back courses: • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction to Chemistry for Engineers • Fundamentals of Physics 2 • Algorithms and Data Structures • Fundamentals of EM Fields • Signals and Systems 1
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.	7. Design, modify, analyze and troubleshoot logic and digital circuits, and embedded microprocessor-based and microcontroller-based systems, including assembly and high-level language programs.	Technology students are not prepared to resolve complex design and operational issues. They are not equipped to deal with all stakeholders in a divergent environment where not all players may agree on a	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	8. Design, analyze and troubleshoot circuits consisting of passive components by applying appropriate measurement techniques. 9. Design, analyze and troubleshoot circuits consisting of low power, high power, active and electromechanical components, and analog integrated circuits. 10. Design, analyze and troubleshoot control systems. 11. Design, analyze, troubleshoot and repair analog and digital communication systems.	recommended course of action.	
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	3. Apply appropriate troubleshooting techniques to electronic circuits or systems and generate and perform test procedures.	The technologist is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	4. Design, build, test and troubleshoot electronic circuits, equipment, systems and subsystems in accordance with job requirements, functional specifications and relevant standards. 6. Determine, select, recommend and justify the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements and functional specifications. 12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces. 13. Collaborate in selecting, coordinating and conducting quality control and quality assurance programs and procedures.	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technologist. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.
5. Demonstrate proficiency in the techniques, skills, and tools necessary for	1. Analyze, interpret, modify, design and produce electrical and electronics	Technologists are not prepared to fully assess the limitations of existing	This gap will be resolved through the reach-back courses and

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
electrical engineering practice with an understanding of the associated limitations.	drawings, layouts and reports. 5. Modify, maintain, repair and recommend electronic equipment and systems in accordance with relevant operational guidelines.	tools and technologies in relation to complex problems.	during years 3 and 4 of the degree experience.
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	13. Collaborate in selecting, coordinating and conducting quality control and quality assurance programs and procedures. 15. Contribute to the planning, implementation, management and evaluation of team projects by applying project management principles.	Technologists are prepared to participate fully as team members in collaborative and multidisciplinary settings	No skills gap is present
7. Communicate technical concepts and issues effectively with both technical and nontechnical audiences.		Technologists are not fully prepared to draft and approve technical and non-technical reports and making presentations tailored to the needs of specialist and non-specialist audiences. They do not participate at the same level of	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
		discourse expected of a qualified engineer.	
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.	12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces. 14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.	Technologists are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the requirement of the profession.	14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.	Technologists are prepared to meet the same standard of ethics and accountability as engineers, though in some cases the consequences for a lapse in behaviour may be greater for the engineer.	

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Electronics Engineering Technology (MTCU 65203)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
11. Incorporate economics and business practices, specifically project management tools and techniques, into practices of engineering.	15. Contribute to the planning, implementation, management and evaluation of team projects by applying project management principles.	Technologists are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.
12. Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		The scope and intensity of the post-graduation and lifelong learning requirements are somewhat greater for a professional engineer than for a technologist due to the differing scope of practice.	This gap will be resolved during years 3 and 4 of the degree experience. The need for continuous growth and development throughout a professional career will be an ongoing theme across the program.

Electronics Engineering Technology Vocational Program Learning Outcomes MTCU65203:

1. Analyze, interpret, modify, design and produce electrical and electronics drawings, layouts and reports.
2. Analyze and solve technical problems related to electronics engineering by applying principles of advanced mathematics and science.
3. Apply appropriate troubleshooting techniques to electronic circuits or systems and generate and perform test procedures.
4. Design, build, test and troubleshoot electronic circuits, equipment, systems and subsystems in accordance with job requirements, functional specifications and relevant standards.
5. Modify, maintain, repair and recommend electronic equipment and systems in accordance with relevant operational guidelines.
6. Determine, select, recommend and justify the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements and functional specifications.

7. Design, modify, analyze and troubleshoot logic and digital circuits, and embedded microprocessor-based and microcontroller-based systems, including assembly and high-level language programs.
8. Design, analyze and troubleshoot circuits consisting of passive components by applying appropriate measurement techniques.
9. Design, analyze and troubleshoot circuits consisting of low power, high power, active and electromechanical components, and analog integrated circuits.
10. Design, analyze and troubleshoot control systems.
11. Design, analyze, troubleshoot and repair analog and digital communication systems.
12. Apply relevant shop practices in compliance with safety policies and current regulations for electronics engineering workplaces.
13. Collaborate in selecting, coordinating and conducting quality control and quality assurance programs and procedures.
14. Complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.
15. Contribute to the planning, implementation, management and evaluation of team projects by applying project management principles.

Students may seek PLAR for some year 3 courses on a case by case basis.

Based on the required reach-back course load, this program is an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Computer Engineering Technician Program (MTCU 50509) Gap Analysis

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Computer Engineering Technician (MTCU 50509)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	5. Apply principles of digital and analog circuits to the troubleshooting of embedded computing devices.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical	This gap will be resolved through the completion of the following reach-back courses: • Calculus 1 • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction To Chemistry for Engineers • Fundamentals of Physics 2 • Fundamentals of EM Fields • Electronic Circuits 2 • Signals and Systems 1
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.		Technician students are not prepared to resolve complex design and operational issues. They are not equipped to deal with all stakeholders in a divergent environment where not all players may agree on a	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technician (MTCU 50509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
		recommended course of action.	
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	1. Use documented solutions to troubleshoot technical problems involving computing devices. 3. Configure, troubleshoot, and maintain a variety of computer systems in accordance with documented functional requirements.	The technician is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	7. Apply knowledge of security issues related to computing devices.	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technician. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.
5. Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an	2. Support the integration of multiple software and hardware components using appropriate network architecture.	Technicians are not prepared to fully assess the limitations of existing tools and technologies in	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technician (MTCU 50509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
understanding of the associated limitations.	3. Configure, troubleshoot, and maintain a variety of computer systems in accordance with documented functional requirements. 4. Install and maintain the operations of a variety of computer hardware, software, and networked systems. 6. Contribute to the analysis, building, testing, implementation, and maintenance of applications.	relation to complex problems. Computer Engineering Technicians lack the required breadth of electrical engineering knowledge.	
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	8. Conform to workplace expectations found in technology environments. 9. Contribute to the successful completion of the project applying the project management principles in use.	Technicians are prepared to participate fully as team members in collaborative and multidisciplinary settings	No skills gap is present
7. Communicate technical concepts and issues effectively with both		Technicians are not fully prepared to draft and approve technical and non-technical reports and	This gap will be resolved through the reach-back courses and during years 3

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technician (MTCU 50509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
technical and nontechnical audiences.		making presentations tailored to the needs of specialist and non-specialist audiences. They do not participate at the same level of discourse expected of a qualified engineer.	and 4 of the degree experience.
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.		Technicians are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the requirement of the profession.		Technicians are prepared to meet the same standard of ethics and accountability as engineers, though in	

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technician (MTCU 50509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
		some cases the consequences for a lapse in behaviour may be greater for the engineer.	
11. Incorporate economics and business practices, specifically project management tools and techniques, into practices of engineering.	9. Contribute to the successful completion of the project applying the project management principles in use.	Technicians are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.
12. Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		The scope and intensity of the post-graduation and lifelong learning requirements are somewhat greater for a professional engineer than for a technician due to the differing scope of practice.	The need for continuous growth and development throughout a professional career will be an ongoing theme across the program.

Computer Engineering Technician Vocational Program Learning Outcomes MTCU 50509:

1. Use documented solutions to troubleshoot technical problems involving computing devices.
2. Support the integration of multiple software and hardware components using appropriate network architecture.
3. Configure, troubleshoot, and maintain a variety of computer systems in accordance with documented functional requirements.
4. Install and maintain the operations of a variety of computer hardware, software, and networked systems.
5. Apply principles of digital and analog circuits to the troubleshooting of embedded computing devices.
6. Contribute to the analysis, building, testing, implementation, and maintenance of applications.
7. Apply knowledge of security issues related to computing devices.
8. Conform to workplace expectations found in technology environments.
9. Contribute to the successful completion of the project applying the project management principles in use.

Based on the required reach-back course load, this program is may not be an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Computer Engineering Technology Program (MTCU 60509) Gap Analysis

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Computer Engineering Technology (MTCU 60509)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
1. Create sustainable engineering solutions through applications of mathematical, scientific and fundamental engineering concepts, methods and techniques.	5. Apply principles of digital and analog circuits to the implementation of embedded computing devices.	Gap in engineering breadth and depth of education and type of knowledge, both theoretical and practical.	This gap will be resolved through the completion of the following reach-back courses: • Linear Algebra • Calculus 2 • Differential Equations • Numerical Methods • Composition and Rhetoric • Introduction To Chemistry for Engineers • Fundamentals of Physics 2 • Fundamentals of EM Fields • Electronic Circuits 2 • Signals and Systems 1
2. Solve complex engineering problems, using appropriate knowledge and skills to identify, formulate, and analyze feasibility, technology, environmental impact, and economic assessments.	4. Plan, install, configure, modify, test, and maintain a variety of computer systems to meet functional requirements.	Technology students are not prepared to resolve complex design and operational issues. They are not equipped to deal with all stakeholders in a divergent environment where not all players may	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technology (MTCU 60509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
		agree on a recommended course of action.	
3. Validate conclusions from investigations of complex engineering problems by methods that include relevant experimentation, data collection, analysis, interpretation and synthesis.	1. Diagnose, solve, troubleshoot, and document technical problems involving computing devices using appropriate methodologies.	The technologist is not prepared to conduct the full complexity of analysis required to meet this outcome.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
4. Design a system, component, or process that meets regulatory and industry standards and considers, health and safety risks, economic, environmental, cultural and social impacts.	7. Evaluate and document security issues associated with a variety of computing devices and propose alternatives to increase product reliability	Breadth and uniqueness of engineering problems are not fully addressed in the preparation of a technologist. They are not equipped to fully determine the extent to which problems are original and to which solutions have previously been identified or codified.	This gap will be resolved during years 3 and 4 of the degree experience.
5. Demonstrate proficiency in the techniques, skills, and tools necessary for electrical engineering practice with an understanding of the associated limitations.	2. Integrate multiple software and hardware components using appropriate network architecture. 3. Participate in analyzing, planning, designing, and developing the architecture	Technologists are not prepared to fully assess the limitations of existing tools and technologies in relation to complex problems. Computer Engineering Technologists lack the required breadth	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technology (MTCU 60509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
	of computing devices and systems. 4. Plan, install, configure, modify, test, and maintain a variety of computer systems to meet functional requirements. 6. Analyze, build, test, implement, and maintain applications.	of electrical engineering knowledge.	
6. Perform as an effective team member and leader in collaborative and multi-disciplinary settings.	9. Contribute to the successful completion of the project applying the project management principles in use.	Technologists are prepared to participate fully as team members in collaborative and multidisciplinary settings.	No skills gap is present
7. Communicate technical concepts and issues effectively with both technical and nontechnical audiences.	8. Articulate, defend, and conform to workplace expectations found in technology environments.	Technologists are not fully prepared to draft and approve technical and non-technical reports and making presentations tailored to the needs of specialist and non-specialist audiences. They do not participate at the same level of discourse expected of a qualified engineer.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	**Program Learning Outcomes for Computer Engineering Technology (MTCU 60509)**	**Gap in Knowledge and Skills**	**Addressing the gap (List courses, placement, etc.)**
8. Explain the roles and responsibilities of the professional engineer in society.		There is a relatively small gap to be addressed with this outcome.	This gap will be resolved during years 3 and 4 of the degree experience.
9. Analyze the impact of engineering solutions in a global, economic, societal, environmental and public safety context.	7. Evaluate and document security issues associated with a variety of computing devices and propose alternatives to increase product reliability.	Technologists are not prepared to analyze the economic and environmental, societal needs. This outcome is integral to the very core of the competence of a professional engineer and is an integral theme addressed across the full degree program.	This gap will be resolved through the reach-back courses and during years 3 and 4 of the degree experience.
10. Demonstrate ethical conduct, accountability and equity consistent with the requirement of the profession.		Technologists are prepared to meet the same standard of ethics and accountability as engineers, though in some cases the consequences for a lapse in behaviour may be greater for the engineer.	
11. Incorporate economics and business practices, specifically project management tools and	9. Contribute to the successful completion of the project applying the project	Technologists are not fully prepared for project management.	This gap will be resolved during years 3 and 4 of the degree experience.

Program Learning Outcomes for Bachelor of Engineering (Electrical Engineering)	Program Learning Outcomes for Computer Engineering Technology (MTCU 60509)	Gap in Knowledge and Skills	Addressing the gap (List courses, placement, etc.)
techniques, into practices of engineering.	management principles in use.		
12. Develop self-leadership strategies to enhance personal and professional effectiveness that is responsive to a rapidly changing world.		The scope and intensity of the post-graduation and lifelong learning requirements are somewhat greater for a professional engineer than for a technologist due to the differing scope of practice.	The need for continuous growth and development throughout a professional career will be an ongoing theme across the program.

Computer Engineering Technology Vocational Program Learning Outcomes MTCU 60509:

1. Diagnose, solve, troubleshoot, and document technical problems involving computing devices using appropriate methodologies.
2. Integrate multiple software and hardware components using appropriate network architecture.
3. Participate in analyzing, planning, designing, and developing the architecture of computing devices and systems.
4. Plan, install, configure, modify, test, and maintain a variety of computer systems to meet functional requirements.
5. Apply principles of digital and analog circuits to the implementation of embedded computing devices.
6. Analyze, build, test, implement, and maintain applications.
7. Evaluate and document security issues associated with a variety of computing devices and propose alternatives to increase product reliability.
8. Articulate, defend, and conform to workplace expectations found in technology environments.
9. Contribute to the successful completion of the project applying the project management principles in use.

Students in the Mechatronics and Embedded Systems option may seek PLAR for some year 3 courses (such as Embedded Software Fundamentals or Embed Application Development) on a case by case basis.

Based on the required reach-back course load, this program may not be an ideal pathway into the Bachelor of Engineering (Electrical Engineering).

Section 5: Program Delivery Standard

Sheridan assures quality of program delivery through new program development processes, faculty development programs for new full-time and part-time faculty, ongoing professional development opportunities for faculty, regular student feedback mechanisms and quality assurance processes. Additional information related to quality assurance of delivery can also be found in the Program Evaluation Standard Section 10.

5.1 Quality Assurance of Delivery

5.1.1 New Program Development

New program development is a collaborative process involving faculty members in the Faculties, curriculum developers in the Centre for Teaching and Learning, an *ad hoc* professional advisory council, senior management and representatives from the various service areas of the college. The development process ensures fit with college strategy and Ministry standards, viability of the program in terms of student and employer support and college resources, rigour and relevance in the curriculum, and support from the various areas of the college.

Sheridan's culture invites creativity and innovation, welcoming input from the college community for the creation of new programs. Once an idea has been formulated, the next step is to examine the industrial and educational context for the proposed program, its competition, and industry trends. Input is solicited from industry through interviews and the creation of an ad hoc professional advisory council.

Once the research for the proposed program has been completed to establish viability, the first phase of development focuses on creating a vision of and framework for the program. Peer review by a cross-disciplinary Senate committee provides a context to learn from each other's experiences in degree development and delivery, and an opportunity to identify possible synergies between programs. In the subsequent development phase, detailed curriculum is worked out. A curriculum specialist from the Centre for Teaching and Learning works closely throughout with the program development team from the Faculty to ensure degree level standards are met in outcomes, course content and evaluation methods. Internal stakeholders are consulted to ensure resources and support for the ultimate implementation of the program. Requirements for vetting and/or approval by several internal bodies ensure proposals are scrutinized closely for both pedagogical strength and operational viability before the proposal is submitted to an external approval body.

5.1.2 Faculty Hiring and On-boarding Full-time

Faculty hiring ensures appropriate credentials, expertise, and teaching effectiveness. Both academic and professional credentials are required. Faculty teaching in applied degree programs have a minimum of a Master's degree in a field of study related to the subjects to be taught; many have their doctorates. In applied discipline-related courses,

faculty also have appropriate experience related to the subject matter. The hiring process consists of at least three steps: team interviews, a teaching demonstration, and thorough checking of credentials and references.

Once hired, all full-time faculty are required to complete a professional development program designed to build strong learning partnerships with colleagues and develop an understanding of the culture and policies specifically related to Sheridan. The Teaching and Learning Academies (TLA) create an environment for educators to discuss and share teaching and learning experience and to practice enhancing their teaching skills. TLA consists of several intensive short-term modules and ongoing small group sessions during the first two years of employment. The aim is to ensure teacher readiness and effectiveness in the classroom.

During the probationary period new hires are monitored regularly. Faculty are observed teaching and provided feedback by their supervisor.

5.1.3 Faculty Hiring and On-boarding Part-time

Part-time faculty members are required to have completed or be registered in a faculty development program called Fundamentals of Teaching and Learning (FTL) by his/her third semester of teaching at Sheridan. FTL is a comprehensive foundational program for those new to teaching and a refresher for those with prior teaching experience. It is a forum provided to all faculty (full-time, part-time, partial load and sessional) so they can engage in discussion regarding classroom teaching and applied learning at Sheridan College. Fundamentals of Teaching and Learning encourages participants to engage in dialogue across disciplines, with an emphasis on exploring and understanding current best practices. It is also an opportunity for part-time faculty members to connect with other part-time faculty and staff across the College, thereby increasing their engagement with the broader Sheridan community.

5.1.4 Ongoing Professional Development

The faculty are provided the opportunity to participate in professional development opportunities organized by the College. During the May-June semester, several of the Teaching and Learning Academy workshops are also opened to experienced faculty. A peer coaching program links college faculty interested in developing aspects of their teaching with peers who offer feedback that is voluntary, timely, confidential and non-evaluative.

Recent offerings focused on experienced faculty but open to all include:

- Showcase of Teaching and Learning - an opportunity for new faculty to share their TLA3 projects and for faculty/staff to deliver sessions to peers, showcasing what is happening in our classrooms
- Instructional Skills Workshop (ISW) - three day workshop focused on peer strength based feedback and reflective practice

- Shadiow Project - Based on Linda Shadiow's book, "What our stories teach us", faculty work through the book in a small group. This initiative is focused on reflective practice
- Spring & Summer Series - A series of sessions and workshops developed and delivered by faculty for faculty (interested faculty submit a proposal that is peer reviewed by a selections committee)

Individuals are also encouraged to organize their own professional training and development opportunities and are supported in this endeavour through professional development funding up to $1000 per year, sabbatical leaves, and tuition reimbursement (up to $15,000 for doctoral degree programs).

5.2 Student Feedback

Sheridan is committed to inspiring creative, innovative teaching and learning, and to providing a premiere learning environment. An important component of that is the regular evaluation of courses by students. Course evaluations are conducted for the following reasons:

1. To provide formative data used by professors for the affirmation of quality teaching and/or continuous improvement.
2. To provide members of the Sheridan community with information about student perceptions of teaching and courses at Sheridan.
3. To provide the aggregate data that contributes to program and curriculum review, and to support Sheridan to meet regulatory requirements (program review, PEQAB, CQAAP or other accreditation or quality assurance purposes).
4. To collect data used in the evaluation of teaching for administrative purposes such as probationary reviews, and as a component part of a formal performance management process, and for decisions related to the provision of future contracts for Sheridan's part-time, partial load and sessional professors.

5.3 Web-facilitated, Hybrid and Online Delivery

Sheridan's policies and practices relating to online learning have been reviewed and approved. The policies on file with PEQAB are current.

Section 6: Capacity to Deliver

6.1 Learning and Physical Resources

6.1.1 On-site and Electronic Library Resources

Sheridan Library provides information and research support to over 30,000 students in a wide range of academic programs, including the engineering sciences. The College currently maintains three libraries, one at the Hazel McCallion Campus in Mississauga, the Davis Campus in Brampton and the Trafalgar Campus in Oakville. All three libraries offer free exchange of materials between campuses.

Sheridan Library offers highly specialized research support and resources for a degree program. Sheridan's Liaison Librarians provide classroom instruction to students concerning the research process; how to search for, evaluate, and use information effectively. The Liaison Librarian for the Faculty of Applied Science & Technology provides support for Engineering faculty, staff and students and responds to their information needs. Students can also meet with the librarian for a research consultation focused on their unique research. Library technicians and reference staff actively interact with students to help them meet their information needs, both in the classroom and in the Learning Commons.

Sheridan Library facilities include three state-of-the-art Learning Commons, one at each campus. Each is equipped with computers that have the latest software. This allows students to search online resources, create presentations and assignments, and collaborate effectively. Group study rooms can be booked online, and come equipped with a large-screen monitor that can be connected to laptops. The study spaces in each library support a variety of learning styles, through group, quiet, and silent study options. Sufficient seating facilities are available. Available printers can print from desktops and laptops, and photocopiers and scanners are also available.

Library & Learning Services

Sheridan Library	**Learning Commons**
72 hours per week from September to June 50 hours per week in July and August	Davis Learning Commons (J-wing): Monday to Friday: 8:00 am – 12:00 am Saturday & Sunday: 9:00 am – 5:00 pm
September to June: Monday to Thursday: 8:30am - 10:00pm Friday: 8:30am – 4:30pm Saturday & Sunday: 11:00am – 4:00pm	HMC Learning Commons (A-217): Monday to Friday: 8:00 am – 12:00 am Saturday & Sunday: 9:00 am – 5:00 pm
July & August: Monday to Friday 8:30am – 4:30pm Saturday & Sunday 11:00am – 4:00pm	Trafalgar Learning Commons (C-wing): Monday to Friday: Open 24/7 Saturday & Sunday: Open 24/7

Key Library Services

- 24/7 access to e-resources, including databases, citation tutorials, e-books, streaming video, etc.
- Chat service available during regular Library hours, to assist students, faculty or staff in any location
- Research assistance in person, by email or phone
- Liaison Librarians provide orientation tours and classroom instruction on request
- *RefWorks* and *Write-N-Cite* citation management system
- Self-serve Online forms:

1) request a workshop (for research instruction);
2) suggest a resource (for faculty to contribute to development of library collection);
3) inter-library loan (for the borrowing of materials from other institutions).

- Free English tutoring to assist students with the writing process (including organizing, editing and citing)
- Free tutoring in the areas of mathematics, accounting and JAVA programming
- Peer tutoring upon faculty recommendation
- Supplemental instruction

Additional Tutoring Centre Services for Math

The Tutoring Centre provides 30min, 60min one-on-one appointments and shorter drop-in sessions to students who are seeking academic support related to Math, including Physics (e.g. Statics), Statistics and Electricity. Students can book 2 hours of appointments per week, per campus. Tutoring is provided by University of Waterloo Undergraduate Math and Physics co-op students. Faculty members and the Tutoring Centre manager interview and hire the co-op students together.

In addition to the tutoring provided by staff tutors at no additional cost, the Tutoring Centre offers Peer-Assisted Learning (PAL) leaders to support students in their learning in first-year courses. Based on faculty request, a student can be hired to provide a non-remedial approach to learning, offering regularly scheduled, out of class review sessions to all students enrolled in the section(s) of the course. Study sessions are informal seminars to review notes, discuss readings, develop organizational tools and prepare for examinations. The PAL program is available at no additional cost to the Faculty and its students. Alternatively, faculty members can simply request a group tutor to host exam review sessions in advance of midterm and final evaluations.

Finally, peer tutoring offers small group course-specific tutoring in courses other than those supported by the staff tutors and/or PAL programming. Peer tutoring is available for $40/10 hours.

Key Learning Commons Services

- Computer workstations (PC and Mac), multiple power connections for laptops, group study rooms, quiet study rooms with carrels, Library training/workshop room, peer tutoring rooms, accessibility rooms, and lounge area for extra seating
- An online booking system for Learning Commons group study rooms
- IT staff to help students with login and password settings, profile resets, computers, printers, and laptop activation
- Tutors in the areas of mathematics, accounting and JAVA software
- Accessibility Services staff are available to assist students with adaptive technologies like Zoom Text, Jaws Screen Reader, Natural Reader and WordQ
- Wireless access

Collections

With a growing collection of over 336,600 books and e-books, 5,300 print and electronic journals, and more than 175 subscription databases, the Sheridan Library is well positioned to meet the needs of an Electrical Engineering degree program for the Sheridan community.

The Library collects material related to all areas of engineering, and staff closely monitor trends and work with faculty to understand the information needs of the program. In consultation with the Program Coordinators and the Liaison Librarian, the Collections Librarian regularly adds current and relevant material to the Library collection in order to ensure that the Library collection reflects the needs of Sheridan's curriculum. In addition, Sheridan Library is part of the Ontario Colleges Library Service (OCLS), a library consortium of Ontario's 24 publicly funded colleges of Applied Arts and Technology. Sheridan students have full access to research resources at these institutions. The Library is able to borrow materials from any of these college libraries, and some other affiliated libraries and institutions. See: Direct Borrowing Agreement (http://bit.ly/1eWVRrv). Sheridan students studying at HMC also have access to Mississauga Public Library's collection in both print and electronic formats.

Library materials are searchable through a single discovery layer called *Summon*. Formats for the collections include print and electronic books, videos, DVDs, and subscriptions to print and e-journals. Online databases provide access to millions of full-text articles, including statistical and technical reports, and the various e-book databases are able to link students to the full contents of several thousand e-books. Through the Library's video-streaming services, students are able to watch over 7,000 international and Canadian videos.

Key Periodical & Reference Databases

AccessScience: Provides full-text access to McGraw-Hill Encyclopaedia of Science and Technology with full-text online encyclopaedic entries dictionary of scientific terminology, late-breaking science and technology news headlines, and much more.

ACM Digital Library: This database provides access to full-text collection of ACM publications, including journals, conference proceedings, technical magazines, newsletters and books.

Sample full-text journal titles include:

- ACM Transactions on Autonomous and Adaptive Systems (TAAS)
- ACM Transactions on Computing Education (TOCE)
- ACM Transactions on Design Automation of Electronic Systems (TODAES)

ASM Handbooks Online: Provides peer-reviewed sources in materials specialization, the complete content of thirty ASM Handbook volumes, several ASM Handbook supplements, and two ASM Desk Editions. This database contains articles, illustrations, tables, graphs, specifications and practical examples.

EBSCO Applied Science & Technology Source: This database features full-text articles, graphs, charts, diagrams, photos, and illustrations in scientific and technical subjects such as atmospheric sciences, civil, environmental, and chemical engineering, textiles industry, transportation, and waste management. Sample full-text journal titles include:

- Advances in Electrical & Electronic Engineering (1336-1376)
- International Journal of Electrical & Computer Engineering (2088-8708)
- Power & Electrical Engineering (1407-7345)

IEEE xPlore Digital Library: IEEE *Xplore* provides access to millions of full-text documents from some of the world's most highly cited publications in electrical engineering, computer science and electronics from IEEE and its members. Subscribed collections include **ASPP** (145 journals & magazines), **POP** (125 conferences), all active standards, as well as a perpetual-access collection of **MIT ebooks**. Sample full-text journal titles include:

- Bell Labs Technical Journal (1089-7089)
- Canadian Journal of Electrical and Computer Engineering (0840-8688)
- IEE Journal on Electric Power Applications
- IEEE Power and Energy Magazine
- IEEE Transactions on Energy Conversion
- IEEE Transactions on Smart Grid
- Proceedings of the International Conference on Computer and Electrical Engineering
- Signal Processing Magazine

Proquest Science Journals: Subject coverage includes computers, engineering, physics, telecommunications, and transportation. Sample full-text journal titles include:

- Advanced Battery Technology (0001-8627)
- Electric Perspectives (0364-474X)
- International Journal of Electrical Engineering Education (0020-7209)
- Journal of Electromagnetic Analysis and Applications

- Mathematics of Control, Signals, and Systems (0932-4194)

ScienceDirect: High quality journals from Elsevier, plus over 1000 open access journals covering physical & engineering sciences as well as health & life sciences. Sample full-text journal titles include:

- Circuits, Systems, and Signal Processing (0278-081X)
- Computers & Electrical Engineering (0045-7906)
- Control Engineering Practice (0967-0661)
- Electric Power Systems Research (0378-7796)
- Signal Processing (0165-1684)

EBSCO Vocational and Career Collection: This database is designed to meet a wide variety of vocational and career research needs. The collection provides full-text coverage of nearly 350 trade and industry-related periodicals, including:

- Wireless Week
- PC World
- Technology Review
- eWeek
- Popular Science

In addition, students in the Bachelor of Engineering (Electrical Engineering) program will make use of a number of multidisciplinary databases (ex. **Academic Search Complete** and **Academic OneFILE**) and business databases (ex. **ABI/Inform**, **Business Search Complete**, & **Euromonitor**) to find related information.

Ebook Databases

AccessEngineering: Provides full-text access to renowned engineering handbooks, global engineering news, and interactive tables and graphs from McGraw-Hill. Sample titles include:

- Cadick, J., Capelli-Schellpfeffer, M., Neitzel, D.K., & Winfield, A. Electrical Safety Handbook, Fourth Edition.
- Coombs, Jr., C.F., & Coombs, C.A. Communications Network Test & Measurement Handbook.
- Dybdal, R. Communication Satellite Antennas: System Architecture, Technology, and Evaluation.
- Hickey, R. Electrical Engineer's Portable Handbook, Second Edition.
- Iniewski, K. CMOS Nanoelectronics: Analog and RF VLSI Circuits.
- Kasera, S., Narang, & N., Narang, S. Communication Networks: Principles and Practice.
- Kiameh, P. Electrical Equipment Handbook: Troubleshooting and Maintenance.
- Martin, P.L. Electronic Failure Analysis Handbook: Techniques and Applications for Electronic and Electrical Packages, Components, and Assemblies.
- Pabla, A.S. Electric Power Distribution, Sixth edition.
- Volakis, J.T. Antenna Engineering Handbook, Fourth Edition.

Books 24/7: We currently subscribe to three large ebook collections, including ITPro, BusinessPro, and EngineeringPro. Sample titles include:

- Andrews, J. (2014). CompTIA A+ 220-801, 220-802 In Depth. Cengage Learning.
- McFarland, G. (2006). Microprocessor Design: A Practical Guide from Design Planning to Manufacturing. McGraw-Hill.
- Null, L., & Lobur, J. (2015). The Essentials of Computer Organization and Architecture, Fourth Edition. Jones and Bartlett Publishers.
- Radamson, H., & Thylén, L. (2015). Monolithic Nanoscale Photonics-Electronics Integration in Silicon and Other Group IV Elements. Academic Press.
- Solomon, M.G., Kim, D., & Carrell, J.L. (2015). Fundamentals of Communications and Networking, Second Edition. Jones and Bartlett Publishers.
- Someya, T. (2013). Stretchable Electronics. Wiley-VCH
- Vittal, V., & Ayyanar, R. (2013). Grid Integration and Dynamic Impact of Wind Energy. Springer.

IEEE Standards & MIT Press Ebooks: In addition to high quality journals, *IEEE Xplore Digital Library* also provides access to all active IEEE standards, as well as a perpetual access collection of **MIT ebooks**. Sample titles include:

- Burdet, E., Franklin, D., & Milner, T. (2013). Human Robotics: Neuromechanics and motor Control. MIT Press.
- Chan, A. (2013). Networking Peripheries: Technological Futures and the Myth of Digital Universalism. MIT Press.
- Cormen, T. (2013). Algorithms Unlocked. MIT Press.
- Groote, J., & Mousavi, M. (2014). Modeling and Analysis of Communicating Systems. MIT Press.

EBSCO Academic eBook Collection: The massive collection of over 100,000 ebooks includes over 8,000 e-books related to Engineering and Technology. Sample titles include:

- Barsukov, Y., & Qian, J. Norwood. (2013). Battery Power Management for Portable Devices. Artech House.
- Iu, H.H., & Fitch, A.L. (2013). Development of Memristor Based Circuits. World Scienctific Series on Nonlinear Science.
- Litan, R.E., & Singer, H.J. (2013). The Need for Speed: A New Framework for Telecommunications Policy for the 21st Century. Brookings Institution Press.
- O'Sullivan, D., & Alcorn, R. (2013). Electrical Design for Ocean Wave and Tidal Energy Systems. IET.
- Pu, D., & Wyglinski, A.M. (2013). Digital Communication Systems Engineering with Software-defined Radio. Artech House.
- Ryan, H.M. (2013). High Voltage Engineering and Testing. IET.
- Wirth, W. (2013). Radar Techniques Using Array Antennas. IET Radar, Sonar, and Navigation Series.

ENGnetBASE: Cutting-edge and bestselling reference works from CRC. Provides access to the latest handbooks in civil, mechanical, and electrical engineering. Sample titles include:

- Adaptive Filtering: Fundamentals of Least Mean Squares with MATLAB® (2014).
- Computer-Aided Control Systems Design: Practical Applications Using MATLAB® and Simulink® (2012)
- Electromagnetics for Electrical Machines (2015).
- Electrotechnical Systems: Simulation with Simulink and SimPowerSystems (2012).
- Labs on Chip: Principles, Design and Technology (2014).
- Mobile Devices, Tools and Technologies (2015).
- Remote Sensing Image Fusion (2015).
- Signal Processing, A Mathematical Approach, Second Edition (2014).
- The Circuits and Filters Handbook, Third Edition (2015).
- Wireless Transceiver Circuits, System Perspectives and Design Aspects (2015).

Knovel: More than just an ebook collection with authoritative handbooks in engineering, Knovel provides Interactive Equations, Data Search, and more. Sample handbook titles include:

- Butcher, K.J. (2009). CIBSE Guide H - Building Control Systems. CIBSE.
- Gulati, R. (2013). Maintenance and Reliability Best Practices (2nd Edition). Industrial Press.
- Mago, P.J. & Srinivasan, K.K. (2010). Exhaust Waste Heat Recovery From Stationary Engines Using Organic Rankine Cycles. Knovel.
- McLean-Conner, P. (2009). Energy Efficiency - Principles and Practices. PennWell.

Safari Books Online: An extensive ebook collection covering business, desktop and web applications, digital media, engineering, IT and software development, math and science, as well as personal and professional development. Sample titles include:

- Canty, M.J. (2015). Image Analysis, Classification and Change Detection in Remote Sensing, 3rd Edition. CRC Press.
- Cox, C. (2014). An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications, 2nd Edition. John Wiley & Sons.
- DiBene, II J.T. (2014). Fundamentals of Power Integrity for Computer Platforms and Systems**.** John Wiley & Sons.
- Koike, Y. (2015). Fundamentals of Plastic Optical Fibers. Wiley-VCH Verlag.
- Pretty, B. (2015). Getting Started with Electronic Projects. Packt Publishing.
- Sen, S.K. (2015). Fieldbus and Networking in Process Automation. CRC Press.
- Yang, Y. (2014). LabVIEW Graphical Programming Cookbook. Packt Publishing
- Zhu, Z, & Nandi, A. (2015). Automatic Modulation Classification: Principles, Algorithms and Applications. John Wiley & Sons.

SpringerLink: A relatively small but mighty multidisciplinary collection of ebooks. There are currently just over 1,300 ebooks in the collection related to Engineering. Sample titles include:

- Altshuller, D. (2013). Frequency Domain Criteria for Absolute Stability: A Delay-integral-quadratic Constraints Approach.
- d'Andréa-Novel, B., & De Lara, M. (2013). Control Theory for Engineers: A Primer.
- Ding, M., & Luo, H. (2013). Multi-point Cooperative Communication Systems: Theory and Applications
- Dolecek, G.J. (2013). Random Signals and Processes Primer with MATLAB.
- Malekzadeh, F.A., Mahmoudi, R., & van Roermund, A.H. (2013). Analog Dithering Techniques for Wireless Transmitters.
- Sozański, K. (2013). Digital Signal Processing in Power Electronics Control Circuits.

Printed Books

Sample titles include:

- Becker, P.D. (2010). Alternative energy. Greenhaven Press.
- Boylestad, R.L. (2009). Electronic devices and circuit theory 10th ed. Pearson/Prentice Hall.
- Boylestad, R.L. (2010). Introductory circuit analysis. Prentice Hall.
- Fanchi, J.R. (2011). Energy in the 21st century 2nd ed. World Scientific.
- Gerrish, H.H. (2009). Electricity & electronics 10th ed. Goodheart-Willcox Co.
- Hambley, A.R. (2011). Electrical engineering: principles and applications, 5th edition.
- International Organization for Standardization. (2011). Energy management systems: requirements with guidance for use.
- Janis, R.R. (2009). Mechanical and electrical systems in buildings 4th ed. Pearson Prentice Hall.
- Kaplan, S.M. (2004). Wiley electrical and electronics engineering dictionary. IEEE Press.
- Mullin, R.C. (2012). Electrical wiring. Delmar Cengage Learning.
- Nelson, V. (2011). Introduction to renewable energy. CRC Press.
- Nersesian, R.L. (2010). Energy for the 21st century: a comprehensive guide to conventional and alternative sources 2nd ed. M.E. Sharpe.
- Northey, M., & Jewinski, J. (2012). Making sense: a student's guide to research and writing: engineering and the technical sciences. Oxford University Press.
- O'Malley, J. (2011). Basic circuit analysis, 2nd ed. McGraw-Hill.
- Petruzella, F.D. (2010). Electric motors and control systems. McGraw Hill Higher Education.
- Rashid, M.H. (2007). Power electronics handbook: devices, circuits, and applications 2nd ed. Academic Press.
- Smith, Z.A. (2008). Renewable and alternative energy resources: a reference handbook. ABC-CLIO.

- White, L.G. (2010). Solar energy technologies: from research to deployment. Nova Science Publishers.
- Wujek, J.B. (2010). Mechanical and electrical systems in architecture, engineering, and construction 5th ed. Pearson Education.

Streaming Video & Tutorial Databases

Films on Demand: Provides online videos on subjects such as social sciences, business, science, math, life sciences, and skilled trades, engineering, and more. Sample titles include:

- The Science Squad Series
- The Genius of Invention: Ideas that Changed the World Series
- Inside Science Series
- The Big Picture: Testing for Tomorrow
- Breaking the Wall of Traditional Electronics: How Embracing Disorder in Nanotechnology May Lead to Quantum Machines

NBC Learn: Provides access to thousands of broadcasts from NBC on a wide variety of topics, including chemistry, microeconomics, environmental sciences, politics & legal issues, business, the arts, and more. Sample titles include:

- Which electronic devices will be allowed in flight?
- 2014 Study: Hands-free tech in cars do more harm than good
- For wearable tech, “Form has to match the function”
- FDA approves artificial retina for the blind
- 1983: Growing problem in business world – computer phobia

Lynda.com Online Training Library: Provides over 3,000 online courses with thousands of online training tutorials on a broad range of topics related to business, software, and career skills.

- Up and Running with MATLAB
- Giving Your Elevator Pitch
- Job Hunting Online
- Communication Fundamentals

Safari Online Books: Includes almost 2,000 videos related to business, desktop and web applications, and digital media.

- PCB Signal Integrity LiveLessons
- SolidWorks Electrical – Schematic Fundamentals
- Learning AutoDesk AutoCAD Electrical 2014
- Neal Ford on Agile Engineering Practices

6.1.2 Computer Resources and Web Access

Students will be required to provide their own laptops. Learning resources will be available online to students in online courses/programs, and if not all appropriate resources are routinely available online, appropriate and adequate arrangements will be made to provide them to online students.

Year	**Number of students (cumulative)**	**Number of computers available to students in proposed program**	**Number of computers with Internet access available to students in proposed program**	**Location of computers**	
				On-site √	*Other (specify)*
Yr. 1	43	45	45	√	Students will be required to have their own personal laptop, in addition to lab computers
Yr. 2	78	81	81	√	
Yr. 3	162	137	137	√	
Yr. 4	190	193	193	√	
Yr. 5	218	221	221	√	

Notes:
- Number of students represents degree program only.
- Each student will have access to a computer with internet access.
- Computer Labs will be shared with diploma cluster, and assigned to degree students per enrollment requirements.

6.1.3 Classroom Space and Seating Capacity

Year	Number of students (cumulative)	Number of existing classrooms (include seating capacity)			Location of Classrooms		Number of new classrooms required
		Comp-uter Labs	***Engineer-ing Labs***	***Classrooms***	*On-site* √	*Other (specify)*	
Yr. 1	43	Labs will be shared with diploma students	Labs will be shared with diploma students	Classrooms are shared with all programs at Davis campus	√	Shared access to Skilled Trades Centre workshops moving to Davis campus	No new classrooms or labs are required as existing classrooms will meet enrolment
Yr. 2	78				√		
Yr. 3	162				√		
Yr. 4	190				√		
Yr. 5	218				√		

The students will have access to a specialized Computer Laboratory, shared with the existing CAD Laboratory, as well as personal laptops. Most of required software are already available to Sheridan students and faculty, such as MultiSim™, Proteus™, RSLogix™, LabView™, MatLab™, MS Office™, MS Project™, etc.

The only software to be acquired is a power system analysis software, such as EasyPower™, PSIM™, PSCAD™, EMTDC™ EMTP-RD™, PSSe™, CYME™, etc. Most of these packages are available at very favorable educational pricing. Due to the restrictive licensing, these should probably be installed on college owned workstations.

6.1.4 Specialized Equipment, Workstations and Laboratory Space

Sheridan's Centre for Advanced Manufacturing and Design Technologies (CAMDT) is located at the Davis Campus in Brampton. The 18,000 square foot facility, constructed in 2007, houses state-of-the-art labs and a flexible automation and fabrication centre. The facility was expanded in 2012 by an additional 10,000 square feet, which enables it to supply more dedicated space for industry projects and better integrate functions such as machining. The Centre's mission is to help meet the current and future needs of local manufacturers as a means of stimulating local economic development and prosperity.

Longevity of the Centre has been assured by financial commitments from Sheridan, and nearly $7 million dollars from project partners: $2.5 million from the City of Brampton, $2.9 million from the Ministry of Economic Development and Trade's Strategic Skills Investment Fund, and over $1.5 million in cash and in-kind support from business and industry.

Sheridan's Strategic Plan describes "imaginative and collaborative learning spaces that create the best opportunity to realize our mission of purposeful educational experience in a creative and innovative environment". Sheridan is now applying this mission to the context of an applied engineering and skilled trades centre at the Davis campus where a new 125,000 gross square foot building will be built. The new facility will house the engineering programs at the Davis Campus, including the new Skills Training Centre, and will provide synergies between the engineering and skills training programs.
The proposed degree program can be accommodated within the existing footprint and capital equipment (no major capital requirements are needed). Current facilities available within the Faculty of Applied Science & Technology are summarized in the table below.

Facility	Equipment/Technology
CAD Instructional Laboratory	MultiSim™, Proteus™, RSLogix™, LabView™, MatLab™, AutoCAD™, SolidWorks™
Electronics Laboratory Four rooms (B315A, B315B, B316, B400)	• Agilent digital oscilloscopes, Tektronix oscilloscopes, NI data acquisition boards, LabVIEW software, PV Panels, Vertical Axis Wind Turbine, Microhydro. • PCB prototyping capability • The laboratory has access to a parts and tool crib which give students and faculty access to thousands of parts and specialized test equipment. • Full computer access and support is also provided. There are also 2 full time certified Electronics Technologists available to support faculty and students.
Applied Mechanics Laboratory	Physics laboratory facilities and apparatus, material testing equipment

Facility	Equipment/Technology
Chemistry Laboratory	pH meters, Perkin Elmer Analyst 40, Anion Column, OHAUS Analytical balance, CO2 meter, constant temp baths, microscopes, electrothermal melting point apparatus, electrophoresis package, ICP spectrometer, distillation columns
Environmental Control Laboratory	Turbidity meters, digital DO meters, RO System, wastewater treatment simulator
Power Systems Laboratory	AC synchronous and induction motors, DC motors, single- and three-phase power supplies, RLC load banks, synchronizing apparatus, power-electronics modules, IGBT DC/DC converters, IGFT DC/AC inverters, Thyristor AC/DC converters
Thermal Laboratory	Gunt HVAC Trainer, Gunt HL312 Solar Collector, Clayton 25BHP steam turbine with automatic/manual controls and auxiliaries, Greenbat 7BHP Steam Turbine
Process Control Laboratory	Electromechanical training systems – pumps, motors, switches, pneumatic interface, temperature control, level and flow
PLC Laboratory	Allen-Bradley, Omron, Siemens PLCs
Manufacturing Centre	Automated pallet delivery system, gantry, Cognex vision system, ABB and Fanuc robot systems, ZCorp rapid prototyping machines, laser cutting system
Metrology Laboratory	Mitutoyo CMM, Apex CMM, Rosseau Measuring workstations, micrometers, calipers
Machining & CNC Laboratory	40T press, manual and CNC lathes, saws, 3 and 4 axis mills; threading machines, CNC trainers, arc welders
Product Innovation Centre	Fortus 900, Fortus 400 production systems for additive manufacturing, Finishing and cleaning stations
Integrated Energy Systems Laboratory (I.E.S.L.)	Integrated Energy Systems Laboratory (I.E.S.L.) facilitates the integration of various energy sources, such as wind, photovoltaic, fuel cell, micro-hydro, geo- thermal, solar thermal, etc., with energy storage and grid connection. The laboratory will also be used to teach the students the fundamentals of various energy systems as well as installation, control, maintenance, and troubleshooting of commercial-grade energy systems and devices.

The following courses in the proposed degree program will have laboratory components.

Term	Course Name	Laboratory Components
Term 1	Fundamentals of Physics 1	Applied Mechanics Laboratory
	Exploring Engineering	Electronics Laboratory CAD Instructional Laboratory Product Innovation Centre
Term 2	Engineering Design and Problem Solving	Electronics Laboratory CAD Instructional Laboratory Product Innovation Centre
	Fundamental of Physics 2	Electronics Laboratory
	Computer Programming	CAD Instructional Laboratory
	Introduction to Chemistry for Engineers	Chemistry Laboratory Environmental Control Laboratory
Term 3	Fundamentals of Digital Systems	Electronics Laboratory
	Algorithms and Data Structures	CAD Instructional Laboratory
	Electronic Circuits 1	Electronics Laboratory
	Electrical Circuits and Power	Electronics Laboratory
Term 4	Signals and Systems 1	CAD Instructional Laboratory
	Electronic Circuits 2	Electronics Laboratory
	Microprocessor Systems	Electronics Laboratory
Term 5	Signals and Systems 2	CAD Instructional Laboratory
	Communication Systems	CAD Instructional Laboratory
	Electric Power Generation and Transmission	CAD Instructional Laboratory Power Systems Laboratory
	Introduction to Energy Systems	CAD Instructional Laboratory Integrated-Energy Systems Laboratory
	Embedded Software Fundamentals	Electronics Laboratory
	Modeling and Simulation	CAD Instructional Laboratory
Term 6	Design of Digital Systems	Electronics Laboratory PLC Laboratory
	Control Systems	CAD Instructional Laboratory Electronics Laboratory
	Electric Machines	CAD Instructional Laboratory Power Systems Laboratory
	Power Electronics	CAD Instructional Laboratory Power Systems Laboratory
	Power Distribution System Design	CAD Instructional Laboratory Power Systems Laboratory

Term	Course Name	Laboratory Components
	Embedded Application Development	Electronics Laboratory
	Kinematics and Robotics	Manufacturing Centre
Term 7	Capstone Project (Conceive and Design)	Electronics Laboratory CAD Instructional Laboratory Product Innovation Centre
	Micro-Controller Applications	Electronics Laboratory
	Power System Analysis	CAD Instructional Laboratory Power Systems Laboratory
	Alternative Energy Systems	CAD Instructional Laboratory Integrated-Energy Systems Laboratory
	Micro-Electro-Mechanical Systems (MEMS)	Electronics Laboratory
	Mechatronics Principles	CAD Instructional Laboratory
Term 8	Capstone Project (Implementation and Operate)	Electronics Laboratory CAD Instructional Laboratory Product Innovation Centre
	Power System Control and Protection	CAD Instructional Laboratory Power Systems Laboratory
	Intelligent Power Systems	CAD Instructional Laboratory Power Systems Laboratory
	Embedded Systems Design	Electronics Laboratory
	Mechatronic Systems Design	CAD Instructional Laboratory Electronics Laboratory Product Innovation Centre, Machining & CNC Laboratory

6.2 Resource Renewal and Upgrading

Sheridan follows an ever-greening strategy for technology, regardless of whether the technology is in the hands of students, faculty or administrators. Technology is kept current with refresh windows varying from two to five years depending on the type of technology. Sheridan campuses are fully wireless with more than 1500+ wireless access points deployed across the four campuses. Students have wireless access in classrooms, dedicated student study rooms, residences and in common areas; many of these spaces have wired network connectivity as well.

Classroom teaching and learning equipment are refreshed on regular cycles based on a priority and needs basis. Virtually all classrooms, studios and labs at Sheridan are equipped with standardized teaching podiums with audio/visual control, a podium computer with DVD playback capability, data projectors, document camera and, where required, a sound system. Approximately 385 classrooms are equipped with technology and 150 of these are fully mobile which means that, in addition to the standard teaching equipment, there are wired network and power connections available for student use.

The Sheridan library resource has an operational budget for collections of $1.5 million annually. The Library is allotted an additional $150 for each new degree student.

6.3 Support Services

The Student Advisement Centre helps with program change advisement, college form completion, college policy and procedure explanation, general education and program elective selection, orientation and student success programs, course/program withdrawal consultation and transfer information for other programs and institutions. Each program at Sheridan includes faculty release time for academic advising.

The Career Centre is one-stop shopping for academic and career success, offering tutoring, career planning, and employment services.

Personal Counselling: Sheridan's professional counsellors work with students on a confidential basis to help them achieve their personal goals. Consultation is available to any student seeking advice on non-academic issues on a drop-in or appointment basis.

Cooperative Education: The Cooperative Education & Internship Office administers the internships that are required for successful completion of degree programs.

Accessible Learning Services: Staff work in collaboration with students with disabilities, faculty and support staff to ensure that fair, equitable and appropriate accommodations are developed and implemented.

The International Centre provides assistance with processing international student applications, advice on housing, residence, off-campus housing or home stay, Health Insurance Coverage/claims and medical referrals, advice on student authorization/visas and extensions, visa and travel information, immigration regulations regarding co-op terms, internships or field placements, personal concerns or emergency situations.

***Alumni Association*:** programs and services for Alumni include Insurance & Credit Card Affinity Benefit Programs, access to Athletic Centres, Libraries & Career Services, Optimal Resume, discounts at Theatre Sheridan, Ovation Magazine once a year and Ovation e-newsletter monthly.

Bookstore provides textbooks – new and used, stationary and professional grade fine art and paper supplies, Sheridan logo clothing, gifts and backpacks, software, general interest books & magazines, personal care items.

Cafeteria: Full service cafeteria facilities and vending machines.

The Sheridan Print Centre: The Sheridan Print Centre is a leader in every facet of document management including: full-service black-and-white or color copying and printing, special papers, posters and banners, laminating, transparencies and finishing, multimedia and graphics, GLink™ online electronic submission of any document.

***Child Care/Preschool*:** Full-day early childhood programs are available for children 18 months to 5 years of age at theTrafalgar Road Campus in Oakville and the Mississauga Civic Centre.

The ***Financial Aid Office*** can assist with Ontario Student Assistance Program (OSAP), Part-time Canada Student Loan, Canada Study Grant funding for students with Dependent Children, Ontario Special Bursary Program Funding, Bursary for Students with Disabilities Funding, Child-care Bursary Funding, Sheridan Tuition Reinvestment Bursaries, Ontario Student Opportunity Trust Fund Assistance (OSOTF)

Athletic Therapy Centre provides treatments for recreational/sports injuries.

Athletics and Recreation*:* Membership to the Athletic Centres is included with tuition fees.

Sheridan's ***Health Centres*** offer professional health care, lifestyle and health counselling, and referrals for students.

Sheridan has three ***Residence buildings***, two in Oakville and one at the Davis Campus in Brampton. Students enjoy the comforts of home with easy access to all College services and facilities. All residences are conveniently located close to many sports and entertainment opportunities in the Greater Toronto area.

Facilities Management supports and enhances the quality of the teaching and learning environment by providing a service oriented approach to maintaining the integrity and efficiency of college facilities, in a cost effective manner.

The ***Library Learning Commons*** is a state-of-the-art study support environment designed with students' comfort, convenience and stimulation in mind. The LLC brings together in one place the services that support students in their learning, writing, research, and use of information technology.

Sheridan oneCARD: The Sheridan oneCARD is a multipurpose identification and access card for students and staff. It provides a consistent method of identification that will give an additional means of establishing a safe and secure environment for students and employees on campus. Also, the oneCARD will be used to provision users with access to Sheridan's Libraries, Network Printers and Campus Recreation facilities.

Inter-Campus Shuttle: Sheridan has partnered with the Sheridan Student Union to offer a free shuttle bus service for Sheridan students and employees. The buses run Monday - Friday between the Davis, HMC, STC and Trafalgar Campuses. Fully accessible buses feature Wi-Fi, recharging stations to charge laptops or mobile phones en route, coach style seating and GPS tracking.

6.4 Faculty

6.4.1 Proposed Enrolment

The proposed program is planned to start in the fall of 2018 with a projected total intake of 43 full time students. This is expected to increase to 218 students across all five years, at a steady state by 2022.

Proposed Enrolment	Year 1	Year 2	Year 3	Year 4	Year 5	Annual Ongoing
Total head count (HC) or full-time equivalent (FTE) count	43	78	162	190	218	218
Full-Time Year 1	43	43	43	43	43	43
Full-Time Year 2	0	35	35	35	35	35
Full-Time Year 3	0	0	56**	56	56	56
Optional Co-Op Term	0	0	28*	28	28	28
Full-Time Year 4	0	0	0	28	56	56
Anticipated No. of Graduates	0	0	0	28	56	56

** Based on the scenario where the pathways provide 20 students growth in the third year.

* Based on the scenario where 50% of the students participate in the optional co-op work term.

6.4.2 Staffing Implications

As indicated in Sheridan's 2020 Program mix plan, the intention is to continue the existing Electrical Engineering diploma programs in parallel with the proposed Bachelor of Engineering (Electrical Engineering) degree program. The enrolment between diploma and degree programs will be balanced such that as the degree program enrolment increases, an equivalent reduction in the diploma programs will occur. The capacity to deliver both the degree and diploma program is possible as the programs will share common faculty resources, class and laboratory space. We expect to draw students through the diploma programs into the degree program.

The table below summarizes the staffing requirements (taken from the 2020 HR Plan) and ratio calculations are based on enrolment of the proposed degree program in the School of Mechanical and Electrical Engineering Technology.

Enrolment			**Staffing Requirements – Projected**				
Total head count (HC)		*Cumulative full-time faculty equivalents*	*Cumulative part-time faculty equivalents*	*Projected Hiring of FT/PT Faculty*	*Cumulative Technical support.*	*Projected Hiring Technical Support*	*Ratio of full-time students/ full-time faculty*
Yr. 1 2018-19	Degree 43	3	0	0	1	0	15:1
Yr. 2 2019-20	Degree 78	5	1	0	1	0	16:1
Yr. 3 2020-21	Degree 162	7	3	0	2	0	20:1
Yr. 4 2021-22	Degree 190	8	5	0	3	0	24:1
Yr. 5 2021-22	Degree 218	9	5	0	3	0	25:1

Notes: Figures above are based on the 2020 Enrolment Plan.

6.5 CV Release

The college has on file and available for inspection, from all faculty and staff whose curriculum vitae (CVs) are included in this submission, signatures that attest to the truthfulness and completeness of the information contained in their CV and agreeing to the inclusion of their curriculum vitae in any documents/websites associated with the submission, review and final status of the program application.

6.6.1 Curriculum Vitae of Faculty Delivering Non-Core Courses

The CVs of faculty responsible for non-core courses on file with PEQAB are current.

Section 7: Credential Recognition Standard

Letters of support for credential recognition of the proposed degree program are being received from many universities and industries. To date, over 30 letters of support have been received, including letters from many major universities in Canada.

In addition to the letters of support, Sheridan's engineering and technology program is endorsed by a number of Memorandums of Understanding (MOU), signed by Sheridan College and industries, namely Siemens Canada Ltd., ABB Inc., and Hatch Ltd. These MOU's specify collaborative effort between Sheridan College and these industries, in strengthening their relationship and establishing a framework of cooperation intended to enhance the educational curriculum, training programs, and applied research initiatives at Sheridan. These collaborations aim to promote the educational and employment opportunities available to Sheridan graduates and to ensure that Siemens and other leaders in Canada's high-tech economy have access to a world-class, highly skilled workforce that supports innovation and economic growth.

Curriculum development at Sheridan is enhanced through professional advisory councils, and participation in other educational events and initiatives, where the industry is able to provide important perspectives and contributions to such bodies or activities.

Industry collaborations also increase opportunities for Sheridan students to participate in internships, apprenticeships, and/or co-operative programs. Under these MOU's, possibilities are also being discussed to establish certification training programs, such as Mechatronics and/or Smart Grid Systems, that meet the needs of industries and of Sheridan students. This will enable Sheridan's faculty and students to gain training, practical knowledge of, and experience with the industries' expertise, practical solutions and technologies.

7.1 University Credential Recognition

Jurisdiction	Academic Institute
Canada	McMaster University
	Ryerson University
	University of Alberta
	University of British Columbia
	University of Guelph
	University of Ontario, Institute of Technology
	University of Toronto
	Western University
United States	University of Michigan-Shanghai Jiao Tong University Joint Institute
	Georgia Institute of Technology
Great Britain	Imperial College of Science, Technology & Medicine

McMaster University ENGINEERING

Department of
Electrical and
Computer Engineering
1280 main Street West
Hamilton, Ontario, Canada
L8S 4K1

Tel. 905.525.9140 Ext. 24305
Fax 905.521.2922
office@ece.eng.mcmaster.ca

March 14th, 2016

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario. I am pleased to offer this letter of endorsement.

I served as the chair of the undergraduate curriculum committee in the Department of Electrical and Computer Engineering, McMaster University, for many years. I have a good experience on undergraduate curricula in different engineering programs. Reading through your proposal plan, I can see that it has all the elements of a successful program. Students learn the needed solid theoretical background in addition to extensive hand-on experiences in laboratories, internships, and co-ops with industry. The CDIO concept is particularly interesting as it allows students to go through all the steps of realizing a well-designed and fully-functional engineering product. This approach to experiential learning is much needed in education as it gives students the chance to solve real-life engineering problems.

I applaud your efforts to bring this industry-relevant engineering program forward. I believe it will be a good contribution to the successful growth of Canadian industry. I hope that this proposal will see the light in the very near future.

Sincerely,

Dr. Mohamed Bakr
Professor,
Department of Electrical and Computer Engineering,
McMaster University,
Hamilton, Ontario,
Canada, L8S 4K1,
Phone: 905 525 9140 x24079
Email: mbakr@mail.ece.mcmaster.ca

RYERSON UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF SCIENCE

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation. The following criteria have been used in this assessment:

- *Viability of the Program*
My overall recommendation is that the proposed program is a highly desirable addition to the existing Sherdian's College undergraduate offerings.

- *The rigour and coherence of the proposed curriculum*
After reviewing the proposed curriculum, I agree that the proposed material is rigorous, relevant, well-organized and meeting the goals and learning objectives. The core courses are well thought out followed by a well-balanced more advanced courses. The co-op option is particularly very appealing and relevant to these types of engineering degrees.

- *The appropriateness of the program's goals and learning objectives*

350 Victoria Street, Toronto, Ontario, Canada M5B 2K3 Tel: 416-979-5063 Fax: 416-979-5064 Office: 245 Church St., ENG287 www.scs.ryerson.ca

A baccalaureate degree program in Electrical Engineering with options in Mechatronics and Power & Energy Systems is a very timely degree with a growing demand (there are only few existing programs that address the said need especially in the area of Mechatronics). I believe that this proposal has an excellent focus that is well suited to the overall academic mission of School of Mechanical and Electrical Engineering & Technology at Sheridan College Institute of Technology and Advanced Learning.
I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,

Dr. Alireza Sadeghian
Professor
Dept. of Computer Science
Ryerson University, Toronto, Ontario M5B 2K3
Tel: (416) 979-5000 ext. 6961
Email: asadeghi@ryerson.ca

UNIVERSITY OF ALBERTA

Electrical & Computer Engineering
Faculty of Engineering

11-389, 11st Floor, D-ICE
Electrical & Computer Engineering Dept.
Phone: 780.492.3449

University of Alberta
Edmonton, Alberta, Canada T6G 2V4
Fax: 780.492.1811

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Date: **September 3, 2015**

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,
It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.
I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.
Students graduating from this program are welcome to apply to the graduate program in Power & Energy Systems disciplines in our department of Electrical and Computer Engineering at University of Alberta.

Sincerely,

S. Ali Khajehoddin, PhD
Assistant Professor
Room: 11-389, 11st Floor, D-ICE building
Electrical & Computer Engineering Dept.
University of Alberta
(9107 - 116 Street)
Edmonton, Alberta, Canada T6G 2V4
Office: 780 492 3449
http://www.ece.ualberta.ca/~khajeddi/

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

ece Electrical and Computer Engineering

EEL Flexible Electronics & Energy Laboratory

June 18, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

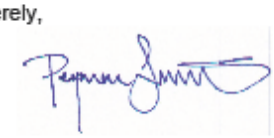
It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides a strong foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & Energy Systems field. In my opinion the balance of theoretical study and engineering practices is considered well by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Students graduating from this program are welcome to apply to the graduate programs in related disciplines at the University of British Columbia.

I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,



Dr Peyman Servati, P.Eng.
Associate Professor
Department of Electrical and Computer Engineering
2332 Main Mall, Vancouver BC V6T 1Z4, Canada
Tel: 1-604-827-4269 Fax: 1-604-822-5949
Email: peymans@ece.ubc.ca http://feel.ece.ubc.ca/

UNIVERSITY of GUELPH
School of Computer Science

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

June 09, 2015

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe this program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Students graduating from this program will have the opportunity to apply for the graduate programs in Mechatronics or Power & Energy Systems disciplines in many universities.

Sincerely,

R Dara

GUELPH • ONTARIO • CANADA • N1G 2W1 • (519) 824-4120 • FAX (519) 824-5930 • www.uoguelph.ca

1 August 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Students graduating from this program are welcome to apply to the graduate program in Mechatronics or Power & Energy Systems disciplines in our Faculty of Engineering and Applied Science at University of Ontario Institute of Technology.

I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,

Vijay Sood, Ph.d., P.Eng., FIEEE, FEIC, FCAE
OPG-NSERC co-Chair in Design Engineering
Associate Professor
UOIT
2000 Simcoe Street North,
Oshawa, ON L1H 7K4
Email: Vijay.sood@uoit.ca
Phone: 905-721-8668 x5478

The Edward S. Rogers Sr. Department
of Electrical & Computer Engineering
UNIVERSITY OF TORONTO

September 12, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Students graduating from this program are welcome to apply to the graduate program in Mechatronics or Power & Energy Systems disciplines in our Department of electrical and Computer Engineering at the University of Toronto.

I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,

Reza Iravani,
Professor, Ph.D, P.Eng., FIEEE
L Lau Chair
Tel: 416 978 7755

Sandford Fleming Building, 10 King's College Road, Toronto, ON M5S 3G4 Canada
www.ece.utoronto.ca

Western Engineering

Department of Electrical & Computer Engineering

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

Western University Department of Electrical and Computer Engineering, Thompson Engineering Building, Rm. 279
1151 Richmond St. N., London, ON, Canada N6A 5B9
t. 519.661.2111 ext. 83758 f. 519.850.2436 www.eng.uwo.ca/electrical

Western Engineering

Department of Electrical & Computer Engineering

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Abdallah Shami, Ph.D., P.Eng
Professor and Associate-Chair (Graduate)
The University of Western Ontario
Department of Electrical and Computer Engineering
London, Ontario, Canada, N6A 5B9
Phone: +1-519-661-2111 Ext: 81259
Email: ashami@eng.uwo.ca

Western University Department of Electrical and Computer Engineering, Thompson Engineering Building, Rm. 279
1151 Richmond St. N., London, ON, Canada N6A 5B9
t. 519.661.2111 ext. 83758 f. 519.850.2436 www.eng.uwo.ca/electrical

JOINT INSTITUTE
交大密西根学院

To: Dr. Farzad Rayegani
Professor, Associate Dean
School of Mechanical and Electrical Engineering & Technology
Sheridan College Institute of Technology and Advanced Learning

October 31, 2015

RE: Proposed Electrical Engineering Bachelor Degree with Mechatronics and Power & Energy Systems Options

Dear Dr. Rayegani,

Thank you for giving me the opportunity to review the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Let me start with introducing myself and my institution: I am an Associate Professor at the University of Michigan-Shanghai Jiao Tong University Joint Institute, and director of the Photovoltaic Solar Cell Laboratory. I am holding the Distinguished Professor and Oriental Scholar designation in Shanghai Universities. I have obtained a PhD from the University of Toronto in 2006, and worked as an Assistant professor at Texas A&M University-Corpus Christi, prior to joining the Joint Institute in China in 2013. Owing to my teaching experience in Canada, United Sates, and China, I am very well familiar with the typical curriculum in Mechanical and Electrical Engineering. I have also been involved with the ABET accreditation process of our program at my former University, Texas A&M-Corpus Christi in 2013, and my current Institution, University of Michigan-Shanghai Jiao Tong University Joint Institute just recently. I met and interviewed the ABET evaluators in both cases.

I reviewed the proposed degree plan by Sheridan. The philosophy and rationale behind the Conceive, Design, Implement, and Operate framework is quite innovative, effective and applied, and addresses the needs of Ontario and global Industry. Meanwhile it highly complies with ABET (and its Canadian counterpart). It combines the required courses on math and science, engineering core courses, and well-designed and targeted

中国 上海闵行区东川路 800 号　　邮编 200240　　Tel: +86-21-34206045
800 Dong Chuan Road, Shanghai, 200240, PRC　　http://umji.sjtu.edu.cn

JOINT INSTITUTE
交大密西根学院

courses in the area of either Mechatronics or Energy & Power Systems, as well as courses in economics and entrepreneurship. The program also includes internship and optional co-op to further help the students to acquire hands-on experience and in-depth workplace knowledge and experience in two demanding fields, i.e., Mechatronics and Energy.

The proposed program is highly effective and beneficial to the students and the Canadian industry and will well prepare the students to enter the job market or graduate studies. Current Engineering curriculum, in most Canadian and American Universities, are general and lack the focus on a specific area, making it difficult for the students to acquire required skills to enter the job market upon graduation. I believe that most engineering companies would be highly interested in hiring the graduates of the proposed program owing to its applied nature. From a research perspective, the proposed program also equips the students with practical engineering knowledge making them ready to conduct cutting edge research in Energy and Mechatronics. Therefore, I am delighted to express that our institution and faculty would be very much interested in recruiting the graduates of the proposed disciplines to our MS and PhD programs.

In conclusion, I am delighted to highly endorse the proposed program. I believe that with the capacity of the City of Toronto, as Canada's economic capital and the first destination for new immigrants to Canada, and the reputation, human resources, faculty, staff, and infrastructure available at Sheridan campuses, the proposed degree will be well received by the students and the industry and can compete with similar programs in major Universities in the country.

Morteza Eslamian, PhD, PEng

Associate Professor
University of Michigan-Shanghai Jiao Tong University Joint Institute
800 Dong Chuan Road
Shanghai, 200240, China
Ph: +86-21-3420-7249
Morteza.Eslamian@sjtu.edu.cn
http://pv.sjtu.edu.cn/index.html

中国 上海闵行区东川路 800 号 邮编 200240 Tel: +86-21-34206045
800 Dong Chuan Road, Shanghai, 200240, PRC http://umji.sjtu.edu.cn

Georgia Tech College of Engineering
School of Electrical and Computer Engineering

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Date: **July 7, 2015**

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Students graduating from this program are welcome to apply to the graduate program in Mechatronics or Power & Energy Systems disciplines in our school of Electrical and Computer Engineering at Georgia Institute of Technology.

Sincerely,

M. Saeedifard

Maryam Saeedifard
Assistant Professor
School of Electrical and Computer Engineering

School of Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332-0250 U.S.A.
PHONE 404-894-2901 FAX 404-894-4641

Imperial College London | SUSTAINABLE GAS INSTITUTE
Founded by BG Group

Sustainable Gas Institute
11 Princes Gardens
Imperial College London
South Kensington campus
London SW7 1NA
Tel: +44 (0)207 594 1539

www.sustainablegasinstitute.org

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

25 February 2016

Dear Dr Rayegani,

RE: Support for the baccalaureate degree program proposed by Sheridan College Institute of Technology and Advanced Learning.

I had an opportunity to review the proposal for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario. I am pleased to offer this letter of endorsement.

I have worked at the University-Business interface for more than 12 years within the private and public sectors, in the UK and in Canada and now as part of industry-sponsored research institute at a leading university. I believe that the proposed courses are well-structured to deliver graduates with a sufficient breadth of knowledge and skills that the industry requires of graduate engineers. In particular I would applaud the proposed:

- **Focus on graduate attributes** - the courses include both a strong focus on the underpinning skills required for a professional electrical engineer combined and sufficient exposure to professional, entrepreneurial, business skills provision. This is essential to develop graduates who can quickly adapt and understand the needs of industry.
- **Approach** - the CDIO framework will bring a focus on real-world engineering principles/approaches while preparing students for their professional careers.
- **Strong integration with industry** - significant internship and co-op opportunities are available.
- **Sector focus** - the course supports relevant growth opportunities in critical segments of the Ontario economy.
- **Interdisciplinarity** - the proposal will go some way to preparing a future generation of engineers who have a strong appreciation of foundational electronic engineering research while being able to transcend traditional subject boundaries.

In conclusion, I believe this is a well-balanced and exciting industry-relevant program. The graduates from this program will fill gaps that exist in the industry, especially in the manufacturing, energy, and power systems sectors.

I wish you the best of luck in this program.

Sincerely,

Chris Jones

Christopher Jones, PhD
Operations Director
Sustainable Gas Institute

Imperial College of Science, Technology and Medicine

7.2 Industry Credential Recognition

Similar to the university credential recognition that have been received, Sheridan has received numerous letters of support from industry for the proposed Bachelor of Engineering (Electrical Engineering):

Altair Innovation Intelligence
ApoSys Technologies
BlackBerry
Cerebral Diagnostics
City of Brampton
Cognitive Systems Corp.
Eaton Electrical
Gannett Fleming
HalTech
Here
Hydro One
L-3 Communications – Aviation Products
Lake Harbour Co. Ltd.
Mass Fidelity
Microsoft
NPO PM Training
ON Semiconductor
Quantum5X Systems Inc.
Research Innovation Commercialization (ric)
S2E Technologies
Samsung
Siemens
Sonos
Structured Silicon
Town of Oakville

Memorandums of Understanding:
ABB Inc.
Hatch
Siemens Canada

March 29, 2016

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

Thanks for providing me with an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario. I am glad to offer this letter of endorsement for this program.

Due to rapid evaluation of technology in our daily life, it is becoming important for future work force to be training in multiple disciplines. I believe that the courses in the program demonstrate how graduates would be prepared with such multi-disciplinary knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for future entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. Altair is always looking for well-trained students in multiple disciplines and the proposed program, in my personal opinion will train such students.

I wish great success of this program, and look forward to working with Sheridan in future.

Sincerely,

C. J. Reddy

Digitally signed by C.J.Reddy
DN: cn=C.J.Reddy, o=Altair Engineering, Inc., ou=Altair - Virginia, email=cjreddy@altair.com, c=US
Date: 2016.03.29 09:58:32 -04'00'

Dr. C. J. Reddy, ***Fellow ACES*** | Vice President Business Development-Electromagnetics, Americas
P 757-224 0548x402
cjreddy@altair.com | altair.com
www.altairhyperworks.com/FEKO
Altair
Innovation Intelligence®

Oliver Wang
Co-founder and CEO
ApoSys Technologies Inc.
2423 Delkus Cres
Mississauga, ON L5A1K8

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Support for the Baccalaureate Degree program in Electrical Engineering

Dear Dr. Rayegani,

I am delighted to write this letter of support for the bachelor program of electrical engineering in Sheridan College. I believe that it embodies some of the best principles of higher education after I review the program structure and philosophy.

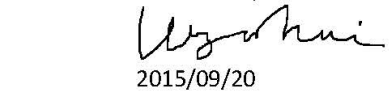
Recently I have chance to collaborate with Electrical Engineering Department in Sheridan College to develop a new concept contactless laser distance measurer. I was very impressed by your program, faculties and facilities and your ambition to make a better engineering education program. A unique designed engineering program will serve better not only the students but also the community of industry, furthermore the future of Canada.

From the introduction of program, the courses are very structured for practical purpose so I believe the graduate student from those programs will be able to adapt into the requirement of real world. The project based CDIO framework will provide students in multiple skill set to become a real world engineer including fundamental knowledges, basic analysis skills and creative thinking capabilities. The undergraduate level education is the major part of workforce in engineering environment so your focus on undergraduate will be able to provide the best education toward student in the field compared with other universities. As well the intra-program design is very brave move from traditional program. I really want to see how those programs will impact innovation of the industry in next few years. Overall I do trust your capabilities and efforts to bring this program to the industry successfully.

I hope that your new program will grow and help industry grow and flourish as well. I know that this brave and innovative move will derive many stories of success in persons such as students, in companies such as us, and in communities such as Ontario economy.

Sincerely,

Oliver Wang



2015/09/20

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I have reviewed the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options that has been proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario. I am pleased to offer my personal endorsement of your planned program.

I believe that a student-centered approach to education, focused on areas of expected growth in industry needs, should serve both students and industry quite well. The curriculum appears to be developed for providing a foundation in electrical engineering, along with specialization in Mechatronics or Power & Energy Systems. As the industry demands grow for entry level engineers in these fields, the proposed program should make a positive impact on the Canadian economy.

Additionally, the interdisciplinary collaboration with the mechanical engineering program offers a chance to produce a better class of engineering graduates, who can more thoroughly understand the role of electrical engineering solutions within larger projects. This can be an important differentiator for Sheridan College. I applaud your efforts to develop a balanced and industry-relevant engineering program.

Sincerely,

Kelce S. Wilson
Senior Technical Director of Litigation at BlackBerry

Cerebral Diagnostics Canada Inc.
690 Queen Street East, Toronto, ON M4M 1G9

September 22, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I reviewed the April 2015 document entitled "Sheridan Bachelor of Engineering, Proposal summary for the School of Mechanical and Electrical Engeneering & Technology. This outlines a plan for a baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options.

I am pleased to lend my voice in support of this plan. I have been collaborating with Sheridan for the last six months and so I have some knowledge of how things function there.

I'm very cognisent of the need for new companies like ours to get the kind of support that is available through Sheridan. I'm also pleased to know that the program includes a mandatory form of internship and a 18 month co-op work term. I believe that industry is well positioned to help institutions like Sheridan and its students understand where the cutting edge is and where the future growth opportunities are. For example, we came to Sheridan with ideas for projects to make an affordable 3D real time, mobile brain imaging system. Alone, given our current resources we couldn't pull of such a project. But now with help from Sheridan, the project is in progress and going well. We are especially thankful to Professor Weijing Ma who is our principle contact there.

The proposed courses seem appropiate to position a new generation of students to advance technology in Ontario. I can't say too much about the utilities stream in their curriculum but I do have a few things to say about their planed target to advance manufacturing in Ontario. What I have seen is an outstanding laboratory that is ideal for the prototyping and design of new products for manufacture. I think we can shift manufacturing back to Ontario over the next 10 years because new companies that are strong in ideas but weak on capital can get up and running if they have access to expertise and facilities such as those at Sheridan. Laser cutting, 3D printing, new scanning technologies and many others are key components in the startup process. Through programs like this and with careful planning of projects to ensure that a balance is reached to meet the needs of both students and industry, I see this new degree program advancing manufacturing in Ontario.

I therefore support this effort whole-heartedly.

Sincerely,

Dr. Mark Doidge
President and Founder

BRAMPTON
brampton.ca Flower City

Office of the COO
Economic Development and Tourism

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

The City of Brampton's Economic Development Office fully supports this direction and is looking forward to seeing our 9th largest and youngest City of Canada's growing needs be fulfilled in this space through Sheridan's new initiative.

I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,

Sohail Saeed
Director
Economic Development and Tourism
The City of Brampton

The Corporation of The City of Brampton
2 Wellington Street West, Brampton, ON L6Y 4R2 311

COGNITIVE SYSTEMS CORP.
560 Westmount Rd. N
Waterloo, ON
Canada N2L 0A9
519-514-3109
cognitivesystems.com

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Liviu George
Principal Researcher
Cognitive Systems Corporation

Electrical Canadian Operations
Eaton Industries (Canada) Company
5050 Mainway
Burlington, Ontario
L7L 5Z1

Date: June 26, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation. I am equally pleased to see that you are incorporating work terms into the program. This is an essential part of graduating students who are ready to work and contribute immediately upon graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, and power systems sectors.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Wm. Keith Jones, P.Eng.
Operational Excellence Manager - Canada
Eaton Electrical Sector, Canadian Operations

Gannett Fleming

Excellence Delivered As Promised

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

After review the plans for the baccalaureate degree program in Electrical Engineering, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, I am pleased to offer this letter of endorsement.

I believe that the curriculum provided in this program supports the essential needs of graduates' knowledge and skills for the degree-level standard of similar programs, and the need of industry for entry level of engineers. I believe the proposed program provides the solid foundation for Electrical Engineering which is transferable to different industries. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Considering the huge amount of investment in transportation in next few year, particularly transit and rail, the need for young engineers to join the work force in this industry in enormous.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Alireza Edraki, MASc, PEng, PMP | Vice President Canadian Operations
Gannett Fleming Transit and Rail Systems | 4211 Yonge St, Unit 600| Toronto, ON, M2P 2A6
Tel: 416-512-6499| Cell: 647-518-6077|E-mail: aedraki@gfnet.com| |www.gftransitrail.com

Excellence Delivered As Promised

Gannett Fleming 100

Gannett Fleming is ISO 9001:2008 Certified

HalTech

Halton's Regional Innovation Centre

November 15, 2015.

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

RE: Sheridan College Institute of Technology and Advanced Learning proposal to establish Bacchalaurate program in Electrical Engineering with Mechatronics and Power & Energy Systems options.

Dear Dr. Rayegani,

On behalf of HalTech Regional Innovation Centre, I am pleased to provide you with this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario. Our team of experienced industrial engineers and entrepreneurs-in-residence have reviewed the proposed program, and we believe that the courses aptly prepare graduates with the theoretical knowledge and essential skills of a degree-level Baccalaureate program. Moreover, we feel that the hands-on experiential learning that the students will obtain in the proposed program will help them become productive contributors for the companies who hire them, and thereby help these companies compete globally.

As Halton's region centre for technology innovation and entrepreneurship, HalTech helps technology companies to collaborate, accelerate and scale-up their innovations into viable and growing businesses that will directly benefit our regional economy. We do this by providing free business advisory services and training workshops in entrepreneurship and technology commercialization to qualifying startups and SMEs. HalTech focuses on developing startups in the technology areas of Advanced Manufacturing and ICT, which has direct connection to the Electrical Engineering programs proposed by the Sheridan College. Many of these startups require technical expertise, access to specialized equipment and skilled engineers and technologists who can help these companies accelerate their path to market. There are several large corporate companies in Halton Region which can potentially provide valuable internship

1430 Trafalgar Road, Sheldon Levy Building - Room J103H, Oakville, ON L6H 2L1
905-845-9430 ext.2762 • info@haltech.ca

HalTech

Halton's Regional Innovation Centre

and future employment prospects to graduates of this Electrical Engineering program, such as Siemens, Evertz Microsystesm, L3 Wescam, Semtech and others. For Sheridan's graduates who are interested in entrepreneurship, HalTech is an excellent resource with free advisory services that can help them get a business started, with mentoring available from HalTech's Entrepreneurs-in-Residence.

We are pleased to know that Sheridan College Institute of Technology and Advanced Learning is seeking to launch the new Electrical Engineering Baccalaurate degree program, which together with their applied research and innovation programs, will enable the college to transition well into an accredited Ontario university. We see huge potential for the proposed degree program to prepare the next-generation of engineering technology graduates that will help build successful and growing companies in Ontario.

Sincerely,

Rina Carlini, PhD
CEO and President, HalTech Regional Innovation Centre

1430 Trafalgar Road, Sheldon Levy Building - Room J103H, Oakville, ON L6H 2L1
905-845-9430 ext.2762 • info@haltech.ca

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

After reviewing the Electrical Engineering Bachelor Degree Program proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, I have decided to offer this letter of support.

The proposed program offers specialization in two very important areas of technologies such as Power and Energy System and Mechatronics and applies Conceiving - Designing - Implementing - Operating (CDIO) approach that minimizes the gap between theoretical education and technology practices. Program will provide students with the real world experience via offering internships and up to 16-week co-op industry term. Students will be able to focus on specific areas of interest in the field such as engineering design, digital control systems and manufacturing maintenance.

In my opinion the program courses are comprehensive and well balanced. Chemistry, physics and curricula in mathematics comprising Linear Algebra, Calculus and Integral Calculus, Differential Equations, Numerical Methods, and Statistics and Quality should build strong theoretical foundation. All special courses in Software and Hardware Engineering, Circuits and Devices, Signals and Systems will help graduates to quickly adapt to the fast changing technologies.

I trust that students will appreciate your EE program and will easily find jobs after graduation due to strong industry demand in such type of specialists.

I wish you and your faculty success with your new program.

Best regards,

Arnold Sheynman, Ph.D.
Senior Engineering Manager,
Traffic and Dynamic Content
HERE

hydro one

July 24, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Andrew Yan

Andrew Yan PhD, P. Eng.,
Manager, Special Studies,
Reliability Studies, Strategies & Compliance
Hydro One Networks Inc.

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors.

I wish you the best of luck in this program.

Sincerely,

Dan Tocila
Sr. Principal Hardware Engineer
L-3 Communications – Aviation Products

LAKE HARBOUR CO. LTD

ENGINEERING, TRADING & CONSULTING

June 18, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: **Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.**

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I have 23+ years of engineering management experience in consumer packaged goods and automotive industries. I have witnessed the dramatic growth of the mechatronics and the Internet of Things. There are also a shortage of practicing engineers in this new fields. The industry is in desperate needs for graduates with proper combinations of hard technical skills and soft skills in communications and entrepreneurship. I do believe your program will be very successful in providing new skilled labor in those fields.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Matthew Xie, P.Eng, MBA
General Manager

7271 Warden Avenue, Markham, Ontario, L3R 5X5 Canada

Tel: (416)-917-5688 www.lakeharbourcanada.com

May 6, 2016
massFIDELITY

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

massFIDELITY
Joe Caci
Chief Technology Officer

519.404.5972
jcaci@massfidelity.com

Letter of support for industry:

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Name: Jari van Wonterghem
Title: Sr Engineer, Antennas
Division: Mobile Phones
Institution: Microsoft ltd

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

Having worked in various parts of the electronics engineering industry for 30 years, I have noticed that the ability of students to contribute to the work of the company varies tremendously. In a four month work-term, a typical student is productive for not much more than half that time. That is obviously a tremendous waste. So, I am particularly pleased to see a degree program specifically designed to produce young engineers who are not just theoretically strong, but ready to start their professional careers already armed with skills that are typically left to industry to develop. For smaller companies, that is a burden which is usually quite hard to shoulder.

The CDIO framework is an excellent innovation in the development of undergraduate training and I was pleased to see a Canadian institution embrace the principles of CDIO in a well developed format. The educational format certainly covers the intellectual components needed by modern engineers and I am sure that the mechatronics and power industries will welcome the program. I was pleased to see also the strong connection to those industries as part of the program structure. The inclusion of the element of Project Management principles is very important given the multi-disciplinary, multi-team nature of many modern projects.

I applaud the efforts of Sheridan College to pursue the development of not just another "me too" degree-level program, but rather a well-balanced, modern and industry-relevant engineering program. Canada and Canadian companies need to innovate and delivering a cadre of young engineers who step into industry well prepared to bring the best of modern engineering practice will be an invaluable contribution.

I wish you the best of luck in this program, and am confident that your bold initiative will be a significant positive development for Sheridan and tremendous boon to many Canadian engineering companies.

Sincerely,

Paul Astell BSc MSc
Co-President, NPO PM Training.org

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as effective engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially for us in our "Hardware and Systems" development teams, where we build miniature electronic systems for medical electronics. I will be very much interested in offering internship opportunities for the students and potentially, hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Gareth Weale

Product Marketing Manager
Medical and RF BU
ON Semiconductor
200-611 Kumpf Dr.
Waterloo, ON

ON Semiconductor :: 200-611 Kumpf Drive Waterloo, Ontario, Canada N2V 1K8 :: **www.onsemi.com**

QUANTUM5X™ SYSTEMS INC.
30 Adelaide Street North
London Ontario Canada N6B 3N5

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program. I strongly encourage you to make the 2nd internship stage mandatory or at least strongly encourage your students to participate. I believe the internship / coop portion of your program will be very important to your students' success.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Dr. Chris DeVries
CTO – Chief Technical Officer
Quantum 5X Systems Inc. (q5x.com)

Research Innovation Commercialization
CENTRE

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Nov 9, 2015

Subject: Support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario

Dear Dr. Rayegani,

It is with pleasure that I provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have reviewed the proposed program and believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & Energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

Based on the program overview graduating students will be equipped with not only technical competencies but also the social skills essential to deal with current industrial challenges. Strong social competencies including teamwork and communication will be a strong asset in the entrepreneurial ecosystem.

I thank you for the opportunity to review your program, and wish you all the best.

Sincerely,

Pam Banks
Executive Director, RIC Centre

2660 Speakman Drive, Mississauga, ON L5K 2L1 t: 289-373-3050 www.riccentre.com

s2e technologies
1440-2 King Street North P.O. Box 547 St. Jacobs, ON, N0B 2N0 Canadá
+ 1 (519) 664-3636 + 1 (519) 644-0440

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Rodolfo Benavides
Director IoT
S2e Technologies

SAMSUNG SEMICONDUCTOR, INC.
3655 North First Street
San Jose, CA 95134-1713
Tel: (408) 544-4000 Fax: (408) 544-4980

May 1, 2016

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

I believe that the courses in the program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard of similar degree programs, and the need of industry for entry level of engineers. I believe the program provides the solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics or Power & energy Systems field. I am also convinced that the balance of theoretical study and engineering practices is very well considered by adopting CDIO framework in the program, which can prepare the students for their professional career as engineers after graduation.

I applaud your efforts to bring this well-balanced and industry-relevant engineering program forward, and I believe it will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the gap existing and positions badly needed in our industry, especially in manufacturing, energy, and power systems sectors. I will be very much interested in offering internship opportunities for the students and hiring the future graduates of the proposed program.

I wish you the best of luck in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Amin Mobasher

Amin Mobasher,
Wireless Architecture Lead, Sr Staff,
Samsung Display Lab,
Samsung Semiconductor Inc.

SIEMENS

Date: October 29th, 2015

To: Farzad Rayegani, Ph.D., P.Eng.

Associate Dean, Professor,
School of Mechanical and Electrical Engineering & Technology
Director, Centre for Advanced Manufacturing and Design Technologies (CAMDT)
Sheridan College Institute of Technology and Advanced Learning in Ontario

Reference:

Sheridan College Institute of Technology and Advanced Learning in Ontario.
Baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options.

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and I am pleased to offer this letter of support.

I believe that the courses included in this program demonstrate how graduates would be prepared with the knowledge and skills appropriate for the degree-level standard programs, and satisfy the need of industry for entry level engineers. In my opinion, the program provides a solid foundation for Electrical Engineering while preparing the students for specialization in Mechatronics and /or Power & energy Systems. I also think that the balance of theoretical study and engineering practices are well considered by adopting CDIO framework in the program, to prepare the students for their engineering career requirements after graduation.

This well-balanced, industry-relevant engineering program will make a great contribution to the successful growth of Canadian innovation. The graduates from this program can fill the existing gap and positions needed in our industry, especially in manufacturing, energy, and power systems sectors.

I wish you all the best in this program, and look forward to our further engagement with Sheridan.

Sincerely,

Dr. Tom Murad, P.Eng., Ph.D. FEC

Head of Siemens Canada Engineering
& Technology Academy
Tel: 647-960-0469
Email: Thamir.murad@siemens.com

Letter of Support for Baccalaureate Program

3/22/2016

Kasra Payan

SONOS

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

It is with great pleasure that I offer this letter of endorsement for the above mentioned program proposal at Sheridan College Institute of Technology and Advanced Learning in Ontario.

I have spent several years at the intersection of academia and industry; as an intern, as an industry researcher who overlooked collaborative projects with multiple universities, and as a reviewer for several journal publications. I have personally witnessed a skills gap between graduates and industry needs. In the past couple of years, the industry has demonstrated its concern about this lack of job-ready graduates through expanding their interns-for-hire programs. I strongly believe it is time for academia to play a bigger role in shrinking this gap by introducing more undergraduate-focused programs similar to the ones proposed by Sheridan College Institute of Technology and Advanced Learning.

The rapid expansion of engineering science has made it difficult for the generic undergraduate program to incorporate a wide range of scientific syllabus and yet be able to provide its licensees with relevant engineering practice. I believe that the above mentioned focused programs provide a nice balanced of theoretical study and engineering practice, preparing their graduates for the specialized fields of Mechatronics or Power & energy Systems. I am also convinced that these two fields are highly demanded by Canadian and global industries.

The proposed program is soundly planned and I believe that the CDIO framework is an excellent choice for training entry level engineers. I am most excited about the innovative project-based BUS structure of the proposed programs. I really enjoyed the BUS structure examples provided in the proposal and look forward to learning more about such novel project-based courses.

I wish you and your colleagues the best of luck in this program.

Sincerely,

Kasra Payandehjoo, Ph.D. ECE
Senior Antenna Engineer
SONOS
2 Avenue De Lafayette

5th May 2016

Structured Silicon Inc.
Jens Kristian Poulsen
505 Landgren Crt
N2A 4J8, Kitchener, ON

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Rd.
Brampton, ON L6Y 5H9

Subject: Letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario.

Dear Dr. Rayegani,

I had an opportunity to review the plans for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options, proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario, and am pleased to offer this letter of endorsement.

Mechatronics offers the ability to bridge, if not close the gap between the mechanical, electronic and programming fields, thereby providing an ability to solve real-life problems. Furthermore, Ontario has a strong history in manufacturing, tool and die making to which this program may offer new angles. The Power and Energy program seems well suited to educate new candidates to a sector that has had a larger outflow than inflow the past couple of years and with many people set to retire in the near couple of years, the program seems to be coming at the right time.

The program seems to have a strong foundation in the theoretical studies, which is necessary for R&D and there is included the adopting CDIO framework in the program, to prepare the students for their professional career as engineers after graduation. I believe the program fills a gap in the need for further education in the technical field in Ontario.

We may all have our own ideas of the ideal program structure and there will likely be as many opinions as there are reviewers. However, given this opportunity, I will point out a few additions to the program that might make an impact to the better.

First of all, it is suggested to include a course on 3D printing in the mechatronics program or include this subject as part of one or more of the courses. This can enforce mechanical and 3D design concepts and serve as an appetizer for the entire field by providing immediate and tangible results. By using a 3D SLA printer accurate design models can quickly be made. This may enable the students at an early stage in their program to experiment and see immediate results of their efforts, which may facilitate learning and improve motivation. The concepts are simple so this can be introduced as early as 2nd or 3rd

semester. Notice, it cannot be recommended to use the fused material 3D printers that are very common these days, because of the much lower quality of the finished products.

Secondly, it is rare to see real MEMS systems without an ASIC, because these micromechanical systems normally need to be driven or provide an output in some way. Therefore, most MEMS systems will require an ASIC (which could be as simple as a single transistor) in order to function. The complexity of such a course could be kept to the entry level similar to "Physical Design of Integrated Circuits using L-EDIT", or be part of the MEMS course. Notice, "L-EDIT" by Tanner/Mentor is typically used for MEMS design.

Thirdly, Power & Energy projects might include FPGA boards, because this may enable the implementation of complex systems in real time at a low cost and encourage experimentation. While an analytical approach is often preferable in cases where an exact solution is available or can be obtained, this is often not the case with complex real world systems. In these cases, numerical simulations are needed. The Power and Energy path might include an introduction to Simulink as an introduction to system level simulations of complex interacting parts or alternatively use Verilog-A/ VHDL-AMS.

I wish you the all best with this program, and look forward to further engagement with Sheridan.

Sincerely,

MScEE, PhD, Jens Kristian Poulsen,
Director, Structured Silicon Inc.

OAKVILLE

November 25, 2015

Farzad Rayegani, Ph.D. P.Eng. FEC
Associate Dean, Professor
School of Mechanical and Electrical Engineering and Technology
Sheridan College Institute of Technology and Advanced Learning
7899 McLaughlin Road
Brampton, ON L6Y 5H9

Dear Dr. Rayegani:

Re: Letter of Support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options proposed by Sheridan College Institute of Technology and Advanced Learning in Ontario

The Town of Oakville is a strong supporter of Sheridan College and the important place it has in our community as both a place of learning for thousands of students and as a major employer. It is my pleasure to provide this letter of support for the baccalaureate degree program in Electrical Engineering with Mechatronics and Power & Energy Systems options.

The proposed program offers a balanced approach that incorporates the key elements to meet the needs of industry including academic learning, hands-on practical experience, project management and team-work skills. As a graduate from a co-op MBA program and presently a local employer, I can personally attest to the value that the intern and co-op aspects of this program will provide to students and to industry. This type of learning will help to bridge the gap between academic learning and the real world industry into which they will transition.

Sheridan's commitment to excellence in engineering aligns well with the Town's economic development strategy which seeks to attract and retain knowledge-based industries. Oakville has a very large concentration of engineering and advanced manufacturing companies including Siemens Canada, Ford Canada, Hatch and SNC Lavalin that will be able to draw on the knowledge and expertise developed through the proposed Electrical Engineering program at Sheridan.

...2

Town of Oakville | 1225 Trafalgar Road, Oakville, Ontario L6H 0H3 | 905-845-6601 | www.oakville.ca

OAKVILLE

I wish you much success with this new program and look forward communicating its existence to our local business community.

Sincerely,

Dorothy St. George, BA, MBA, EcD
Director
Economic Development Department
Town of Oakville

Sheridan | Get Creative

GIFT AGREEMENT
Between

ABB INC
(the "Donor")

&

SHERIDAN COLLEGE
("Sheridan")

i. THE GIFT

The Donor has generously made a gift in-kind pledge valued at 185,000 CDN (the "Gift") to Sheridan. This pledge will be fulfilled in the form of a fully equipped ABB training system, including 6 robotic stations, to be installed in Sheridan's CAMDT lab no later than May 1, 2014, assuming the lab is in a ready state to receive the entire system. The terms and conditions of the transfer of the equipment are identified in the Equipment Transfer Agreement attached as an Appendix to this Gift Agreement.

The Donor may install the equipment at another date in advance of the above date in order to fulfill the pledge assuming Sheridan's readiness to receive the entire system.

Sheridan shall be responsible for the management of the Gift in accordance with Sheridan policies and practice, as applicable, in the advancement office.

Any obligations contained herein on the part of Sheridan shall cease in the event of any default by the Donor to provide the Gift or any portion thereof or if Sheridan chooses to cease to perform its obligations as set out below in the section entitled "Recognition".

The Donor shall be solely responsible for any and all tax treatment and/or liability as a result of the Gift.

ii. PURPOSE

The purpose of the Gift is to support students, faculty and industry associated with the School of Mechanical and Electrical Engineering at Sheridan. ABB hopes that by providing this training system, they will be able to attract Sheridan students to become employees who have specialized knowledge of robotics through co-operative education programs and internships arranged in collaboration with the Faculty of Science and Technology.

Both the Donor and Sheridan agree that the Gift does not and shall not, in any way, compromise Sheridan's Mission and Values or contravene any policy of Sheridan, or reflect negatively on its public image.

The parties acknowledge that this agreement constitutes a donor relationship that is not intended to produce liability for the Donor arising from the equipment or any activities, work or services at Sheridan related to the Purpose set out above. Sheridan agrees to indemnify and save the Donor harmless from any and all claims, causes of action, suits, proceedings, and costs including, without limitations, any claims which may be made by any third party, which may arise in any way from any alleged accident, injury or damage on the part of Sheridan, its agents or employees in connection with the Purpose set out above.

Sheridan | Get Creative

iii. RECOGNITION

The Donor shall receive recognition in the form of a plaque to be placed at Sheridan's Davis Campus in an area to be determined in consultation between the organizations, but which shall be in Sheridan's ultimate sole discretion.

The Donor hereby consents to the use of the name of ABB to be displayed prominently in appropriate location at Sheridan. The name may also appear in other relevant materials distributed by Sheridan, including but not limited to print, website and other recognition vehicles, which shall be determined by Sheridan in its sole discretion.

In the event of a change of function, or significant renovation/reconstruction of area designated in association with the Donor, Sheridan shall have the option of renaming the area and the Donor shall be given the first opportunity to rename the named area at a set rate, to be determined by Sheridan in its sole discretion. If the Donor chooses not to participate in the renaming of the space, the contribution of the Donor will be recognized in another location at Sheridan to be agreed upon by the parties acting reasonably having regard to Sheridan's established relative donor recognition practice.

Sheridan shall retain the right in its sole discretion to discontinue its association publicly with the Donor, including but not limited to removal of any plaques or recognition, in the event there is any anticipated, perceived and/or actual negative impact on Sheridan's image and/or reputation as a result of the Gift or association with the Donor.

iii. COMMUNICATION & DONOR RELATIONS

Additional communication activities that the Donor will receive in recognition of this Gift include:

- Public announcement of the donation at the plaque unveiling ceremony
- Recognition on the Donor Wall system at Sheridan
- Acknowledgement in Sheridan's Donor Report
- Acknowledgement in *Ovation*, Sheridan Alumni magazine or feature in the Sheridan Alumni Bulletin
- Invitations to donor recognition and other events hosted by Sheridan

No initial public announcement concerning this Agreement or the participation of the Donor or Sheridan shall be made without the prior consent and collective approval of the Donor and Sheridan. Thereafter, the above communication activities will be executed by Sheridan.

_____	_____
Casey DiBattista General Manager, Robotics ABB Inc	Lisa E. Piccolo, MPA VP of Advancement & External Relations The Sheridan College Institute of Technology and Advanced Learning
_____ Date	_____ Date

Sheridan | Get Creative

Appendix A - EQUIPMENT TRANSFER AGREEMENT

In consideration of the mutual covenants contained herein and with the intention of being legally bound under the laws of the province of Ontario, the parties agree as follows:

1. The Parties to this Agreement are: ABB Inc., 201 Westcreek Blvd, Brampton, Ontario L6T 5S6 (herein referred to as "DONOR") and The Sheridan College Institute of Advanced Learning and Technology, 1430 Trafalgar Road, Oakville, ON L6H 2L1 (herein referred to as "RECIPIENT")
2. The EQUIPMENT covered by this Agreement is defined as and includes the following: a fully equipped ABB training system, including 6 robotic stations.
3. The DONOR is providing the RECIPIENT with an indefinite long term unrestricted loan of the EQUIPMENT but the DONOR retains ownership of the EQUIPMENT. The DONOR agrees to deliver the EQUIPMENT at its cost to the RECIPIENT. The RECIPIENT reserves the right to request the DONOR to remove the equipment by providing written notice and providing a minimum of 30 days for removal. Similarly the DONOR may remove the equipment at its sole discretion by giving the RECIPIENT at least 30 days written notice of its intent to remove the equipment. In all cases, the cost of the removal of the equipment will be borne by the DONOR. The DONOR agrees not to remove the equipment during a semester where the equipment is being used by the RECIPIENT.
4. The RECIPIENT agrees to provide a suitable space dedicated and capable of supporting and sustaining the operation of the EQUIPMENT.
5. The DONOR agrees to provide regular maintenance and support of the system with the expectation that the equipment will be monitored and in good care by RECIPIENT staff and faculty.
6. The DONOR agrees to upgrade the equipment at no cost to the RECIPIENT to maintain currency with manufacturing standards. RECIPIENT reserves the right to request an upgrade of the equipment but this will be at the sole discretion of the DONOR
7. The RECIPIENT agrees to purchase and provide the necessary equipment to ensure the safety of students, faculty and staff using the EQUIPMENT.
8. The DONOR agrees that the RECIPIENT has the right to allow access to the EQUIPMENT to individuals and groups at the discretion of the RECIPIENT and without approval of the DONOR.
9. The RECIPIENT agrees to allow the DONOR to bring prospective customers to view the EQUIPMENT and its operation including potential training sessions on the EQUIOMENT provided that sufficient notice is provided to the Director of CAMDT.
10. This Agreement and the resulting transfer of the EQUIPMENT constitute a restricted license for the RECIPIENT to use the EQUIPMENT solely for teaching, educational and applied research purposes. The EQUIPMENT will not be used for any Purpose inconsistent with this Agreement. Commercial use of the EQUIPMENT is strictly prohibited. Nothing in this Agreement grants the RECIPIENT any additional rights, either expressed or implied to DONOR patents, trademarks, copyrights, know-how or other intellectual property. The RECIPIENT agrees that it will not attempt in way to reverse engineer the EQUIPMENT.
11. This Agreement shall be governed by the Laws of Ontario

MEMORANDUM OF UNDERSTANDING BETWEEN

HATCH LTD ("Hatch")
AND
The SHERIDAN COLLEGE INSTITUTE OF TECHNOLOGY AND ADVANCED LEARNING ("SHERIDAN")

September 22nd, 2015

Memorandum of Understanding between Hatch Limited ("Hatch") and The Sheridan College Institute of Technology and Advanced Learning ("Sheridan") individually referred to as a "Party" and collectively as the "Parties"

Whereas:

Hatch and its affiliated companies are major employers within Canada, providing critical high skilled jobs in the areas of engineering, consulting, research, process development, and project and construction management to the Mining, Metallurgical, Energy and Infrastructure sectors. In conjunction with its strong global position, resources and robust portfolio in advanced manufacturing, Hatch seeks to foster education and innovation in this emerging business segment, with a focus on managing and optimizing production, executing projects that involve the scale-up of process technologies, and managing startups, commissioning and ramp-ups.

Sheridan is a publically funded Ontario college and a leader in the areas of Technology and Applied Research serving communities in the Oakville, Brampton and Mississauga areas. Sheridan recognizes that enhancing collaborations with key private sector partners enhances a quality educational experience for its students and creates a path-way to pursue rich and rewarding careers.

Hatch has recognized the extensive technical and professional expertise, know-how, and research and training facilities of Sheridan, which is the reason why Hatch and Sheridan executed a Master Collaborative Research and Contribution Agreement on June 23, 2015. However, Hatch now wishes to investigate other opportunities for new collaborations with Sheridan which would enhance the excellent educational opportunities available to Sheridan students, and enable Hatch to participate in the training of tomorrow's skilled workforce, foster future innovation, and create additional economic activity within Canada.

Hatch and Sheridan each recognize the extraordinary challenges facing the global and Canadian economies and the forces behind these challenges, including demographics, urbanization, climate change and the drive for sustainable economies and cities – challenges to which Hatch's expertise and product portfolio, as well as Sheridan's applied educational offerings, are ideally and uniquely suited. The Parties also recognize that effective responses to these challenges will greatly depend on the development and deployment of innovative technologies by a skilled and well-trained workforce.

Sheridan and Hatch agree that:

1. Hatch and Sheridan will work towards strengthening their relationship and establishing a framework of cooperation intended to enhance the educational curriculum, training programs, and applied research initiatives at Sheridan. This cooperation shall aim to promote the educational and employment opportunities available to Sheridan graduates and to ensure that Hatch and other leaders in Canada's high-tech economy have access to a world-class, highly skilled workforce that supports innovation and economic growth. This Memorandum of Understanding ("MOU") outlines that framework.

2. Hatch and Sheridan will explore opportunities for Hatch's engagement with Sheridan students through the establishment of internships, apprenticeships, and/or co-operative programs, as well as explore the possibility of making available international assignments with Hatch for Sheridan students on a selective basis.

3. Hatch and Sheridan will discuss ways in which Hatch can participate in Program Advisory Committees (PACs) and other educational events and initiatives where Hatch is able to provide important contributions to such bodies or activities. As a member of PACs, Hatch can lend its expertise and know-how to Sheridan in the form of guest lecturers, technical workshops, and advice related to curriculum development.

4. Hatch and Sheridan shall discuss initiatives to promote and build community and cultural awareness of the value of technical and manufacturing careers, with particular focus on the critical importance of the STEM disciplines – Science, Technology, Engineering and Math – in developing innovative ways to turn current challenges into opportunities to build sustainable economies and cities for the 21st century.

5. Hatch and Sheridan shall discuss ways in which each can promote and raise awareness of the programs and activities contemplated under this MOU. This shall include discussions between the Parties to find ways to support the efforts of either of the Parties to obtain sources of public and private funding for programs which further the objectives or activities outlined in this MOU.

6. Any public announcement related to this MOU, related discussions, any business relationship or any transaction contemplated by the Parties in relation to this MOU shall be the subject of further agreement by both Parties, and shall only be made at times acceptable to both Parties.

7. The Parties will each appoint an executive who shall be responsible for the implementation and on-going administration of this MOU, whose name shall be communicated to the other Party.

8. This MOU is not intended to effect any change or alteration in ownership and rights of the Parties respecting any intellectual property that each may own, and all matters relating to the rights of the Parties to any intellectual property will be as specified in any agreements the Parties may conclude in respect of such collaborative projects.

9. The term of this MOU shall be for a period of three (3) years from the date of execution, which may be terminated upon thirty (30) days written notice to the attention of the executive appointed for the other party, as set out in paragraph 7 herein.

10. This MOU shall be governed by the laws of the Province of Ontario.

This MOU expresses the intent of the two Parties to enter into discussions with respect to the activities mentioned above. However, the Parties agree that nothing in this MOU will give rise to any legally binding or enforceable obligation, liability or agreement on the part of either Party. Nothing in this MOU is intended to imply or create a legal partnership or any other relationship between the Parties.

Dated this 22nd day of September, 2015.

Jeff Zabudsky, Ph.D. President and CEO Sheridan College Institute of Technology and Advanced Learning	Bruce MacKay Managing Director Hatch Limited

SIEMENS

MEMORANDUM OF UNDERSTANDING BETWEEN

SIEMENS CANADA LIMITED (“Siemens”)
AND
The SHERIDAN COLLEGE INSTITUTE OF TECHNOLOGY AND ADVANCED LEARNING (“SHERIDAN”)

February 13th, 2015

Memorandum of Understanding between Siemens Canada Limited ("Siemens") and The Sheridan College Institute of technology and Advanced Learning (“Sheridan”) individually referred to as a "Party" and collectively as the "Parties"

Whereas:

Siemens and its affiliated companies are major employers within Canada, providing critical high skilled jobs in the areas of engineering, research, management, and state of the art manufacturing in electrification, automation and digitization. In conjunction with its strong global position, resources and robust portfolio in sustainable green technologies and advanced manufacturing, Siemens seeks to foster education and innovation in this emerging business segment, with a focus on renewable energy, energy conservation, and improved energy efficiency and industrial productivity.

Sheridan is a publically funded Ontario college and a leader in the areas of Technology and Applied Research serving communities in the Oakville, Brampton and Mississauga areas. Sheridan recognizes that enhancing collaborations with key private sector partners enhances a quality educational experience for its students as well as rich and rewarding careers.

Siemens recognizes the extensive technical and professional expertise, know-how, and research and training facilities of Sheridan, and wishes to investigate opportunities for new collaboration with Sheridan which would enhance the excellent educational opportunities available to Sheridan students, and enable Siemens to participate in the training of tomorrow’s skilled workforce, foster future innovation, and create additional economic activity within Canada.

Siemens and Sheridan each recognize the extraordinary challenges facing the global and Canadian economies and the forces behind these challenges, including demographics, urbanization, climate change and the drive for sustainable economies and cities – challenges to which Siemens’s expertise and product portfolio, as well as Sheridan’s applied educational offerings, are ideally and uniquely suited. The Parties also recognize that effective responses to these challenges will greatly depend on the development and deployment of innovative technologies by a skilled and well trained workforce.

SIEMENS

Sheridan and Siemens agree that:

1. Siemens and Sheridan will work towards strengthening their relationship and establishing a framework of cooperation intended to enhance the educational curriculum, training programs, and applied research initiatives at Sheridan. This cooperation shall aim to promote the educational and employment opportunities available to Sheridan graduates and to ensure that Siemens and other leaders in Canada's high-tech economy have access to a world-class, highly skilled workforce that supports innovation and economic growth. This Memorandum of Understanding ("MOU") outlines that framework.

2. Siemens and Sheridan shall discuss ways in which Siemens can participate in, and lend its expertise and know-how to, the curriculum at Sheridan in the form of guest lecturers, technical workshops and providing recommendations in respect of curriculum development at Sheridan.

3. Siemens and Sheridan shall collaborate with respect to the potential design of specific programs in which Sheridan faculty and students gain training, practical knowledge of, and experience with Siemens's portfolio of products, solutions and technologies.

4. Siemens and Sheridan will explore opportunities for Siemens's engagement with Sheridan students through the establishment of internships, apprenticeships, and/or co-operative programs, as well as explore the possibility of making available international assignments with Siemens for Sheridan students on a selective basis.

5. Siemens and Sheridan will discuss ways in which Siemens can participate in program advisory committees and other educational events and initiatives where Siemens is able to provide important contributions to such bodies or activities.

6. Siemens and Sheridan shall discuss innovative ways to establish "Siemens certification" training programs (such as Mechatronics and / or Smart systems) that meets the needs of Siemens and of Sheridan students. In so doing, Sheridan and Siemens will discuss potential joint strategies to encourage and facilitate government support for such training programs.

7. Siemens and Sheridan shall discuss initiatives to promote and build community and cultural awareness of the value of technical and manufacturing careers, with particular focus on the critical importance of the STEM disciplines – Science, Technology, Engineering and Math – in developing innovative ways to turn current challenges into opportunities to build sustainable economies and cities for the 21st century.

8. Siemens and Sheridan shall discuss ways in which each can promote and raise awareness of the programs and activities contemplated under this MOU. This shall include discussions between the Parties to find ways to support the efforts of either of the Parties to obtain sources of public and private funding for programs which further the objectives or activities outlined in this MOU.

9. Any public announcement related to this MOU, related discussions, any business relationship or any transaction contemplated by the Parties in relation to this MOU shall be the subject of further agreement by both Parties, and shall only be made at times acceptable to both Parties.

10. The Parties will each appoint an executive who shall be responsible for the implementation and ongoing administration of this MOU, whose name shall be communicated to the other Party.

11. This MOU is not intended to effect any change or alteration in ownership and rights of the Parties respecting any intellectual property that each may own, and all matters relating to the rights of the Parties to any intellectual property will be as specified in any subsequent agreements the Parties may conclude in respect of such collaborative projects.

SIEMENS

12. The term of this MOU shall be for a period of three (3) years from the date of execution, which may be terminated upon thirty (30) days written notice to the attention of the executive appointed for the other party, as set out in paragraph 10 herein.

13. This MOU shall be governed by the laws of the Province of Ontario.

This MOU expresses the intent of the two Parties to enter into discussions with respect to the activities mentioned above. However, the Parties agree that nothing in this MOU will give rise to any legally binding or enforceable obligation, liability or agreement on the part of either Party. Nothing in this MOU is intended to imply or create a legal partnership or any other relationship between the Parties.

Dated this 13th day of February, 2015.

Jeff Zabudsky, Ph.D. President and CEO Sheridan College Institute of Technology and Advanced Learning	Robert Hardt President and CEO Siemens Canada Limited

Section 8: Regulation and Accreditation Standard

The proposed Electrical Engineering program has been developed following the guidelines of the Canadian Engineering Accreditation Board (CEAB). We believe the curriculum meets the requirements of the Canadian Engineering Accreditation Board for accreditation. The proposed program has also received very strong support from the Professional Advisory Council, the members of which represent a cross-section of stakeholders in electrical engineering, specializing in the fields of Power Systems and Mechatronics. The formal accreditation assessment will occur in the fourth year of the delivery of the proposed program, in accordance with CEAB guidelines.

The licensing of Professional Engineers in Canada falls under the jurisdiction of each provincial engineering association, such as Professional Engineers of Ontario (PEO). Each provincial engineering association, in turn, is a member of the Canadian Council of Professional Engineers (CCPE). The CCPE establishes the guidelines for the professional status of university graduates in Canada through its Canadian Engineering Accreditation Board (CEAB), which reports to the CCPE council. All member associations, such as PEO, accept the decision of the CEAB with respect to the technical preparedness of university graduates, if the program from which they graduated is “accredited” by the CEAB. Accreditation covers a five-year period or less pending CEAB decision (e.g. upgrading of laboratories required). The provincial associations then add their practical experience requirement (typically four years post-graduation) before licensing an applicant as a Professional Engineer (P. Eng.).

Eligibility for Professional Engineering (P. Eng.) designation and accreditation by the Canadian Engineering Accreditation Board (CEAB) are important design specifications required to overcome any perceived differentiations between college and university credentials. The program development team has ensured that the program map and its learning outcomes are in resonance with academic requirements of both accrediting bodies. It is essential that these two accreditations position college and university degrees at the same level of achievement and recognition by both prospective graduates and employers alike.

Section 9: Nomenclature Standard

Electrical engineering is one of the original and most diverse branches of the traditional engineering disciplines. In Canada, the United States and Europe, the nomenclature commonly used to denote a four-year engineering degree is “Bachelor of Engineering,” or “B. Eng.” in short form. The program nomenclature “Bachelor of Engineering (Electrical Engineering)” is an accurate reflection of the degree level and the nature of the proposed degree program.

The curriculum for the proposed Bachelor of Engineering (Electrical Engineering) contains courses and learning outcomes that cover a number of subject categories identified by the Canadian Engineering Accreditation Board (CEAB) and has been designed to meet and exceed CEAB requirements in Mathematics, Basic Science, Engineering Sciences, Engineering Design, as well as Applied Research and Complementary Studies.

Section 10: Program Evaluation Standard

See electronic policy file for Sheridan's policy and procedure on program review.

Section 11: Academic Freedom and Integrity Standard

See electronic policy file for Sheridan's policy and procedure regarding academic integrity.

Section 12: Student Protection Standard

12.1 Student Protection Regarding Academic Calendar

All printed and online communications regarding program information are verified with the relevant college areas before publication/going live. The Office of the Registrar is vigilant in ensuring all information regarding the program name (MAESD approved), duration, credential, campus, code, intake date and admission requirements are accurate. The academic Faculties vet the program information, learning outcomes and career opportunities to confirm they are accurate, up-to-date and do not misrepresent a course, outcome or program in any way.

12.2 Student Awareness of Policies and Procedures

Every student who applies to Sheridan receives a Sheridan Access account and cannot proceed with their application unless they enter that Access account number online. The first screen that comes up when they enter that account is a notification requesting that the student read the linked policies. The student has access to all Sheridan policies and procedures from this page.

The student is asked to check off the box that indicates they have read, understood and agree to abide by Sheridan's policies. If they do not check off that box, the notification page appears every time they log in to that account and will not disappear until they have checked the box. Given this account is the student's access to check grades, view their timetable, and work with many course materials, they cannot avoid the policy notification. The student is also reminded on the screen that, if they do not check off the box, they are still bound by Sheridan's policies.

12.3 Resolution of Students' Academic Appeals, Complaints, Grievances, and/or Other Disputes

See electronic policy file for Sheridan's policy and procedure regarding academic appeals and consideration.

12.4 Student Dismissal

See electronic policy file for Sheridan's policy and procedure regarding student code of conduct.

12.5 Current Academic Calendar

https://www.sheridancollege.ca/academics/programs-and-courses.aspx

Section 13: Economic Need Standard

Sheridan College
Electrical Engineering Degree Program
Feasibility Study

Summary Report

January 2015

PREPARED BY:

Academica Group Inc.
London, ON

Introduction

Academica Group conducted this study on behalf of Sheridan to assist the institution in assessing the feasibility of a proposed bachelor's degree program in electrical engineering. The research had three primary objectives:

- Provide an overview of industry and labour market trends, potential opportunities, and employment prospects for potential graduates of a an electrical engineering program
- Measure levels of interest in pursuing Sheridan's proposed bachelor's degree in electrical engineering among prospective students
- Assess employer interest in and support for the proposed degree
- Understand the competitive environment in which Sheridan is considering the development of its new degree program, including college and university offerings, and explore pathway opportunities.

The research was conducted in three phases. The first phase was an environmental scan that included an industry overview, employment projections, and competitive program review. The second stage involved interviews with industry representatives. Finally, the third stage was an online survey of prospective students. This report brings together the research from each of the phases, summarizing the key findings. The research findings are organized into five sections: Industry and Labour Market Trends, Employment Outlook, Student Interest, Employer Interest, and Comparative Program Analysis.

Methodology

Secondary Research

Secondary research was conducted to obtain information on industry and labour market trends, employment outlooks, comparative program offerings, and pathway opportunities.

The industry and labour market trends provide a broad summary of the political, economic, social and technological trends affecting the industries that graduates of the proposed electrical engineering program would enter. Secondary research related to trends was obtained from government, industry association and sector council reports, as well as general labour market studies.

For the employment outlooks, several occupations were selected to explore as potential career pathways and both Canadian and US labour market information was consulted. Labour market information for each occupation is provided for Ontario, the Greater Toronto Area (GTA), and the United States (US). Unfortunately, national Canadian labour market projections are only available at the 3-digit NOC code level, meaning that the projections are for a wide range of occupations rather than the specific occupation of interest. Therefore, national projections are not provided. Provincial labour market projections were based on economic models developed by the Centre for Spatial

Economics. These projections extend to 2022, and were developed for 520 occupations identified by 4-digit NOC codes.

US labour market projections are taken from the Bureau of Labor Statistics (BLS). BLS projections are developed for the Standard Occupational Classification (SOC) system, in which all workers are classified into one of 840 detailed occupations according to their occupational definition. Projections are available to 2022.

The analysis of comparative programs and pathway opportunities sought to better understand the landscape in which Sheridan is considering developing its electrical engineering degree program. The focus was on comparable programs in Ontario, and the information presented is based on data gathered from publicly available sources, including the Association of Universities and Colleges of Canada and individual institutions' websites.

Industry Representative Interviews

Primary data on industry and employment trends as well as employer interest in the proposed program was obtained by conducting key informant interviews with industry representatives. A list of potential interviewees was created based on web searches and contacts provided by Sheridan. The regional focus was on the GTA, while the associations were national. In total, 50 individuals from a variety of organizations were invited by either email or phone to participate in an interview. A total of six individuals agreed to be interviewed.

The interviews were conducted between December 5, 2013 January 24, 2014, and each interview was approximately 30 minutes in length. Prior to each interview, the industry representative was sent a description of the proposed program for review. Key informants interviewed were from various industries such as consulting, electric power generation and distribution, and utility/natural gas distribution. Representatives from Engineers Canada and Electricity Human Resources Canada were also interviewed. A list of the organizations that participated in the interviews is located in Appendix 1.

Prospective Student Survey

To obtain prospective students' views of the proposed program, an online survey was conducted using Academica Group's StudentVu panel. The objective of the survey was to gauge perceptions of and potential interest in the proposed program among prospective students. Panelists who had applied to engineering, computer science, and related program areas at colleges and universities across Ontario in the last three years were invited to participate. The survey was in-field from March 27 until June 30. A total of 163 respondents completed the survey.

Industry and Labour Market Trends

Engineering in Canada is a regulated occupation, meaning that engineers are required to meet certain competence standards before they can carry out specific activities or use the title of professional engineer. The Canadian Engineering Accreditation Board (CEAB) certifies undergraduate engineering programs that provide the requirements necessary for licensure as a professional engineer in Canada. The strict regulation and national guidelines set for engineering programs ensures that graduates meet high standards for admission into the profession and increases the mobility of graduates of accredited engineering programs, allowing them to find employment across Canada.

Individuals trained in electrical engineering have a wide range of career opportunities in a variety of industries, including utilities, professional, scientific and managements services, ICT, and manufacturing. As a particularly specialized branch of engineering that is heavily focused on technological developments and innovation, electrical engineers are one of the most in-demand engineering occupations (Brown, 2013; Prism Economics and Analysis, 2010). A recent analysis of hiring trends in Canada named electrical engineer as one of the most commonly posted job advertisements between January 2012 and January 2013 (Lombardi, 2013).

Trends affecting electrical engineering in Canada that were identified in this research include:

- Acute skills gaps expected to develop as a rising proportion of the workforce approaches retirement age over the next decade; replacement demand is expected to far exceed expansion demand.
- Many engineering students are graduating with strong theoretical knowledge but little practical experience or skills. Employers are frustrated in having to train graduates on-the-job, and job seekers are frustrated by the level of experience required by many job postings.
- Regional imbalance with tight labour markets in Alberta, Newfoundland and Labrador driven by oil and gas industries, and weaker prospects in regions such as Ontario where power and energy systems are key industries.
- Aging infrastructure across the country needs to be revitalized and rebuilt. In relation to power systems, increasing demand on the electrical system and the move toward smart grids, for example, are creating demand for electrical engineers with specialized skills.
- Renewable energy is a key growth area for electrical engineering, especially in Ontario, and the focus on sustainability is creating new skills requirements.

Each of these trends is discussed in greater detail below.

Replacement demand created by retirements is one of the key issues facing many sectors as the population ages. Retirements can mean a significant loss of expertise, leaving organizations to focus on recruiting experienced professionals. This presents a major challenge not only for employers, but also for new graduates looking for entry-level positions when employers are focused on replacing experienced workers. Engineers Canada predicts that between 2011 and 2020, there will be 111,000 engineering job openings available from retirements alone. The report also predicts that about 180,000 trained engineers will be entering the workforce during this time, but most will not have the practical skills or experience to adequately fill the positions (Engineers Canada, 2012). This skills gap is seen as a pressing issue across the industry and is being felt Canada-wide. Industry representatives interviewed for this study also identified impending retirements as a key challenge.

- *There is a gap in expertise available, because people are retiring …many people especially in engineering they struggle to find jobs when they graduate. It's tough to find a job if you don't have the experience or if you don't have the necessary skills required. – Industry Representative*

- *For us our industry does tend to retire a lot of them early, about 58, because they have very good defined pension plans and all that sort of thing... I have one utility that I know has done a succession planning exercise, and they have a little over 38% of their folks retiring in the next eight years in the organization. Throughout the whole organization. That's a huge challenge. – Industry Representative*

A related trend from the past few years is the "graduation-to-work" challenge, in which businesses often require five to ten years' experience of their applicants. The work experience is desired because it provides important skills, such as written and oral communication, experience administering contracts, project management, teamwork, the preparation of business case analyses, and the communication of technical issues to non-technical colleagues – skills that are not regularly taught in college and university engineering programs. This gap between the needs of employers and the skill profiles of graduates from traditional engineering programs significantly tightens the labour market, while at the same time making it more difficult for newly-graduated engineers to find employment for lack of practical skills and work experience. The traditional skills learned in an engineering degree program are said to not be enough, and practical, business, financial and management skills are becoming increasingly important for employers (Deveau, 2014). Industry representatives interviewed agreed that the challenge is finding engineering graduates with a well-rounded skillset that can meet the needs of the sector, particularly the ability to apply theoretical knowledge to day-to-day work.

- *I've always said you bring two things when you come in to work... You bring your technical competencies, and the second thing you bring and it's as important, is your ability to apply those technical competencies. – Industry Representative*

- *Basically, when you hire a new engineer, and I've done it before, they come out with great academic knowledge, but they're fairly … pretty much useless…*

there's a lot of training and development that has to go in after the fact. – Industry Representative

Some postsecondary institutions have started to recognize the need for multidisciplinary skills in the industry. For example, McMaster University and Western University both have entrepreneurial and management streams that offer students skills beyond the traditional technical engineering skills.

Soft skills such as communication, leadership, problem solving and critical thinking, were also mentioned by industry representatives as key skills that were often lacking among new graduates.

- *What the industry is looking for now is not just the technical components of the job; they're looking for leadership skills, project management skills, communication skills. – Industry Representative*
- *Soft skills are critical. It's not just the CV and the knowledge, but it's the ability to be able to multitask and to be a project manager for certain areas. It's a lot of soft skills, communication based as well. Communication is one of the most important factors. – Industry Representative*
- *Historically, it would be industry wide saying all graduates have been lacking the soft skills. Communication, team work, all that good stuff. – Industry Representative*

As the skills imbalance affects replacement demand, a regional imbalance of projects across the country creates varying expansion demand for engineers (Ontario Society for Professional Engineers, 2014). Engineers Canada referenced this imbalance in its most recent labour market report, noting the concentration of projects in the western provinces creating tighter markets and the cyclical nature of resource and infrastructure projects having an effect on other provinces, especially for civil and electrical engineers (Engineers Canada, 2012). “Engineering-intensive” projects are mostly focused in mining, oil and gas, transportation and utilities. The highest demand for engineers is expected in British Columbia, Alberta and Saskatchewan; while Manitoba and Ontario will see limited growth. In Ontario, resource and infrastructure projects in the North will likely tighten the labour market, as will potential improvements in the manufacturing sector (Engineers Canada, 2012). Eastern provinces aside from Newfoundland and Labrador are in the process of completing projects and will likely not require a new supply of engineers in the near future.

The main sector that was highlighted by industry representatives as growing significantly fast in certain regions of Canada was oil and gas, especially in Alberta and in Newfoundland and Labrador.

Representatives stated that Ontario’s key sector for electrical engineers was power and energy systems.

- *Ontario is big in power and energy systems so I think it is a good place to be, good position. – Industry Representative*

- *Again I think it is really regional because Canada has such a diverse economy and industries are all over the place. Obviously oil and gas is pretty hot now in both in Newfoundland and Labrador and Alberta. It is not just specific to those types of engineering. You need the electrical engineers, you need the mechanical engineers, civil engineers to work as a team to develop all the infrastructure and resources that go into maintaining those industries. – Industry Representative*
- *I have people in Alberta frantically, frantically trying to find power engineers right now. I'm having difficulty in finding them. – Industry Representative*

Industries employing electrical engineers have been noted to be highly cyclical and reliant on investment and economic prosperity. Since the research and interviews for this degree were completed, the price of oil has fell significantly which could have a negative effect on the demand for electrical engineers, especially in the oil and gas sector. Already oil sands workers have experienced job losses in Alberta, and Saskatchewan and Newfoundland's economies could soon be affected (Bebad, 2014). As these provinces rely heavily on the export of oil, the dropping prices may slow some projects down, requiring fewer workers. At this time it is unclear how this will impact demand for electrical engineers in Ontario's renewable energy sector.

As referenced, resources and infrastructure are two key drivers of demand for engineers in Canada. As more funding is invested into infrastructure at all levels of government, and more energy generation and distribution projects are implemented, the demand for electrical engineers is likely to increase.

Expected investment into electricity infrastructure from 2011 through to 2030 across Canada could increase demand, particularly in Ontario (Shenfeld & Tal, 2011).

Industry representatives interviewed noted that it is not only new projects that are creating demand, but that increased efforts to address the aging infrastructure are creating national demand for electrical engineers as well. Older gas and power generation and distribution infrastructure has been targeted for massive projects that aim to re-construct the existing systems to become more efficient and sustainable.

- *The other key driver would be the fact that our infrastructure is very old and aging in a lot of areas… you may have seen this report that came out last year anticipating $295 billion worth of infrastructure around 2030. – Industry Representative*

- *A lot of the infrastructure right now is old and failing on its own. – Industry Representative*

Recent events and natural disasters such as flooding in Calgary and the ice storm in Toronto have increased the need for new and stronger infrastructure across the country, requiring engineers to develop sustainable, innovative and modern systems.

- *So you've heard about the recent ice storms in Toronto. People were out of power for three weeks almost… so there is growing demand to modernise the*

system, the utility system, so that it will be more robust and can withstand the changing weather patterns. – Industry Representative

In recent years, environmental concerns have spurred demands for environmentally sustainable solutions for energy generation and distribution and organizations are being pressured, both socially and through legislation, to implement environmentally sustainable practices. Engineering has an important role to play in Ontario's green economy as more regulations begin to be implemented.

According to a report by ECO Canada, environmental engineers or engineering specialists are the highest in-demand jobs by employers in the green economy (ECO Canada, 2010), and engineering is one of the top fields of study for professionals interested in entering sustainability careers (ECO Canada, 2013).

- *In the renewable energy piece as well, too, engineers and then electrical engineers were actually identified as being one of the key occupations that they're going to need to look for to actually be able to deliver their growth and their expansion requirements... Keeping an eye obviously on skill sets, from an engineering perspective as well, too, you have smart grid coming on board, you've got renewables feeding into the grid; you've got schoolhouses and churches selling solar power to the grid. That requires a lot more interconnection points than there would have been in the past and different requirements for managing that flow of power. That's a changing skill set as well. – Industry Representative*

Renewable energy sources, such as wind and solar power systems and new technologies such as smart grids, are key growth areas that require skilled electrical engineers.

- When I was in generation there was a lot of growth. On the generation side there is a lot of scrutiny on how the power is getting generated. More green energy. So this is also a growing area. – Industry Representative
- There is a large trend from a renewable energy perspective, mainly geared towards environmental regulations, policies and standards. I think there is a large trend as far as meeting the new policies and standards and regulation, especially environmentally to basically meet the code, meet the requirements, meet the specification and all of that. There is more of a strict nature over the last five to 10 years as far meeting those requirements. – Industry Representative

Employment Outlook

Engineers Canada (2012) forecasts that employers will face moderate to significant supply pressures between 2012 and 2020, meaning that employers will have to more actively recruit qualified and experienced workers outside of their region, improve compensation packages, and in some cases outsource basic engineering and technology work. In addition, a recent Conference Board of Canada employer survey found that engineering occupations were expected to be the most difficult to fill, followed by electrical trades and professions (Stuckey and Munro, 2013).

For the most part, industry representatives gave consistent positive feedback with regards to the labour market and hiring expectations. As projected by Engineers Canada (2012), demand for electrical engineers is set to increase over the next decade. Graduates of the proposed program would have a wide range of employment opportunities. Several occupations from the National Occupational Classification System (NOC) were selected to explore as potential career pathways. The occupational categories selected include:

- Engineering managers (NOC 0211)
- Utilities managers (NOC 0912)
- Electrical and electronics engineers (NOC 2133)
- Electrical and electronics engineering technologists and technicians (NOC 2241)
- Engineering inspectors and regulatory officers (NOC 2262)
- Natural and applied science policy researchers, consultants and program officers (NOC 4161)
- Technical sales specialists – wholesale trade (NOC 6221)
- Supervisors, petroleum, gas and chemical processing and utilities (NOC 9212)

Tables 1 and 2 provide a provincial and regional summary showing average annual data over the projection period (2014-2022) for four key labour market indicators: job openings as a percentage of the labour force, employment growth rate, employment size, and the unemployment rate. These charts also provide labour market indicator ratings based on each occupation's position on the labour market indicator relative to all occupations within the geographic area. The rating scale is based on quintiles:

- Bottom (lowest 20% of occupations) = Poor
- Second (20%-40%) = Below Average
- Third (40%-60%) = Average
- Fourth (60%-80%) = Above Average
- Fifth (80%-100%)=Excellent

Table 1. Ontario Labour Market Information for Related Occupations

		Average Annual (2014-2022)	**Rating**
Engineering managers (NOC 0211)	Job Openings/Labour Force	5.74%	Excellent
	Employment Growth	0.85%	Average
	Employment Size	10,123	Above Average
	Unemployment Rate	4.26%	Excellent
Utilities managers (NOC 0912)	Job Openings/Labour Force	4.15%	Excellent
	Employment Growth	0.36%	Poor
	Employment Size	4,676	Average
	Unemployment Rate	4.37%	Excellent
Electrical and electronics engineers (NOC 2133)	Job Openings/Labour Force	3.10%	Average
	Employment Growth	0.92%	Average
	Employment Size	17,507	Above Average
	Unemployment Rate	5.90%	Above Average
Electrical and electronics engineering technologists and technicians (NOC 2241)	Job Openings/Labour Force	3.35%	Above Average
	Employment Growth	0.80%	Below Average
	Employment Size	13,829	Above Average
	Unemployment Rate	5.82%	Above Average
Engineering inspectors and regulatory officers (NOC 2262)	Job Openings/Labour Force	3.36%	Above Average
	Employment Growth	0.87%	Above Average
	Employment Size	1,467	Poor
	Unemployment Rate	5.78%	Above Average
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	Job Openings/Labour Force	2.87%	Below Average
	Employment Growth	0.84%	Average
	Employment Size	8,103	Above Average
	Unemployment Rate	5.65%	Above Average

Table 2. GTA Labour Market Information for Related Occupations

		Average Annual	**Rating**
Engineering managers (NOC 0211)	Job Openings/Labour Force	4.84%	Excellent
	Employment Growth	1.23%	Below Average
	Employment Size	4,760	Above Average
	Unemployment Rate	4.83%	Excellent
Utilities managers (NOC 0912)	Job Openings/Labour Force	4.22%	Above Average
	Employment Growth	0.70%	Poor
	Employment Size	2,264	Average
	Unemployment Rate	4.88%	Excellent
Electrical and electronics engineers (NOC 2133)	Job Openings/Labour Force	3.26%	Below Average
	Employment Growth	1.14%	Below Average
	Employment Size	9,736	Excellent
	Unemployment Rate	6.30%	Above Average
Electrical and electronics engineering technologists and technicians (NOC 2241)	Job Openings/Labour Force	3.67%	Average
	Employment Growth	1.16%	Below Average
	Employment Size	6,588	Above Average
	Unemployment Rate	6.30%	Above Average
Engineering inspectors and regulatory officers (NOC 2262)	Job Openings/Labour Force	3.54%	Average
	Employment Growth	1.39%	Average
	Employment Size	687	Below Average
	Unemployment Rate	6.27	Above Average
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	Job Openings/Labour Force	3.08%	Below Average
	Employment Growth	1.32%	Below Average
	Employment Size	3,041	Average
	Unemployment Rate	6.15%	Average

In Ontario, engineering managers are expected to experience excellent job openings and average employment growth between 2014 and 2022. Employment size for this occupation is expected to be above average, and the unemployment rate is anticipated to be excellent during this period. Trends are similar for the GTA, though employment growth for the region will be below average. New job openings in the GTA are expected to come from replacement demand with expansion demand only a minor source of demand. The primary source of labour supply will be mobility.

In the US, cumulative growth expected for engineering managers from 2012-2022 is 7%, lower than the 11% growth expected for all occupations.

The median hourly wage in Ontario is $48 per hour and the educational requirements are a bachelor's degree in engineering or college diploma in engineering technology. In addition, extensive experience in engineering with supervisory experience is required and registration as either a P. Eng. or certification as an engineering technologist may be required. The US median hourly wage is $60 per hour and the educational requirement is a bachelor's degree.

Utilities managers

This occupational group is expected to experience excellent job openings and unemployment rate and average employment size in Ontario between 2014 and 2022. Employment growth, however, is expected to be poor for this occupational group during this period. In the GTA, there will be an above average number of job openings but poor employment growth, as well as an average employment size and excellent unemployment rate. New job openings are expected to come primarily from replacement demand. The main source of supply is expected to be mobility.

The median hourly wage in Ontario is $55 per hour and the educational requirement is a bachelor's degree in a related field (e.g. electrical engineering) and experience in a supervisory role. Certification as a P. Eng. is usually required.

Electrical and electronics engineers

In Ontario, electrical and electronics engineers are expected to experience average job openings and employment growth, and above average employment size and unemployment rates between 2014 and 2022. In the GTA, however, there is expected to be a below average number of job openings and employment growth, excellent employment size and above average unemployment rate. New job openings are expected to come from mainly from replacement demand, though expansion will play a secondary role in growth. The primary source of supply is expected to be new entrants with mobility and migration to account for close to half of supply.

In the US, cumulative growth expected for electrical and electronics engineers from 2012-2022 is 4%, slower than average.

The median hourly wage in Ontario is $40 per hour and the minimal educational requirements are a bachelor's degree in electrical engineering. A master's or doctoral

degree may be required by some employers, as will a P. Eng. Designation. The US median hourly wage is $43 per hour and the educational requirement is a bachelor's degree.

Electrical and electronics engineering technologists and technicians

In Ontario between 2014 and 2022, this occupational group is expected to experience above average job openings, employment size and unemployment rates; job growth, though will be poor. Slightly more positive in the GTA, job openings, employment size and unemployment rates are expected to be average and above, while employment growth is expected to be below average. New job openings are expected to come mainly from replacement demand, especially nearing the end of the projection period, with expansion a secondary source of demand. The primary source of supply of workers for this occupational group is expected to be new entrants and mobility.

In the US, there is no growth expected for electrical and electronics engineering technicians from 2012- 2022.

The median hourly wage in Ontario is $29 per hour and the minimal educational requirements are a college diploma in engineering technology and certification as a technologist/technician. The US median hourly wage is $28 per hour and the educational requirement is an associate's degree.

Engineering inspectors and regulatory officers

Engineering inspectors are expected to experience above average job openings, employment growth, and unemployment rates in Ontario between 2014 and 2022. Employment size is expected to be poor during this period. In the GTA, job openings and employment growth are expected to be average, with below average employment size and above average unemployment rates. Job openings are expected to mainly from replacement demand with expansion a secondary source of demand. The primary source of supply is expected to be new entrants.

The median hourly wage in Ontario is $38 per hour and the educational requirement is a university degree or college diploma in an engineering field. Trade qualifications and engineering certifications may be required.

There is no equivalent occupational category in the US occupational handbook.

Natural and applied science policy researchers, consultants and program officers

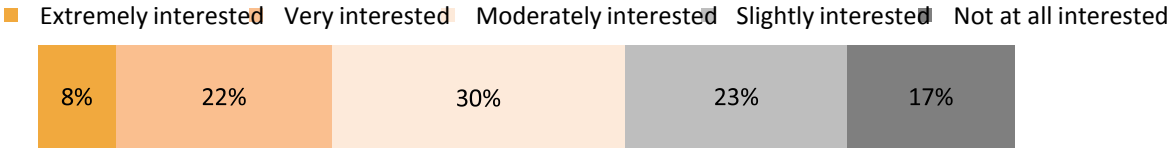
This occupation group is expected to experience below average job openings, average employment growth and above average employment size and unemployment rates in Ontario between 2014 and 2022. In the GTA there is expected to be below average job openings and employment growth for this occupation and average employment size and unemployment rates. Demand will come primarily from replacement demand, with expansion a secondary source of demand. The primary source of supply will be new entrants, with mobility as a minor source of supply over the reference period.

The median hourly wage in Ontario is $38.31 per hour and the educational requirements are a bachelor's degree or college diploma in a scientific or technical field. There is no equivalent occupation in the US occupational handbook.

Student Interest

To gauge student interest in the proposed program, individuals who had applied to engineering, computer science, and related program areas at colleges and universities across Ontario in the last three years were surveyed. Sixty percent of those surveyed indicated they would have been moderately to extremely interested in applying to the program had it been available to them at the time of entering postsecondary, suggesting that the program would be in-demand among students.

Figure 1 – If this degree program had been offered by a college at the time when you were first applying to postsecondary, how interested would you have been in applying to this program? (All respondents, n= 163)



The most appealing aspect of the program was the work placement component (internship and co-op opportunities). Preparation for the workplace and making industry connections were seen as especially beneficial in the engineering field. Other appealing aspects were the streams being offered, the hands-on teaching approach, and the wide range of knowledge and transferable skills that would be learned.

Representative comments from survey respondents are provided below:

- The required internship. I think having real world experience is an extremely valuable aspect in engineering and would benefit students greatly. In addition, I like the curriculum set up, and think it will prepare students much better post-graduation. – Survey respondent
- The electives offered within the program, especially the mechatronics option, seem like a great window into alternative engineering programs…. The new MIT recommended CDIO framework seems interesting also. Additionally, the internship opportunity is a great way to gain work experience and network with possible future employers. – Survey respondent
- That it is an interdisciplinary program that does not entail just engineering but business, entrepreneurship, and hands-on-experience. – Survey respondent
- The project oriented course seems that it would better prepare those taking the course with real world, resume-worthy experiences. – Survey respondent

As further evidence of student demand, undergraduate engineering enrolment in Canada has increased 24% from 2009 to 2013, and electrical engineering is the second most popular engineering discipline in Ontario after mechanical engineering (Engineers Canada, 2014). Common University Data Ontario (CUDO) shows that applications to engineering programs in Ontario have grown 38% from 2007 to 2012.

Employer Interest

Industry representatives had generally positive reactions to the proposed program. The consensus was that the program seemed to cover many of the missing links in existing programs and would be a unique offering for the province. Addressing the current and anticipated skills gap within the sector, representatives felt this program would alleviate some pressure by training students in key areas where new entrants seem to be lacking skills.

The main strengths noted included the use of the CDIO framework and the inclusion of substantial co-op and internship experience in the program. Representatives also confirmed that the two areas of specialization (Power and Energy Systems and Mechatronics) are currently in high demand in the industry.

- *It's anchored around the experience and that's the driving factor. It's important to teach the students the skills required to be able to get into industry with a smoother transition. As a mission statement or value or vision… it was very clear as to what they're going for. – Industry Representative*

- *The first thing that really jumped out at me is the CDIO framework that is the more innovative approach to teaching the curriculum. I know that it is being used in a few programs in the schools across the country and with great success, but I think it is a good way of getting the hands-on experience and a good approach to problem solving, problem-based learning I think is the next best thing to co-op and internship… I think the graduate at the end of the program will be better suited to actually being able to contribute to the economy when he or she graduates from the program. . – Industry Representative*

- *The fact that you have an internship here, and it's substantial… To me that means that you end up with a much more qualified graduate coming out, that is work-ready. For me, no, I think you guys are on the right track. When I saw this, I was just sort of ticking off the boxes. . – Industry Representative*

- *The topics sound modern. In the future these people with those skills and knowledge probably will be in demand. They are right now becoming in demand increasingly. . – Industry Representative*

The only concern among representatives was the fact that there are some very well-known and respected engineering programs in Ontario, and there is a certain weight placed on brand and reputation of an institution both in the eyes of students and employers. However, the unique approach to teaching, based on the CDIO framework, should help to differentiate Sheridan's program and build a positive reputation.

Comparative Analysis

There is currently no other college in Ontario that offers a bachelor's degree in electrical engineering. Eleven Ontario universities offer bachelor of electrical engineering programs (Table 3). The majority of these programs have co-op options or internships available. Co-ops range from twelve to sixteen months, usually taken in the form of a work term beginning after second year. Internship programs are also offered through many engineering schools, and are anywhere from four to sixteen weeks. Typically, students apply for co-op or internship aspect of the program following their second year of study.

Several universities offer multiple streams, options or specializations to students. These are offered formally as streams in some cases, but often are offered as specialized courses or projects in the final two years of study that allow students to focus their interests. Streams vary but some are quite standard across universities in Ontario. Common streams include: Biomedical Engineering; Communications; Nanotechnology; Aerospace Electronics; Mechatronics and Control Systems; Power Systems; Photonics. A full list is provided in Table 3 along with associated institutional requirements. Typically, specializations begin after the second year of study and the amount of courses or credits required to obtain a specialization varies from institution to institution (anywhere from four to eleven).

McMaster University, University of Ottawa, University of Ontario Institute of Technology, and University of Waterloo all offer either degrees in Engineering Management /Entrepreneurship, or offer this area of specialization.

One stream that has been proposed in Sheridan's degree program is Mechatronics. There are three universities in Ontario that offer degree programs in mechatronics engineering:

- University of Waterloo (Bachelor of Mechatronics Engineering)
- McMaster University (Bachelor of Mechatronics Engineering; Bachelor of Mechatronics Engineering and Management; Bachelor of Mechatronics Engineering and Society)
- Western University (Bachelor of Mechatronic Systems Engineering)

Looking across Canada, there are a number of electrical engineering degree programs that offer a range of options to students. For example, the University of Alberta, University of Calgary, University of British Columbia, and University of New Brunswick all offer Biomedical Engineering options. Other common options include Energy and Environment, Electrical Energy Systems, Nano-technology, Telecommunications, and more.

A key component of Sheridan's proposed program is the inclusion of the CDIO framework. Sheridan is an official member of the CDIO initiative[1]. Other members in Canada include: Queen's University, University of Calgary, and University of Manitoba.

[1] http://www.cdio.org/cdio-collaborators/school-profiles

A summary of program offerings in Ontario is provided in Table 3; a summary of programs across Canada is provided in Table 4. Detailed descriptions of the Ontario program offerings are also provided along with unique features.

Table 3. University Offerings in Ontario

Institution	Program Title	WIL	Specializations/Specialized Courses[2]	Details
Carleton University	Electrical Engineering	Co-op program available beginning with one term in summer of year two; followed by fall of year three, and all three terms in year four	Specialized courses: Wireless Electronics Integrated Circuit Design and Fabrication Nanotechnology Green Energy Biomedical Sensors and Techniques Antennas Light-Wave Devices Aerospace Electronics Design Automation	Fourth year offers specialized courses for students to focus their studies.
McMaster University	Electrical Engineering Electrical Engineering and Management Electrical Engineering and Society	Co-op is available, required twelve months of co-op to receive designation		
University of Toronto	Electrical and Computer Engineering	Co-op available in form of Professional Experience Year (12 – 16 months) after third year of study 600 hours practical experience also required	Specialized courses: Biomedical engineering Mechatronics and systems controls Electromagnetics Software and hardware engineering Photonics Digital and analog electronics Energy systems Communications	First two years are foundational. Final two years, students choose four "areas of interest" and two areas to focus in-depth.
Lakehead University	Electrical Engineering	Co-op is available: five work terms starting in year one.	Specializations: Computer Applications Communications Networks Industrial Control Electrical Power Distribution	Final two years consist of a series of core and elective courses, engineering design, and a major project all focusing on a particular area of specialization. Qualified engineering technology graduates from accredited Canadian technology programs can enter the degree program in third year after completing post-diploma transition courses offered in the summer session prior to third year.

Institution	Program Title	WIL	Specializations/Specialized Courses[2]	Details
University of Waterloo	Electrical Engineering	Co-op available in the form of six work terms	Specialized course areas: Systems for communication, control or power Digital hardware, software and computer as a component Electronic, radio-frequency, or optical devices, circuits and fabrication	Core courses complemented by five technical elective courses, two natural sciences elective courses, and four complementary studies elective courses. Elective choices allow students to focus on three broad domains.
Western University	Electrical Engineering	Internship and Summer Engineering Co-op programs offered through institution.	Specializations: Wireless Communication Option Power Systems Option Biomedical Signals and Systems Option	Fourth year offers technical electives that lead to specialization
Queen's University	Electrical Engineering	Internship available in second and third year	Specializations: Biomedical Engineering Communications and Signal Processing Communications Systems and Networks Electronics and Photonics	Five electives taken in years three and four lead to specializations.
Ryerson University	Electrical Engineering	Optional industrial internship program available to third year students (8 – 16 months)	Specializations: Energy Systems Option Multimedia Systems Option Microsystems Option Robotics and Control Systems Option	Electives are taken in fourth year to specialize.
University of Ottawa	Electrical Engineering	Co-op available in summer of second year.	Specializations: Engineering Management and Entrepreneurship Option Communications Option Systems Engineering Option Electronics Option Microwave and Photonic Engineering Option Power and Sustainable Energy option	Eight courses required to complete Management and Entrepreneurship Option Ten courses (7 compulsory and 3 technical electives) to complete other options.
University of Windsor	Electrical Engineering	Co-op available in four work terms.	Electronics, Communications Automotive Electronics Computer Engineering	Four courses required for specializations.
University of Ontario Institute of Technology	Electrical Engineering Electrical Engineering and Management	Internship for 12 – 16 months optional for students completing third year. Two to four month co-op placements also available.		Fourth year of program is dedicated to business and management courses for those in Management stream; traditional fourth year courses are then taken in a fifth year.

Institution	Program Title	WIL	Specializations/Specialized Courses[2]	Details
University of Waterloo	Mechatronics Engineering	Co-op required: five four-month work terms.	Specializations: Biomechanics Environmental Engineering International Studies Management Sciences Mathematics Physics Statistics Water Resources	Administered by Dept. of Mechanical and Mechatronics Engineering, half of second and third year courses provided by Systems Design Engineering and Electrical and Computer Engineering depts. Each specialization consists of six to eight courses.
McMaster University	Mechatronics Engineering Mechatronics Engineering and Management Mechatronics Engineering and Society	Co-op is available, required twelve months of co-op to receive designation		
Carleton University	Sustainable and Renewable Energy Engineering	Co-op program available beginning with one term in summer of year two; followed by fall of year three, and all three terms in year four	Specializations: Smart Technologies for Power Generation and Distribution Efficient Energy Generation and Conversion	
Western University	Bachelor of Mechatronic Systems Engineering	Internship and Summer Engineering Co-op programs available through institution.		Students apply after common first year.

[2] Specializations indicates the program explicitly states these as options, streams or specializations and students graduate with this title. Specialized courses indicates students are able to choose courses that allow them to focus on particular areas but formal streams are not explicitly identified.

Table 4. University Offerings Outside of Ontario

Institution	Program Title	WIL	Specializations/Specialized Courses	Details
University of Alberta	Electrical Engineering	Co-op available in Traditional and Nano-Engineering Option.	Specializations: Biomedical Nano-Engineering	Within Electrical Engineering students can choose electives in Biomedical Engineering, Communications Engineering, Control Systems Engineering, Digital Systems Engineering, Electronic Materials and Nanotechnology, Electronics Engineering, Electromagnetics and Photonics, and Power Engineering in order to focus their studies.
University of Calgary	Electrical Engineering	12 – 16 months internship after third year.	Specializations: Biomedical Energy and Environment	Students take different courses in second, third and fourth year in order to specialize.
University of Victoria	Electrical and Computer Engineering	16 months of co-op optional.	Specializations: Communications Computational intelligence Computer systems Digital and embedded systems Digital Signal Processing Electrical Energy Systems Electromagnetics and Photonics Electronics Mechatronics Networks, security and privacy	Three courses required for specialization.
University of British Columbia	Electrical Engineering	Up to 20 months of co-op available; students apply after second year.	Specializations: Biomedical, Engineering Electrical Energy Systems Nanotechnology and Microsystems	Biomedical: 17 credits Nanotechnology and Microsystems: 20 credits Electrical Energy Systems: 13 credits
British Columbia Institute of Technology	Electrical Engineering	Workplace Education work term is available in summer after either second or third year.		
Simon Fraser University	Mechatronic Systems Engineering	Co-op terms available (3)		
University of New Brunswick	Electrical Engineering	Minimum of four, four-month work terms.	Specializations: Biomedical, Engineering Instrumentation and Control Mechatronics	
Memorial University	Electrical Engineering	Four work terms required.		
Dalhousie University	Electrical Engineering	Co-op available, three work terms		
Concordia University	Electrical Engineering	Work terms of 12 to 16 weeks.	Specialization: Electronics/VLSI Telecommunications Power and Renewable Energy Avionics and Control	Begin specialization after first year.
McGill University	Electrical Engineering	Engineering Internship Program: 4, 8, 12, or 16 weeks.		
University of Saskatchewan	Electrical Engineering		Specializations: Power Systems Communications Electronic Materials and Devices	Specializations start in third and fourth year

Detailed Program Descriptions: Ontario

Carleton University
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op program is available

- One term in summer following year 2
- One term fall of year three
- Three terms in year four (additional two study terms following co-op)

Accreditation: Canadian Engineering Accreditation Board

Description:
The program offers foundational first and second year with courses in math and science; second year introduces students to network analysis, electronic circuit design, object-oriented programming and numerical analysis. Third year courses focus on digital and analog circuit design, semiconductor device physics, electromagnetics and real-time programming. Fourth year offers options (specializations) in areas such as wireless electronics, antennas, integrated circuit design, layout and fabrication, fibre optic communications, nanoelectronics, sensors and sensing technology, solar cell/photovoltaic technology, power systems, aerospace electronics and CAD for electronics engineering.

Unique Features

- Co-op opportunities available
- Specializations unique to Carleton
- Students design their own integrated circuits in the on-campus fabrication facility
- Facilities are all right on-site
- Close association with government laboratories and NRCC and CRCC

McMaster University
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op program is available

- Flexible terms: All students eligible to work for summer four-month terms
- Final year students can work for 8, 12 or 16 months

Accreditation: Canadian Engineering Accreditation Board

Description
Students start off in "Eng1" exploring different engineering disciplines before deciding where to focus for upper years. At the end of the first year students choose a discipline (e.g. chemical, civil, electrical, etc.). As a fifth-year option students can select the Engineering & Management, Engineering & Society, or Engineering & International Studies options.

Unique Features

- Offers three options: Management; Society; International Studies
- Students can enroll in the one-year master's program upon graduation
- Flexible co-op terms
- Fully PEO-accredited faculty

University of Toronto

Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op program is available

- Professional Experience Year (PEY) is 12-16 months of study after third year
- 600 hours practical experience required

Accreditation: Canadian Engineering Accreditation Board

Description

First two years of program are foundational and identical for both Electrical and Computer engineering programs. After second year, students choose four "areas of interest" and two areas to focus on in-depth. Specialized courses include: Biomedical engineering; Mechatronics and systems controls; Electromagnetics; Software and hardware engineering; Photonic; Digital and analog electronics; Energy systems; Communications.

Unique Features

- Customizable program following second year to allow both breadth and depth into concepts of interest
- PEY program
- Engineering Summer Internship Program (eSIP)
- University of Toronto ranked as premier engineering school in Canada

Lakehead University

Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op /Internship option is available

- Application is made in year 2 or 3
- Summer terms of years 2 and 3, followed by a full three terms in year 4
- Students obtain 16 months of practical work and graduates one year later

Accreditation: Canadian Engineering Accreditation Board

Description

The first two years of the Bachelor of Engineering degree program in Electrical Engineering emphasizes the fundamentals of circuit theory, control systems, instrumentation, and telecommunications, thus preparing the student for positions covering broad employment areas in electrical engineering such as the electrical power industry, the communications industry and industrial electronics.

The final two years of the degree program extend the technologists' capabilities into more advanced conceptual and design phases of engineering. This is accomplished through a series of core and elective courses, engineering design, and a major project which enables the student to emphasize a particular area, such as computer applications, communications networks, industrial control or electrical power distribution.

Unique Features

- Qualified engineering technology graduates from accredited Canadian technology programs can enter the degree program in third year after completing post-diploma transition courses offered in the summer session prior to third year.
- Students can enter right from high school or take a common year in applied science. The program structure also allows students to complete the requirements of an Engineering Technology Diploma by the end of second year.

University of Waterloo
Program Electrical Engineering
Credential Bachelor of Applied Science
Work-Integrated Learning: Co-op required 6 work terms
Accreditation: Canadian Engineering Accreditation Board

Description
Core courses complemented by five technical elective courses, two natural sciences elective courses, and four complementary studies elective courses. Elective choices allow students to focus on three broad domains: Systems for communication, control or power; Digital hardware, software and computer as a component; Electronic, radio-frequency, or optical devices, circuits and fabrication.

Unique Features

- Elective courses allow students to focus on specific areas of electrical engineering
- Co-op is required; Waterloo’s co-op program is largest in the country

Western University
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op and internship experience offered through institution:

- The 12-to 16-month internship is available to students following their third year of study. Summer co-ops provide technical work experience during the summer months and are available to qualifying students at each level of undergraduate studies.

Accreditation: Canadian Engineering Accreditation Board

Description
After a common first year of study in engineering, students spend the next three years in electrical engineering. In fourth year students may choose from a range of technical

electives or choose to specialize in one of the following options: Wireless communications; Power systems; Biomedical signals and systems.

Unique Features

- Western offers combined degrees:
  - Electrical Engineering & Management
  - Electrical Engineering & Medicine
  - Electrical Engineering & Law

Queen's University
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Internship is available second and third year
Accreditation: Canadian Engineering Accreditation Board

Description
Students are able to customize their curriculum following the first two years. They can choose from a number of elective courses that will allow them to specialize in specific streams: Biomedical engineering; Communications and signal processing; Communications systems & networks; Electronics & photonics; Mechatronics; Power electronics & systems; Robotics & control

Unique Features

- Queen's offers a special curriculum called the Electrical and Computer Engineering Innovation Stream that focuses on developing entrepreneurial skills. This program is limited to 50 students.

Ryerson University
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Optional industrial internship program available to third year students (8 – 16 months)
Accreditation: Canadian Engineering Accreditation Board

Description
The first-year courses provide the students with a solid foundation of science and engineering science fundamentals such as mathematics, physics, chemistry, computer science and the theory of electric circuits. The second year of the program introduces discrete mathematics, data structures and engineering algorithms, electrical networks, analog and digital electronic circuits and systems. In the third year of the Electrical Engineering program, the emphasis is shifted to advanced engineering science and engineering subjects such as electromagnetics, communication systems, control systems, signals & systems, microprocessors and advanced electronic circuits.

Ryerson's fourth year offers a broad range of professional elective courses in instrumentation, analog and digital integrated circuits, radio-frequency integrated circuits, VLSI design, optical and wireless communication systems, multimedia, control

systems, power electronics, power systems, and electromechanic systems. Students can freely choose these courses based on their interest. Students also have the freedom to choose to be specialized in one of the following options: Energy option, Microsystems option, Multimedia option, and Robotics and Control option where students must take a set of required courses in order to have the chosen option stated in their official transcript.

Unique Features

- Curriculum emphasizes theoretical foundation and practical aspects of electrical engineering.
- Unique specializations offered but not required. Students are able to study broadly or narrow their focus.

University of Ottawa
Program Electrical Engineering
Credential Bachelor of Applied Science
Work-Integrated Learning: Co-op opportunity available
Accreditation: Canadian Engineering Accreditation Board

Description
The curriculum includes courses in engineering science and design, electronics, circuits and computers and offers five technical specializations: communications, systems engineering, electronics, microwaves and photonic engineering and power and sustainable energy.

Students can also follow courses to complete the Management and Entrepreneurship option that includes courses in business management, financial accounting, marketing, entrepreneurship and engineering law.

Unique Features

- Engineering Management and Entrepreneurship option

University of Windsor
Program Electrical Engineering
Credential Bachelor of Applied Science
Work-Integrated Learning: Co-op opportunity available four work terms
Accreditation: Canadian Engineering Accreditation Board

Description
Students take standard courses for all years of study. Students are also required to take five technical electives in the fourth year. Those who wish to specialize must choose their electives from their area of specialization. Streams include: Electronics; Communications; Automotive Electronics; Computer Engineering.

Unique Features

- Integrated BASc/MASc option allows advanced students to achieve both degrees in five years.

- Honours Certificate Program has a fifth year to upgrade knowledge in a new field of electrical engineering
- Capstone design project in fourth year

University of Ontario Institute of Technology
Program Electrical Engineering
Credential Bachelor of Engineering
Work-Integrated Learning
- Internship: 12 – 16 months optional for students after third year
- Co-op: Two to four month co-op placements available

Accreditation: Canadian Engineering Accreditation Board

Description
The program provides graduates with the knowledge and skills required to carry out engineering work for a wide range of electrical and computer companies and for the many industries that use electrical and computer products. In the first year, you study mathematics, sciences, computing and technical communications — courses that represent the foundation building blocks of most engineering programs. In the second year, you cover, in addition to advanced mathematics, fundamental engineering courses like electronics, digital systems, electromagnetics, and algorithms and data structures. In third and fourth year, you study a range of applied and advanced electrical engineering courses including computer architecture, signals and systems, circuit design, microprocessors, power systems, computer networks, digital communications, and control systems.

Fourth year of program is dedicated to business and management courses for those in Management stream; traditional fourth year courses are then taken in a fifth year.

Unique Features
- UOIT also offers a five-year Electrical Engineering Management stream
- State-of-the-art laboratories
- Integrated Manufacturing Centre

University of Waterloo
Program Mechatronics Engineering
Credential Bachelor of Applied Science
Work-Integrated Learning: Co-op required - 6 work terms
Accreditation: Canadian Engineering Accreditation Board

Description
The Mechatronics Engineering program is based on the Mechanical Engineering program, but with about half of the courses in 2nd and 3rd year being taught by the Electrical & Computer Engineering and Systems Design Engineering departments.

Mechatronics students can select options similar to those available to all engineering students with some restrictions: Environmental engineering; Management studies; Mathematics; Statistics; Water resources.

Unique Features

- Streams offered unique to University of Waterloo
- Waterloo sells this program as the most original, innovative and best in Canada
- Combination of multiple faculties creates a range of topics

McMaster University
Program Mechatronics Engineering
Credential Bachelor of Applied Science
Work-Integrated Learning: Co-op program is available

- Flexible terms: All students eligible to work for summer four-month terms
- Final year students can work for 8, 12 or 16 months

Accreditation: Canadian Engineering Accreditation Board

Description
At different Universities Mechatronics Engineering is offered with different flavours - Mechanical, Electrical, or Embedded Systems. McMaster designed an innovative world class Mechatronics program that offers a balance of Mechanical, Electrical and Software content with a focus on Embedded Systems Design. The Mechatronics program gives students a solid foundation in Mechanical, Software and Electrical Engineering and then exposes students to a suite of innovative Mechatronics specific lab-based courses for a hands-on experience that provides significant advantages in today's job market.

As a fifth-year option students can select the Engineering & Management, Engineering & Society, or Engineering & International Studies options.

Unique Features

- Offers a three options: Management; Society; International Studies
- Students can enrolment into the 1 year master's program upon graduation

Carleton University
Program Sustainable and Renewable Energy Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op program is available

- One term in summer following year 2
- One term fall of year three
- Three terms in year four (additional two study terms following co-op)

Accreditation: None

Description
This program provides analytical and hands-on skills for designing, building, operating and enhancing sustainable energy systems that combine energy generation, distribution

and utilization in an environmentally responsible and economically beneficial manner. Two streams are offered: Smart Technologies for Power Generation and Distribution, and Efficient Energy Generation and Conversion.

Unique Features

- State-of-the-art laboratory and fabrication facilities
- Energy, combustion and air emissions lab; fuel cell development lab; thermodynamics/energy conversion lab; microfabrication facility; power electronics and smart grids laboratory.

Western University
Program Mechatronics Systems Engineering
Credential Bachelor of Engineering
Work-Integrated Learning: Co-op and internship experience offered through institution

- The 12-to 16-month internship is available to students following their third year of study.
- Summer co-ops provide technical work experience during the summer months and are available to qualifying students at each level of undergraduate studies.

Accreditation: None

Description
New program for 2011 - Throughout the program, students take core courses in Electrical and Computer Engineering as well as core courses in Mechanical and Materials Engineering. In addition to these core concepts, students receive specialized instruction in mechatronic design principles through a three-year design curriculum, as well as specialized instruction in robotics and advanced sensing.

Unique Features

- Multi-year design focus

Pathway Opportunities

Pathways In

The primary pathway into the electrical engineering degree program would be electrical engineering technologist and power engineering technology diploma programs. Colleges in Ontario that offer electrical engineering technologist programs include:

- Algonquin College
- Humber College
- Cambrian College
- Conestoga College
- Confederation College
- Fanshawe College
- Georgian College
- Mohawk College
- Sheridan College

Colleges in Ontario that offer power engineering technology diploma programs include:

- Cambrian College
- Georgian College
- St. Clair College

Pathways Out

Graduates of the proposed program could enter any number of graduate and professional level programs. Areas where students may apply include Master of Engineering, Master of Engineering Science, and Doctoral degrees in Engineering. Further to these, graduates could enter Masters or Doctoral programs in Computer Science, Physics, and Environmental Sustainability. The typical entry requirements for these programs are a bachelor's degree in science, engineering or a related field. Graduate programs relevant to the proposed electrical engineering program are included in Table 5.

Table 5. Relevant Graduate Programs

Institution	Program Title	Credential
Carleton University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Concordia University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Dalhousie University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Lakehead University	Electrical and Computer Engineering	M.E.Sc
McGill University	Electrical and Computer Engineering	M.Eng, PhD
McMaster University	Electrical and Biomedical Engineering	M.Eng
McMaster University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Memorial University	Electrical Engineering	M.Eng, PhD
Queen's University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Royal Military College of Canada	Electrical Engineering	M.Eng, M.A.Sc
Ryerson University	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD

Institution	Program Title	Credential
University of Alberta	Electrical and Computer Engineering	M.Eng, PhD
University of British Columbia	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
University of Calgary	Electrical Engineering	M.Eng, M.A.Sc, PhD
University of Manitoba	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
University of New Brunswick	Electrical and Computer Engineering	M.Eng, PhD
University of Ontario Institute of Technology	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
University of Ottawa	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
University of Saskatchewan	Electrical Engineering	M.Eng, PhD
University of Toronto	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
University of Victoria	Electrical and Computer Engineering	M.Eng, M.A.Sc, PhD
Brock University	Computer Science	M.Sc
University of Lethbridge	Computer Science	M.Sc
Acadia University	Computer Science	M.Sc
Bishop's University	Computer Science	M.Sc
Carleton University	Computer Science	M.Sc, PhD
Concordia University	Computer Science	M.Sc, M.A.Sc, PhD
Dalhousie University	Computer Science	M.Sc, M.A.Sc, PhD
University of Waterloo	Computer Science	M.Sc, PhD
Lakehead University	Computer Science	M.Sc
Laurentian University	Computational Sciences	M.Sc
McGill University	Computer Science	M.Sc, PhD
McMaster University	Computer Science	M.Sc, PhD
McMaster University	Computational Engineering and Science	M.Sc, M.A.Sc
McMaster University	Computer Science	M.Eng
McMaster University	Computational Engineering and Science	M.End
Memorial University	Computer Science	M.Sc, PhD
Memorial University	Computational Sciences	M.Sc, PhD
Queen's University	Computing	M.Sc, PhD
Ryerson University	Computer Science	M.Sc, PhD
Simon Fraser University	Computing Science	M.Sc, PhD
St. Francis Xavier University	Computer Science	M.Sc
University of British Columbia	Computer Science	M.Sc, PhD
Western University	Computer Science	M.Sc, PhD
Western University	Scientific Computing	M.Sc, PhD
Brock University	Physics	M.Sc, PhD
University of Lethbridge	Physics	M.Sc
Bishop's University	Physics	M.Sc
Carleton University	Physics	M.Sc, PhD
Concordia University	Physics	M.Sc, PhD
Dalhousie University	Physics	M.Sc, PhD
Dalhousie University	Physics and Atmospheric Sciences	M.Sc, PhD
University of Waterloo	Physics	M.Sc, PhD
Lakehead University	Physics	M.Sc
Laurentian University	Physics	M.Sc
McGill University	Physics	M.Sc, PhD
McMaster University	Physics and Astronomy	M.Sc, PhD
Memorial University	Physics	M.Sc, PhD
Queen's University	Physics	M.Sc, M.A.Sc, PhD
Simon Fraser University	Physics	M.Sc, PhD
St. Francis Xavier University	Physics	M.Sc
University of British Columbia	Physics	M.Sc, PhD
Queen's University	Environmental Studies	MES, PhD

Institution	Program Title	Credential
Carleton University	Environmental Engineering	M.A.Sc, PhD
Concordia University	Environmental Assessment	MEA
Dalhousie University	Environmental Engineering	M.A.Sc, M.Eng, PhD
University of Waterloo	Environment and Resource Studies	MES, PhD
Lakehead University	Environmental Engineering	M.Sc
McGill University	Environmental Engineering Option	M.Sc, M.Eng
McMaster University	Earth and Environmental Sciences	M.Sc, PhD
Memorial University	Environmental Science	M.Sc, M.Env.Sci, PhD
Memorial University	Environmental Systems Engineering and Management	PhD
Nipissing University	Environmental Sciences/ Studies	MES, M.Sc
Ryerson University	Environmental Applied Science and Management	M.A.Sc, Phd
University of Regina	Environmental Systems Engineering	M.Sc, PhD
University of Saskatchewan	Environmental Engineering	M.Sc, PhD
University of Saskatchewan	Environment and Sustainability	M.Sc, PhD
University of Saskatchewan	Sustainable Environmental Management	M.Sc
University of Toronto	Environmental Studies	M.Sc
University of Toronto	Environmental Engineering	M.Sc, PhD
University of Victoria	Environmental Studies	MA, M.Sc, PhD
University of Windsor	Environmental Engineering	M.A.Sc, M.Eng, PhD
University of Windsor	Environmental Science	M.Sc, PhD
Western University	Environment and Sustainability	M.E.S, M.A, M.Sc, M.Eng, PhD
York University	Environmental Studies	M.Sc, PhD

References

Brown, K. (2013 March 7). *Hiring Demand for Engineers: Job Trends in 2013*. Exact Source. Retrieved: http://info.exactsource.com/blog/bid/274331/Hiring-Demand-for-Engineers-Job-Trends-in-2013

Deveau, D. (2014 May 27). *Can universities and colleges keep up with the skills demanded by the 'new manufacturing'?* National Post. Retrieved: http://business.financialpost.com/2014/05/27/can- universities-and-colleges-keep-up-with-the-skills-demanded-by-the-new-manufacturing/?_lsa=220e-0013

ECO Canada. (2010). *Profile of Canadian Environmental Employment: Labour Market Research Study*. Calgary: ECO Canada.

ECO Canada. (2013). *Careers in sustainability: Current job trends and future growth.* Calgary: ECO Canada.

Engineers Canada. (n.d.) *P.Eng: The License to engineer.* Retrieved: http://peng.ca/english/index.html

Engineers Canada. (2008). *Canadian Engineering Accreditation Board*. Retrieved: http://www.engineerscanada.ca/e/pr_accreditation.cfm

Engineers Canada. (2012). *The Engineering Labour Market in Canada: Projections to 2020*. Toronto: Prism Economics and Analysis.

Engineers Canada. (2014). *Canadian Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2009-2013*. Ottawa: Engineers Canada.

Lombardi, A. (2013 February 26). *Engineering Hiring Demand Grows in Canada*. Wanted Analytics. Retrieved: http://www.wantedanalytics.com/insight/tag/electrical-engineers/

Ontario Society of Professional Engineers. (2014). Crisis *In Canada's Engineering Labour Market.* Retrieved: http://c.ymcdn.com/sites/www.ospe.on.ca/resource/resmgr/DOC_advocacy/2014_DOC_Crisis_Lab our_Marke.pdf

Prism Economics and Analysis for Engineers Canada. (2010). *Engineering Labour Market Tracking System Labour Market Conditions 2009 – 2018.* Toronto: Prism Economics and Analysis.

Professional Engineers Ontario. (n.d.). *Changes to the Engineering Profession.* Toronto: Professional Engineers Ontario.

Shenfeld, A. & Tal, B. (2011). *Canadian Business: Targeting the new mix.* Toronto: CIBC. Retrieved: https://www.cibc.com/ca/pdf/shenfield-new-mix-2011-en.pdf

Stuckey, James and Daniel Munro. (2013). *The Need to Make Skills Work: The Cost of Ontario's Skills Gap.* Ottawa: The Conference Board of Canada.

Appendix 1: List of Industry Interview Participants

Organization	Position	Sector
Engineers Canada	Director of Education	National Engineering Regulation Organization
Union Gas	Design Engineer	Natural Gas Distribution
Veridian Connections	Manager of Engineering	Electric Services/Electric Power Distribution
Preferred to remain anonymous	Engineering Manager	Natural Gas Transmission
Bliant Electrical	Electrical Engineer	Design and Construction
Electricity Human Resources Canada	Chief Executive Officer	Human Resources Organization in Electricity and Renewable Energy

Appendix 2: Program Description

This proposed Bachelor of Engineering will be a 5 year (4 years of coursework plus an internship) CEAB accredited undergraduate program in Electrical Engineering, with elective options in Power & Energy Systems and Mechatronics. In addition to coursework, graduates of this degree will have completed a 4 month co-op term between years 2 and 3 of their studies and an internship of 12 to 16 months between their third and fourth years. Graduates from this program will have met the academic requirements for licensure as a professional engineer; the internship will qualify as a pre-graduation experience towards the work requirement of an engineering license, reducing the time required for graduates to earn their professional engineering designation.

This proposed program is designed on the CDIO framework as advocated by MIT. The CDIO framework emphasizes four key aspects of the practice of engineering – Conceive, Design, Implement, and Operate. While contemporary undergraduate engineering programs emphasize the teaching of engineering science, the CDIO framework seeks to interweave the teaching of engineering science with the teaching of the skills needed for the practice of engineering in a modern context. These skills include, but are not limited to, business knowledge, systematic thinking, creativity, entrepreneurship, leadership, and problem solving. The proposed program curriculum is designed to provide students with opportunities to effectively develop students' technical and functional expertise. The electrical engineering curriculum focuses on innovation, design, hands-on-experience, multi-disciplinarily communication, teamwork and problem solving. This is achieved by integrating project-based learning throughout the program. This instructional method encourages students to develop their problem solving and critical thinking skills through their involvement in real-life industrial projects. In this approach there is less emphasis on passive transmission of information and more

emphasis on engaging students in manipulating, applying, analyzing, and evaluating ideas.

Power and Energy Systems Option

This intensive elective consists of 8 courses which will give students an in-depth background in modern electrical power generation, transmission and distribution; including emerging technologies in power systems (Smart Grid, F.A.C.T.S. [dynamic compensation], Energy Storage, Integration of Renewable Energy Sources, Distributed Generation and Micro Grids). Graduates of this option will be able to demonstrate their interdisciplinary engineering skills for the analysis, modelling, design, development, and operation of sustainable energy systems.

Mechatronics Option

Mechatronics is a modern interdisciplinary field, combining the elements of electrical and mechanical engineering. Graduates of this interdisciplinary option will be able to utilize a holistic approach to solve modern engineering problems with integrated skills and knowledge in mechanical, electrical, computer, and control engineering; meeting the needs of trans-disciplinary high-tech industries.

Section 14: Duplication Standard

The following section summarizes the benefits of the proposed Electrical Engineering degree program to Sheridan College in relation to the diploma programs, how the degree program is differentiated from other similar degree programs in Ontario and a detailed analysis comparing the degree program to similar degrees at other Ontario engineering schools.

Effects on Existing Programs at Sheridan

The program development team does not anticipate any adverse effect on current engineering and technology diploma programs, or any programs currently offered at Sheridan College. In fact, the proposed program will complement the current diploma programs offered and support other programs at Sheridan College. The proposed program will offer diploma students a new pathway to continue their education at Sheridan, while continuing to live in the Brampton area.

Furthermore, the proposed Electrical Engineering degree program would share resources with the current diploma program, including teaching and lab resources, thus maximizing the use of the facilities. The current diploma programs would benefit from the increased recognition that the School of Mechanical and Electrical Engineering Technology would gain in the marketplace. The diploma students would have new opportunities as a result of industry partnerships and projects, as well as research opportunities that would come with the proposed program.

Having mechanical engineering students within the same school, sharing classrooms and labs and even working on the same projects in senior years, the program will encourage interdisciplinary collaboration, which is very desirable for the industry. Furthermore the proposed program can offer the opportunity for interdisciplinary projects with other schools within Sheridan, such as Business, Chemistry, Architecture, and Industrial Design, through the Capstone projects.

Differentiating Sheridan's Engineering Program

Sheridan's proposed degree program in Electrical Engineering would differentiate itself in many ways from programs at other engineering schools. The program is based on the CDIO framework and other differentiating factors as summarized below:

Sheridan Differentiators	Description
Differentiator #1: CDIO Principles	Sheridan's degree program is based on the CDIO initiative, an innovative educational framework for producing the next generation of engineers. The framework provides students with engineering fundamentals set in the context of Conceiving - Designing - Implementing - Operating real-world systems and products. The CDIO approach will accelerate the student's

Sheridan Differentiators	Description
	development from entry level engineer to strong, effective contributors from day one.
Differentiator #2: Learning Outcomes	Sheridan's degree program embodies specific and detailed learning outcomes, not only for disciplinary knowledge and technical skills, but also for personal and interpersonal skills, and system building knowledge and skills, which prepare the graduates to function in real engineering teams and to produce real products, processes and systems, meeting professional standards, enterprise and societal needs.
Differentiator #3: Integrated Curriculum	Sheridan's degree program curriculum is designed with mutually supporting disciplinary courses that integrate project-based learning environment with personal and interpersonal skills, project management skills, and building skills for real products, processes and systems. The teaching of these skills is not added as separate courses to the program, but is an integral part of the entire program.
Differentiator #4: Four Cycles of Design - Implement Experiences	Sheridan's degree program provides four cycles of the Design - Implement experience through the yearly project in BUS structure. With increasing scope and complexity, these projects begin in Year 1 and scaffold learning to Year 4 where the students complete their Capstone project. These experiences reinforce students' under-standing of the product, process and system development cycles and provide them with opportunities to make connections between the technical content they learn and their professional and career interests. Most universities only have 1 or 2 iterations of the Design - Implement cycle; many just have one final capstone project.
Differentiator #5: Engineering Workspaces	Sheridan's engineering workspaces and laboratories support and encourage hands-on and project-based learning environment for building skills for real products, processes and systems, as well as disciplinary knowledge and social learning. These facilities are user-friendly, accessible, available outside of class times and interactive with lab technicians. Sheridan's class sizes will be small (classroom maximum 48, labs maximum 24, throughout four years), relative to class sizes at traditional engineering schools, which can be well over 100 students.
Differentiator #6: Industry-Relevant Learning Experiences	The program includes unique courses and contents to address and close the skills gap existing in the relevant industry job market. Through BUS projects, Sheridan's engineering students will be engaged with applied research and project

Sheridan Differentiators	Description
	partners from industry. With integrated learning experiences, the program can be more effective in enabling students to apply disciplinary knowledge to engineering practices and equipping them with the skills to meet the demands of today's engineering profession.
Differentiator #7: Active Learning	Sheridan's teaching and learning methods, based on project-based environment, engage students directly in thinking and problem solving activities, giving them opportunities to manipulate, apply, analyze and evaluate ideas. Experiential learning methods will be used through the use of BUS projects, flipped classroom learning, tours, guest speakers, to name a few. This will lead to a high level of student achievement of learning outcomes and satisfaction.
Differentiator #8: Enhancement of Faculty Skills and Teaching	The BUS projects and industry-relevant learning experience will be direct results of applied research activities engaged by Sheridan's engineering faculty in collaboration with industry. They are "Professors of Practice," often with many years of industry experience and specific skill sets, who will continuously update their engineering knowledge and skills. They can provide industry-relevant examples to students and better serve as role models. Faculty teaching Engineering Science and Design courses will have the credential of Ph.D. in a relevant discipline, P. Eng. designation and relevant industrial work experience.

In addition to the above 8 differentiators, the following factors can be also identified as differentiators:

- Sheridan's focus on undergraduate education is a significant differentiator from programs at many large research-oriented universities.
- The narrowed focus on only two intra-program specialization options is a differentiator that is important and ensures quality.
- Sheridan's program closes the gap between traditional programs at many universities that focus only on conceptual theory and the practical needs of industry for starting engineers. Having the opportunity to design a new program with no institutional tradition allows Sheridan to learn from the experience of others.
- The co-existence of the technician and technology programs is a unique differentiator. Diploma programs and degree programs can be mutually beneficial and the students can have a chance to transfer into the degree program after completing the diploma program. This is attractive to students as they have more flexibility in designing their career path.

- Having mechanical engineering students sharing classrooms and labs and even working on the same projects in senior years, the program will encourage interdisciplinary collaboration, which is very desirable for the industry.

14.1 Similar College Programs

As identified in the economic need, currently there is no other college offering a bachelor's degree in Electrical Engineering. The only comparable program is at Conestoga College, where a degree program in Electronic Systems Engineering is offered. However, the Conestoga program is a program with a limited scope and does not offer a comprehensive coverage of Electrical Engineering like Sheridan's proposed program.

1. Institution: Conestoga College
Program Name & Credential: Electronic Systems Engineering (Bachelor of Engineering, B.Eng.), CEAB accredited program in the School of Engineering and Information
Program Description: Graduates of the program will be prepared to assume engineering and managerial functions in test and software design, network design, embedded systems design, and wireless networks.
Analysis of Similarities and Differences: • Both programs have a set of common first year courses such as fundamentals of engineering, math, and sciences. • Both programs have small class sizes. • Both programs employ a project-based curriculum, with a series of increasingly complex engineering projects. • Both programs encompass capstone projects in their last years. • Both programs are designed to meet CEAB and PEO requirements. **Differences:** • Conestoga's program has a limited scope, oriented towards data communications, signal processing, wireless communications and network related applications. It is not a broad Electrical Engineering program like Sheridan's proposed program. • Sheridan's program includes two technical specializations, one in Power Systems and the other in the Mechatronics fields. Each of these technical streams allocates eight full specialization specific courses over the last two years of the program. • Sheridan's program organizes its project based learning and practical engineering work through small classes and integrated work teams from semester one using five engineering design courses and four integrated learning blocks. • Sheridan's program is based on the Conceive – Design – Implement – Operate approach, including a sequence of integrated learning experiences to challenge students to resolve complex, interdisciplinary engineering problems.

- Sheridan's program has both a four-month mandatory internship work term and an optional 8-16 month professional co-op work term, whereas Conestoga includes three four-month mandatory work terms.

14.2 Similar or Related University Programs

A summary and analysis of the similarities and differences between the college's proposed program and the **five programs** offered at Ontario Universities that are most similar or related to the one proposed.

1. Institution: University of Ontario Institute of Technology

Program Name & Credential:

Electrical Engineering (Bachelor of Engineering), CEAB accredited program in the Department of Electrical, Computer and Software Engineering, Faculty of Engineering and Applied Science

Program Description:

In the first year, students study courses in mathematics, sciences, and computing, which represent the foundation building blocks of most engineering programs. In the second year, students cover, in addition to advanced mathematics, fundamental electrical engineering courses. In third and fourth year, students study a range of applied and advanced electrical engineering courses, including computer architecture, signals and systems, circuit design, microprocessors, power systems, computer networks, digital communications, and control systems.

Analysis of Similarities and Differences:

- Both programs are for undergraduate degrees in electrical engineering.
- Both programs have a set of common first year courses for fundamentals, math, and sciences.
- Both programs emphasize core electrical and electronics engineering in general.
- Both programs encompass capstone projects in their final year.
- Both programs are designed to meet CEAB and PEO requirements.

Differences:

- UOIT's program is a general electrical engineering degree with a fixed engineering curriculum, with two technical elective courses in the final year of study, whereas Sheridan's program builds a comprehensive specialization with an eight-course technical stream in either Power & Energy Systems or Mechatronics over the last two years. Sheridan graduates with either stream benefit from both a general knowledge of electrical engineering principals and specialized knowledge in their chosen option, which will make the graduates more productive immediately after graduation.

- Sheridan's program emphasizes project-based learning and practical engineering work from semester one using five engineering design courses and four integrated learning blocks.
- Sheridan's program consists of four BUS Structure learning blocks that connect the learning outcomes and deliverables of course clusters through common design projects.
- Sheridan's program is based on the Conceive – Design – Implement – Operate approach. It constructs a sequence of incrementally difficult integrated learning experiences to challenge students to resolve modern, complex engineering problems.
- Sheridan's program has a four-month internship work term and an optional 8-16 month professional co-op work term, whereas UOIT's program has an optional one year internship.

2. Institution: The University of Western Ontario

Program Name & Credential:

Electrical Engineering (Bachelor of Engineering Science), CEAB accredited program in the Department of Electrical and Computer Engineering, Faculty of Engineering

Program Description:

After following the common curriculum for the first three years, the students have an option to enroll in a Wireless Communication option, a Power Systems option or a Biomedical Signals and Systems option in the fourth year.

Analysis of Similarities and Differences:

- Both programs are for undergraduate degrees in electrical engineering.
- Both programs have a set of common first year courses such as fundamentals of engineering, math, and sciences.
- Both programs emphasize core electrical and electronics engineering in general.
- Both programs encompass capstone projects in their final year.
- Both programs have elective specializations in electrical power and energy systems
- Both programs are designed to meet CEAB and PEO requirements.

Differences:

- Western's program consists of 4 specialist courses in electrical power systems (1 of the four courses is required for all EE undergraduates), and the specialization takes place in year 4; whereas, Sheridan's program allows students to develop a core specialization in electrical engineering, with an intensive program of 8 electives over years 3 and 4 in electrical power and energy systems, including cross disciplinary electives. This larger elective base allows students to develop a broader base of power system specific knowledge, better preparing them for careers in the power generation, transmission and distribution industries.

- Sheridan's program emphasizes project-based learning and practical engineering work from semester one using five engineering design courses and four integrated learning blocks.
- Sheridan's program consists of four BUS Structures learning blocks that connect the learning outcomes and deliverables of course clusters through common design projects.
- Sheridan's program is based on the Conceive – Design – Implement – Operate approach. It constructs a sequence of incrementally difficult integrated learning experiences to challenge students to resolve modern, complex engineering problems.
- Sheridan's program has a four month internship and an optional 8-16 month professional co-op work term whereas Western's program has an optional one year internship.
- Programs at Sheridan College benefit from much smaller class sizes (max 48 students for lectures). This allows for a much friendlier and close interaction between instructors and students**.**
- Programs at Sheridan are more intensively hands on, typical upper year classes at Western have four 3-hour lab sessions, whereas upper year classes at Sheridan have 28 hours of laboratory scheduled per course.

3. Institution: McMaster University

Program Name & Credential:

Electrical Engineering (Bachelor of Engineering), CEAB accredited program in the Department of Electrical and Computer Engineering, Faculty of Engineering

Program Description:

The program starts with a common first year engineering curriculum, Engineering I. The Electrical Engineering is focused more heavily on electronics, electromagnetics and communication systems. In addition, power systems, sustainable energy, and computer hardware/software are integrated into the program. In fourth year, students can choose elective courses for options in Control, Photonics, Microelectronic, Power and Energy, and Communications.

Analysis of Similarities and Differences:

- Both programs are for undergraduate degrees in electrical engineering.
- Both programs have a set of common first year courses such as fundamentals of engineering, math, and sciences.
- Both programs emphasize core electrical engineering in general.
- Both programs encompass capstone projects in their final year.
- Both programs are designed to meet CEAB and PEO requirements.

Differences:

- The McMaster program offers four technical elective courses as specialization in their fourth year, whereas Sheridan's program builds a comprehensive

specialization with an eight-course technical stream in either Power & Energy Systems or Mechatronics over the last two years. Sheridan graduates with either stream benefit from both a general knowledge of electrical engineering principals and specialized knowledge in their chosen option, which will make the graduates more productive immediately after graduation.

- Sheridan's specialization in Power & Energy Systems with eight specialization courses, is designed to ensure stronger foundations and advanced skills in power generation, transmission, distribution system design, and alternative energy, to suit the requirement of utility and energy industry.
- Sheridan's program has a mandatory four-month internship and a 8-16 month optional professional co-op, whereas McMaster's program offers flexible co-op work terms – all students are eligible to work for four summer months and students can go out for 8, 12, or 16 months, with the requirement to complete 12 months of industrial/practical experience prior to graduation.
- Sheridan's program consists of BUS structures and integrated learning blocks that connect the learning outcomes and deliverables of course clusters through common design projects.
- Sheridan's program is based on the Conceive-Design-Implement-Operate approach.
- Sheridan's program emphasizes project based learning and practical engineering work from semester one, using four cycles of integrated design projects and internship/co-op placement.

4. Institution: University of Waterloo

Program Name & Credential:

Electrical Engineering (Bachelor of Applied Science, B.A.Sc.), CEAB accredited program in the Department of Electrical and Computer Engineering, Faculty of Engineering

Program Description:

The curriculum consists of prescribed core courses complemented by five technical elective courses, two natural sciences elective courses, and four complementary studies elective courses. Each cohort students share all courses in the first three academic terms. The next three academic terms see two shared core courses, two program-specific courses, and an elective of each student's choice. The last two years see all electrical and computer engineering students merge again to take their chosen technical electives in each student's own personal areas of focus. There are six co-operative work terms.

Analysis of Similarities and Differences:

- Both programs are for undergraduate degrees in electrical engineering.
- Both programs have a set of common first year courses in fundamentals, math, and sciences.
- Both programs emphasize core electrical engineering in general.
- Both programs encompass capstone projects in their final year.

- Both programs are designed to meet CEAB and PEO requirements.

Differences:

- Electrical Engineering program at University of Waterloo puts relatively more emphasis on microwave/photonic systems, devices/fabrication, and power systems, whereas Sheridan's electrical engineering program has a broader scope.
- Electrical Engineering program at University of Waterloo offers five technical elective courses as specialization in the fourth year, whereas Sheridan's program builds a comprehensive specialization with an eight-course technical stream in either Power & Energy Systems or Mechatronics over the last two years. Sheridan graduates with either stream benefit from both a general knowledge of electrical engineering principals and specialized knowledge in their chosen option, which will make the graduates more productive immediately after graduation.
- Sheridan's Electrical Engineering program emphasizes practical engineering aspects using project-based learning from the first semester, whereas the University of Waterloo program introduces the project courses in their final year.
- Sheridan's Electrical Engineering program consists of four BUS Structures learning blocks that connect the learning outcomes and deliverables of various courses through common design projects. There is no such design project at the University of Waterloo program.
- Sheridan's Electrical Engineering program is based on the Conceive – Design – Implement - Operate concept. This concept covers the critical methodologies and experiences needed for students to work as productive engineers in industrial teams designing and building Electrical and electronic products.
- Sheridan's program benefits from much smaller class sizes for lectures.

5. Institution: University of Guelph

Program Name & Credential:

Engineering Systems and Computing (Bachelor of Engineering, B.Eng.), CEAB accredited program in the School of Engineering, College of Physical and Engineering Science

Program Description:

The program has been designed with a focus on designing integrated computer based engineering systems covering software development, computer hardware design, mechanics and energy transfer, signal processing and optimization control to empower the graduates to tackle the design of modern systems that requires multi-disciplinary skills and knowledge.

Analysis of Similarities and Differences:

- Both programs have a set of common first year courses such as fundamental sciences, math and engineering.
- Both programs have a specialization option in mechatronics

- Both programs encompass capstone projects in their last years.
- Both programs are designed to meet CEAB and PEO requirements.

Differences:

- Guelph's program has 4 stream options in Mechatronics, Embedded System, Computing and Biomedical Engineering, while Sheridan's program has 2 stream options in Mechatronics and Power Systems. Although Guelph's program appears to offer more options, they are all somewhat related fields in a broader definition of embedded systems. Sheridan's program offers two distinct specializations. The Power & Energy Systems in Sheridan's program targets utilities and energy systems sector, which may be the most important field in Electrical Engineering.
- Sheridan's program emphasizes project based learning and hands-on work from semester one.
- Sheridan program has a mandatory four-month internship and an optional 8-16 month professional co-op work term whereas Guelph has a 16-20 month optional co-op work placement.
- Sheridan's program is based on the Conceive, Design, Implement and Operate approach. It constructs a sequence of incrementally difficult integrated learning experiences to challenge the students to resolve modern day complex engineering problems.

Section 15: Optional Material

Bachelor of Engineering (Electrical Engineering) Proposed Program Map (Power & Energy Systems Option)

	Discipline Courses						**Breadth Courses**
Term 1 Fall Year 1	Calculus 1	Linear Algebra	Fundamentals of Physics 1	Exploring Engineering	Engineering in Society – Health & Safety		Composition & Rhetoric
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (2-2-2)	Credits: 3.0 (3-0-0)		Credits: 3.0 (3-0-0)
Term 2 Winter Year 1	Calculus 2 P: Calculus 1	Intro. to Chemistry for Engineers	Fundamentals of Physics 2 P: Calculus 1 and Fund. of Physics 1	Engineering Design and Problem Solving P: Exploring Engineering	Computer Programming		*Breadth Elective Course*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 3 Fall Year 2	Differential Equations P: Calculus 2	Fundamentals of Digital Systems	Algorithms and Data Structures P: Computer Programming	Electronic Circuits 1 P: Fund. of Physics 2	Electrical Circuits and Power P: Fund. of Physics 2		*Breadth Elective Course*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (2-2-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 4 Winter Year 2	Numerical Methods P: Differential Equations	Signals and Systems 1 P: Diff. Equations	Fundamentals of EM Fields P: Fund. of Physics 2	Electronic Circuits 2 P: Electronic Circuits 1	Microprocessor Systems P: Fund. of Digital Systems	Co-op and Career Preparation	*Breadth Elective Course*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (2-2-2)	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 1.0 (1-0-0)	*Credits: 3.0 (3-0-0)*
Mandatory Internship Term (4 summer months)							
Term 5 Fall Year 3	Statistics and Quality P: Linear Algebra	Signals and Systems 2 P: Signals and Systems 1	Communication Systems P: Signals and Systems 1	Electric Power Gen. and Transmission P: Electrical Circuits and Power	Introduction to Energy Systems P: Fund. of Physics 2		*Breadth Elective Course*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 6 Winter Year 3	Design of Digital Systems P: Microprocessor Systems	Control Systems P: Signals and Systems 2	Electric Machines P: Electrical Circuits and Power	Power Electronics P: Electrical Circuits and Power, and Electronic Circuits 1	Power Distribution System Design P: Electrical Circuits and Power	Engineering Internship Preparation	*Breadth Elective Course*
Credits:	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 0.0 (1-0-0)	*Credits: 3.0 (3-0-0)*
Optional Co-Op Term (8 to 16 months, year 4)							
Term 7 Fall Year 4	Capstone Project (C&D)	Micro-Controller Applications P: Design of Digital Systems		Power System Analysis P: Electric Power Gen. and Trans.	Alternative Energy Systems P: Introduction To Energy Systems	Engineering Economics and Entrepreneurship	*Breadth Elective Course*
Credits:	Credits: 4.0 (2-4-0)	Credits: 4.0 (3-2-0)		Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 3.0 (3-0-0)	*Credits: 3.0 (3-0-0)*
Term 8 Winter Year 4	Capstone Project (D, I & O) P: Capstone Project (C&D)			Power System Control & Protection P: Power System Analysis	Intelligent Power Systems P: Power System Analysis		*Breadth Elective Course*
Credits:	Credits: 5.0 (2-6-0)			Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Total Credits:				**Total Hours: Core (2674 hours) and Non-core (336 hours)**			

Bachelor of Engineering (Electrical Engineering) Proposed Program Map (Mechatronics Option)

	Discipline Courses						Breadth Courses
Term 1 Fall Year 1	Calculus 1	Linear Algebra	Fundamentals of Physics 1	Exploring Engineering	Engineering in Society – Health & Safety		Composition & Rhetoric
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (2-2-2)	Credits: 3.0 (3-0-0)		Credits: 3.0 (3-0-0)
Term 2 Winter Year 1	Calculus 2 P: Calculus 1	Intro. to Chemistry for Engineers	Fundamentals of Physics 2 P: Calculus 1 and Fund. of Physics 1	Engineering Design and Problem Solving P: Exploring Engineering	Computer Programming		*Breadth Elective*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 3 Fall Year 2	Differential Equations P: Calculus 2	Fundamentals of Digital Systems	Algorithms and Data Structures P: Computer Programming	Electronic Circuits 1 P: Fund. of Physics 2	Electrical Circuits and Power P: Fund. of Physics 2		*Breadth Elective*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (2-2-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 4 Winter Year 2	Numerical Methods P: Differential Equations	Signals and Systems 1 P: Diff. Equations	Fundamentals of EM Fields P: Fund. of Physics 2	Electronic Circuits 2 P: Electronic Circuits 1	Microprocessor Systems P: Fund. of Digital Systems	Co-op and Career Preparation	*Breadth Elective*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (2-2-2)	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 1.0 (1-0-0)	*Credits: 3.0 (3-0-0)*
Mandatory Internship Term (4 summer months)							
Term 5 Fall Year 3	Statistics and Quality P: Linear Algebra	Signals and Systems 2 P: Signals and Systems 1	Communication Systems P: Signals and Systems 1	Embedded Software Fundamentals P: Algorithms and Data Structures	Modeling and Simulation P: Numerical Methods		*Breadth Elective*
Credits:	Credits: 4.0 (3-0-2)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Term 6 Winter Year 3	Design of Digital Systems P: Microprocessor Systems	Control Systems P: Signals and Systems 2	Electric Machines P: Electrical Circuits and Power	Embedded Appl. Development P: Embedded Software Fund.	Kinematics and Robotics P: Fund. of Physics 1	Engineering Internship Preparation	*Breadth Elective*
Credits:	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 0.0 (1-0-0)	*Credits: 3.0 (3-0-0)*
Optional Co-Op Term (8 to 16 months, year 4)							
Term 7 Fall Year 4	Capstone Project (C&D)	Micro-Controller Applications P: Design of Digital Systems		Microelectromechanical Systems (MEMS) P: Design of Digital Systems	Mechatronics Principles P: Design of Digital Systems	Engineering Economics and Entrepreneurship	*Breadth Elective*
Credits:	Credits: 4.0 (2-4-0)	Credits: 4.0 (3-2-0)		Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)	Credits: 3.0 (3-0-0)	*Credits: 3.0 (3-0-0)*
Term 8 Winter Year 4	Capstone Project (D, I & O) P: Capstone Project (C&D)			Embedded Systems Design P: Micro-Controller Applications	Mechatronic System Design P: Mechatronics Principles		*Breadth Elective*
Credits:	Credits: 5.0 (2-6-0)			Credits: 4.0 (3-2-0)	Credits: 4.0 (3-2-0)		*Credits: 3.0 (3-0-0)*
Total Credits:				**Total Course Hours: Core (2674 hours), Non-core (336 hours)**			

Section 16: Policies

The policies on file with PEQAB are current.

References

Aon Hewitt. (2016). Developing Canada's future workforce: A survey of large private-sector employers. Business Council of Canada. Retrieved from http://thebusinesscouncil.ca/wp-content/uploads/2016/03/Developing-Canadas-Future-Workforce.pdf

CDIO. (2016). Conceive, design, implement, operate. Chalmers University of Technology, Gothenburg, Sweden. Retrieved from http://www.cdio.org.

Conference Board of Canada's (2013, June). The need to make skills work: The cost of Ontario's skills gap by Stuckey, J. and Munro, D. Retrieved from http://www.collegesontario.org/Need_to_Make_Skills_Work_Report_June_2013.pdf

Engineers Canada (2015, June). Engineering labour market in Canada: Projections to 2025. Prepared by C4SE. Retrieved from https://engineerscanada.ca/sites/default/files/Labour-Market-2015-e.pdf

Matthews, D. (2016, September). Memo on Engineering in Ontario. Minister of Advanced Education and Skills Development.

Office of the Premier. (2016). Speech from the throne: A balanced plan to build Ontario up for everyone. Retrieved from https://news.ontario.ca/opo/en/2016/09/speech-from-the-throne.html

Ontario Provincial Government. (2016). Business growth initiative. Queen's Printer for Ontario. Retrieved from https://www.ontario.ca/page/business-growth-initiative.

Schwab, K. (2015, May). The new key to economic growth is unlocking latent talent. Globe and Mail. Retrieved from http://www.theglobeandmail.com/report-on-business/rob-commentary/the-new-key-to-economic-growth-is-unlocking-latent-talent/article24424439/