Area of Interest: Engineering and Architecture

**Electrical Engineering Technician (Co-op and Non Co-op Version)**

Ontario College Diploma
2 Years
Ottawa Campus

**Academic Year:** 2020/2021

**Program Code:** 0317X01FWO

**Our Program**

*Use state-of-the-art equipment to obtain valuable career-ready skills.*

The two-year Electrical Engineering Technician Ontario College Diploma program provides you with the essential knowledge and skills sought by employers in the industry. Develop skills in the design, installation, maintenance and repair of electrical systems from cable loops, phone and fire suppression systems to robotics and machinery.

Through a series of theory courses and extensive practical labs, you learn to use scientific and engineering principles, including:

- foundation of electrical principles, codes and regulations
- how to design, install and troubleshoot electromagnetic controls, electrical machinery and programmable controllers
- the different instrumentation options available and the applicable use for them
- an understanding of robotics and controls as well as industrial telecommunications
- critical thinking skills and an understanding of the environmental impact of technology
- AutoCAD and applications
- the different infrastructure requirements of distributed electrical systems or fire alarm system codes and standards, installation and maintenance
- fundamentals of mathematics, calculus, technical communications for engineers, programming and computer applications
- project management and leadership skills

OACETT (Ontario Association of Certified Engineering Technicians and Technologists) recognizes this program as meeting the academic requirements for certification in the Certified Technician (C.Tech) category. While a student, you are encouraged to register as an Associate member of OACETT.

Graduates of the Electrical Engineering Technician program may pursue the Electrical Engineering Technology Ontario College Advanced Diploma to further open career options in the electrical engineering field. The advanced diploma also creates an opportunity to transfer into year 3 of the Electrical Engineering program at Lakehead University.

This program prepares you to work in a wide variety of careers in the electrical industry, including in areas such as electrical testing and maintenance, manufacturing and electrical automation.

Graduates may work in the electrical engineering field as a(n):

- electrical designer
- electrical technician/technologist electrical engineering technologist
• robotics technician
• instrumentation and Controls (I&C) technician
• automation engineering technologist
• control/automation technician
• instrument Technician

SUCCESS FACTORS
This program is well-suited for students who:
• Enjoy applying physical and chemical laws and practising logic to find solutions to physical problems.
• Seek variety and opportunity in their career.
• Have strong observational and analytical skills.

Employment
Graduates may find employment as Electrical Engineering Technicians in the following areas: design and testing, manufacturing, installation and/or supervision, diagnostics and analysis of electrical, communication, utilities, and fire protection equipment and systems.

Learning Outcomes
The graduate has reliably demonstrated the ability to:
• Interpret and produce electrical and electronics drawings including other related documents and graphics.
• Analyze and solve routine technical problems related to electrical systems by applying mathematics and science principles.
• Use, verify, and maintain instrumentation equipment and systems.
• Assemble, test, modify and maintain electrical circuits and equipment to fulfill requirements and specifications under the supervision of a qualified person.
• Install and troubleshoot static and rotating electrical machines and associated control systems under the supervision of a qualified person.
• Verify acceptable functionality and apply troubleshooting techniques for electrical and electronic circuits, components, equipment, and systems under the supervision of a qualified person.
• Analyze, assemble and troubleshoot control systems under the supervision of a qualified person.
• Use computer skills and tools to solve routine electrical related problems.
• Assist in creating and conducting quality assurance procedures under the supervision of a qualified person.
• Prepare and maintain records and documentation systems.
• Install, test and troubleshoot telecommunication systems under the supervision of a qualified person.
• Apply health and safety standards and best practices to workplaces.
• Perform tasks in accordance with relevant legislation, policies, procedures, standards, regulations and ethical principles.

• 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.

• Assist in commissioning, testing and troubleshooting electrical power systems under the supervision of a qualified person.

• Select electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.

• Apply project management principles to assist in the implementation of projects.

• Identify and apply discipline-specific practices that contribute to the local and global community through social responsibility, economic commitment and environmental stewardship.

### Program of Study

<table>
<thead>
<tr>
<th>Level: 01</th>
<th>Courses</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAT8942</td>
<td>Computer Applications - Electrical</td>
<td>42.0</td>
</tr>
<tr>
<td>ELE8909</td>
<td>Electrical Principles I</td>
<td>84.0</td>
</tr>
<tr>
<td>ELE8913</td>
<td>Codes and Regulations</td>
<td>42.0</td>
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<td>ELE8919</td>
<td>Achieving Success in the 21st Century</td>
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<td>ENL1813T</td>
<td>Communications I</td>
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<tr>
<td>MAT8100</td>
<td>Essential Mathematics</td>
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<tr>
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<tr>
<td>DAT8921</td>
<td>Introduction to Programming</td>
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<tr>
<td>ELE8921</td>
<td>Electromagnetic Control</td>
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<tr>
<td>ELE8922A</td>
<td>Electrical Principles - II</td>
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<tr>
<td>ELE8923</td>
<td>Electrical Machinery</td>
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<td>PHY8201</td>
<td>Environmental Impact of Technology</td>
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<tr>
<td>ELE8930</td>
<td>Power Electronics</td>
<td>98.0</td>
</tr>
<tr>
<td>ELE8932</td>
<td>Programmable Controllers</td>
<td>84.0</td>
</tr>
<tr>
<td>ELE8944</td>
<td>Building Electrical Systems with AutoCAD</td>
<td>56.0</td>
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<tr>
<td>MAT8101</td>
<td>Differential Calculus</td>
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Choose one from equivalencies:

<table>
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<tr>
<th>Courses</th>
<th>Hours</th>
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<tbody>
<tr>
<td>GED0317</td>
<td>General Education Elective</td>
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### Co-op: 01

<table>
<thead>
<tr>
<th>Courses</th>
<th>Hours</th>
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<tbody>
<tr>
<td>WKT2101E</td>
<td>Co-op Work Term Electrical</td>
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<table>
<thead>
<tr>
<th>Level: 04</th>
<th>Courses</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ELE8931</td>
<td>Industrial Instrumentation</td>
<td>56.0</td>
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<tr>
<td>ELE8940</td>
<td>Industrial Telecommunications</td>
<td>70.0</td>
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<tr>
<td>ELE8941</td>
<td>Robotics and Controls</td>
<td>56.0</td>
</tr>
<tr>
<td>ELE8949</td>
<td>Project Management for Electrical Engineering Technicians</td>
<td>14.0</td>
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<tr>
<td>ENL2019T</td>
<td>Technical Communication for Engineering Technologies</td>
<td>42.0</td>
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### Elective: choose 1

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<tr>
<th>Courses</th>
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<tr>
<td>ELE8945</td>
<td>Distributed Power Systems</td>
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<tr>
<td>ELE8946</td>
<td>Fire Alarm Systems</td>
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<tr>
<th>Approved Other Electives</th>
<th>Courses</th>
<th>Hours</th>
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<tr>
<td>ELE8942T</td>
<td>Technician Skills</td>
<td>42.0</td>
</tr>
<tr>
<td>MAT8102</td>
<td>Integral Calculus</td>
<td>42.0</td>
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</table>
Fees for the 2020/2021 Academic Year

Tuition and related ancillary fees for this program can be viewed by using the Tuition and Fees Estimator tool at [https://www.algonquincollege.com/fee-estimator](https://www.algonquincollege.com/fee-estimator).

Further information on fees can be found by visiting the Registrar’s Office website at [https://www.algonquincollege.com/ro](https://www.algonquincollege.com/ro).

Fees are subject to change.

Additional program related expenses include:

Expenses total approximately $1,200 in the first year and $750 in the second year. Most supplies can be purchased at the campus store. See [https://www.algonquincollege.com/coursematerials/](https://www.algonquincollege.com/coursematerials/) for more information about books.

Students are responsible for parking and locker fees, if applicable.

All students are responsible to supply their own personal protective equipment, such as CSA-approved safety footwear, protective eyewear, hearing protection, gloves, hard hat, as required in each lab environment.

Admission Requirements for the 2021/2022 Academic Year

College Eligibility

• Ontario Secondary School Diploma (OSSD) or equivalent. Applicants with an OSSD showing senior English and/or Mathematics courses at the Basic Level, or with Workplace or Open courses, will be tested to determine their eligibility for admission; OR

• Academic and Career Entrance (ACE) certificate; OR

• General Educational Development (GED) certificate; OR

• Mature Student status (19 years of age or older and without a high school diploma at the start of the program). Eligibility may be determined by academic achievement testing for which a fee of $50 (subject to change) will be charged.

Program Eligibility

• English, Grade 12 (ENG4C or equivalent).

• Mathematics, (Grade 12 MCT4C) or (Grade 11 MCR3U) or equivalent.

• Applicants with Grade 12 (MAP4C with a grade of 60% or higher) or Grade 11 (MCF3M with a grade of 50% or higher) will be required to take additional preparatory mathematics as part of their program of study.

• Applicants with international transcripts must provide proof of the subject specific requirements noted above and may be required to provide proof of language proficiency. Domestic applicants with international transcripts must be evaluated through the International Credential Assessment Service of Canada (ICAS) or World Education Services (WES).

• IELTS-International English Language Testing Service (Academic) Overall band of 6.0 with a minimum of 5.5 in each band; OR TOEFL-Internet-based (iBT)-overall 80, with a minimum of 20 in each component: Reading 20; Listening 20; Speaking 20; Writing 20.

Should the number of qualified applicants exceed the number of available places, applicants will be selected on the basis of their proficiency in English and mathematics.

Admission Requirements for 2020/2021 Academic Year

College Eligibility

• Ontario Secondary School Diploma (OSSD) or equivalent. Applicants with an OSSD showing
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• Academic and Career Entrance (ACE) certificate; OR

• General Educational Development (GED) certificate; OR

• Mature Student status (19 years of age or older and without a high school diploma at the start of the program). Eligibility may be determined by academic achievement testing for which a fee of $50 (subject to change) will be charged.

Program Eligibility

• English, Grade 12 (ENG4C or equivalent).

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• Applicants with Grade 12 (MAP4C with a grade of 60% or higher) or Grade 11 (MCF3M with a grade of 50% or higher) will be required to take additional preparatory mathematics as part of their program of study.

• International applicants must provide proof of the subject specific requirements noted above along with proof of either: (IELTS / TOEFL) IELTS-International English Language Testing Service (Academic) Overall band of 6.0 with a minimum of 5.5 in each band; OR TOEFL-Internet-based (iBT)-overall 80, with a minimum of 20 in each component: Reading 20; Listening 20; Speaking 20; Writing 20.

• Applicants with international transcripts must provide proof of the subject specific requirements noted above and may be required to provide proof of language proficiency.

Should the number of qualified applicants exceed the number of available places, applicants will be selected on the basis of their proficiency in English and mathematics.

Application Information

ELECTRICAL ENGINEERING TECHNICIAN (CO-OP AND NON CO-OP VERSION)
Program Code 0317X01FWO

Applications to full-time day programs must be submitted with official transcripts showing completion of the academic admission requirements through:

ontariocolleges.ca
60 Corporate Court
Guelph, Ontario N1G 5J3
1-888-892-2228

Students currently enrolled in an Ontario secondary school should notify their Guidance Office prior to their online application at http://www.ontariocolleges.ca/.

Applications for Fall Term and Winter Term admission received by February 1 will be given equal consideration. Applications received after February 1 will be processed on a first-come, first-served basis as long as places are available.

International applicants please visit this link for application process information: https://algonquincollege.force.com/myACint/.

For further information on the admissions process, contact:

Registrar’s Office
Algonquin College
1385 Woodroffe Ave
Ottawa, ON K2G 1V8
Telephone: 613-727-0002
Toll-free: 1-800-565-4723
TTY: 613-727-7766
Fax: 613-727-7632
Additional Information

Programs at Algonquin College are Bring Your Own Device (BYOD). To see the BYOD requirements for your program, please visit: https://www7.algonquincollege.com/byod/.

Apply directly to the co-op or non co-op version of this program through OntarioColleges.ca or our International Application Portal.

Cooperative education (Co-op) allows students to integrate their classroom learning with a real-world experience though paid work terms. Two academic terms prior to the cooperative education work term, students are required to actively participate in and successfully complete the self-directed co-op online readiness activities and in-person workshops.

Students must actively conduct a guided, self-directed job search and are responsible for securing approved program-related paid co-op employment. Students compete for co-op positions alongside students from Algonquin and other Canadian and international colleges and universities. Algonquin College’s Co-op Department provides assistance in developing co-op job opportunities and facilitates the overall process, but does not guarantee that a student will obtain employment in a co-op work term. Co-op students may be required to re-locate to take part in the co-op employment opportunities available in their industry and must cover all associated expenses; e.g., travel, work permits, visa applications, accommodation and all other incurred expenses.

Co-op work terms are typically 14 weeks in duration and are completed during a term when students are not taking courses.

International students enrolled in a co-op program are required by Immigration, Refugees and Citizenship Canada (IRCC) to have a valid Co-op/Internship Work Permit prior to commencing their work term. Without this document, International students are not legally eligible to engage in work in Canada that is a mandatory part of an academic program.

For more information, please visit https://www.algonquincollege.com/coop.

Students are trained on a Windows-based platform which is the industry standard in the field of engineering. Mac platforms are not acceptable because they are not compatible with the hardware and software used in this program.

OACETT (Ontario Association of Certified Engineering Technicians and Technologists) recognizes this program as meeting the academic requirements for certification in the Certified Technician (C.Tech) category. Students are encouraged to register as Associate members of OACETT. Additional requirements to become fully certified (work experience, the OACETT Professional Practice Examination, peer references, etc.) are the jurisdiction of OACETT.


Note: Students who are unsuccessful in ELE8909 - Electrical Principles I are withdrawn from the program and must reapply to Level 01 through ontariocolleges.ca.

Note: Students will not be admitted to level 03 unless they have completed MAT8100.

For more information, contact Frank Bowick, Program Coordinator, at 613-727-4723 ext. 5987 or mailto:Frank.Bowick@algonquincollege.com.

Course Descriptions

DAT8921 Introduction to Programming

Students learn to create structured programs in a high-level language to solve engineering problems. This course emphasizes problem-solving strategies, program design, debugging method and program documentation. Students are introduced to available (std) library resources for a particular language, how to write appropriate user functions, and how to apply code control structures and work with supported data-types and structures, such as arrays.

Prerequisite(s): none
Corerequisite(s): none
DAT8942 Computer Applications - Electrical

Students are introduced to the College computer network, spreadsheet applications, word processing software and electrical design software, including Multisim electronic workbench and AutoCAD. Focus is on AutoCAD, in particular electrical applications.

Prerequisite(s): none
Corerequisite(s): none

ELE8909 Electrical Principles I

Students are introduced to the fundamentals of direct current circuit analysis. The standards for electrical measurement are studied and practiced. Electrical circuit design, construction and documentation are also practiced. The first module is a compulsory orientation to safe electrical work practices.

Prerequisite(s): none
Corerequisite(s): none

ELE8913 Codes and Regulations

Students locate and interpret the Canadian Electrical Code rules that ensure that electrical systems and equipment do not create hazardous conditions to person or property. This forms the basis for building electrical system design.

Prerequisite(s): none
Corerequisite(s): none

ELE8919 Achieving Success in the 21st Century

Rapid changes in technology have created new employment and business opportunities that challenge each of us to find our place as citizens in the emerging society. Life in the 21st century presents significant opportunities, creates potential hazards, and demands that we face new responsibilities in ethical ways. Students explore the possibilities ahead, assess their own aptitudes and strengths, and apply critical thinking and decision making tools to help resolve some of the important issues present in our complex society with its competing interests.

Prerequisite(s): none
Corerequisite(s): none

ELE8921 Electromagnetic Control

Students cover the design, installation and troubleshooting of relay logic, electronic logic, electromagnetic controls and AC motor control methods using full voltage starters and selection and installation of variable frequency drivers (VFD's). Students also study the design of motor power circuits, using the Canadian Electrical Code.

Prerequisite(s): ELE8909
Corerequisite(s): none

ELE8922A Electrical Principles - II

Resistive, inductive and capacitive circuits in both DC and AC (including power factor correction) are covered. Operation of basic electronic components, such as diodes, zener diodes, SCRs, voltage regulators, single phase and three phase rectifiers and power supplies are also studied. Students learn to design, construct, analyze and test electronic circuitry at the “breadboard” level.

Prerequisite(s): ELE8909
Corerequisite(s): none

ELE8923 Electrical Machinery
Beginning with electromagnetism and induction, single phase and three phase transformers are studied. Schematic representation using single line diagrams is introduced. Students learn the construction, selection and operational characteristics of the most common single phase and three phase motors and generators, including high efficiency designs. The operation of primary and secondary batteries and related technologies are covered. The time-current characteristics of fuses and breakers are studied.

Prerequisite(s): ELE8909
Corerequisite(s): none

**ELE8930 Power Electronics**

This course extends the study of analog circuits and digital logic building blocks from previous courses. Students study the principles and applications of semiconductor devices, BJTs, FETs and IGBTs with an emphasis on their application as switches within power Inverter circuits, variable frequency drives (VFDs), DC power lines, switched mode power supplies. Analog circuits are studied from general purpose operational amplifiers to basic active filters. The lab portion focuses on circuit building, the use of test equipment, collecting, recording and analyzing results, including comparison to calculated values produced by computer simulation. Safe work practices within the lab are an essential part of this course.

Prerequisite(s): ELE8922A
Corerequisite(s): none

**ELE8931 Industrial Instrumentation**

The procedures for the selection, connection and calibration of instruments are covered. Instruments are used to measure quantities, such as temperature, pressure, fluid flow and level. Students learn standard testing and calibration procedures of instrumentation and sensing devices. Students connect and program PLCs to measure and control temperature, pressure, flow and level. In addition, students are introduced to process control systems and to the design of instrumentation systems.

Prerequisite(s): ELE8932
Corerequisite(s): none

**ELE8932 Programmable Controllers**

This Programmable Logic Controllers (PLC) course extends the principles learned in the first year and applies them to programmable logic controllers. The emphasis is on programming and installing of the current generation of PLC technology. Industrial ladder diagrams, structured text and sequential function chart software are covered. Students develop programs to solve typical industrial applications using relay logic, counters, timers, sequencers, mathematical functions and move commands. Students configure and connect digital and analog input/output modules.

Prerequisite(s): ELE8921
Corerequisite(s): none

**ELE8940 Industrial Telecommunications**

Students are introduced to the basic concepts and theories utilized in modern electronic communications. This includes basic signal and information theory, analog and digital modulation, and data communications technologies. In the lab, students gain hands on experience using industry standard communications test equipment. Students conduct experiments in frequency response measurement, signal power measurement, time domain reflectometry, and data communications at both the protocol and physical level.

Prerequisite(s): none
Corerequisite(s): none

**ELE8941 Robotics and Controls**

Robotics is approached as a special case within the larger area of interactive, software-driven
devices. Students are introduced to the basics of robotics and feedback control, setting up and programming a microcontroller, designing and programming actuation and sensing devices associated with a robot, analogue and digital control and DC motor control using Pulse Width Modulation (PWM).

Prerequisite(s): DAT8921
Corerequisite(s): none

**ELE8942T Technician Skills**

Using a series of guided, hands-on exercises learners acquire the practical skills sought by employers. Key skills include lighting, alarm installation, telecommunications and home automation.

Prerequisite(s): none
Corerequisite(s): none

**ELE8944 Building Electrical Systems with AutoCAD**

Students develop their AutoCAD skills including the use of layers, blocks, PaperSpace, ModelSpace, block attributes, dynamic blocks, templates (DWT), drawing standards and DWF (Drawing Web Format). The application of standards, particularly the Canadian Electrical Code, specifications, and manufacturers’ data to the design of both residential and commercial building electrical systems are included.

Prerequisite(s): DAT8942
Corerequisite(s): none

**ELE8945 Distributed Power Systems**

Students examine power generation, transmission and distribution with particular emphasis on the province of Ontario. This includes an understanding of standard voltage levels, energy sources, cost of electricity, environmental impact, major system components, reactive loads, power quality, arc flash safety, effects of weather on the delivery of electricity and organizational structures that control electricity in Ontario.

Prerequisite(s): none
Corerequisite(s): none

**ELE8946 Fire Alarm Systems**

Students are introduced to the fire alarm industry, the applicable codes and standards, the nature of fire and extinguishment processes, different types of systems, verification and inspections. An overview of fire alarm systems emphasizes requirements for initiating devices, signal appliances, and control panels together with the different types of field wiring and microprocessor-based systems.

Prerequisite(s): none
Corerequisite(s): none

**ELE8949 Project Management for Electrical Engineering Technicians**

Students develop the planning, scheduling, budgeting and organizing skills required to manage projects. Relevant industrial examples are used.

Prerequisite(s): ENL1813T
Corerequisite(s): ENL2019T and ENL8720

**ENL1813T Communications I**

Communication remains an essential skill sought by employers, regardless of discipline or field of study. Using a practical, vocation-oriented approach, students focus on meeting the requirements
of effective communication. Through a combination of lectures, exercises, and independent learning, students practise writing, speaking, reading, listening, locating and documenting information and using technology to communicate professionally. Students develop and strengthen communication skills that contribute to success in both educational and workplace environments.

Prerequisite(s): none
Corerequisite(s): none

**ENL2019T Technical Communication for Engineering Technologies**

The ability to communicate effectively in a technically-oriented interdisciplinary workplace is a foundational skill in an innovation-driven economy. Students are exposed to exercises and assignments designed to foster independent and collaborative critical thinking, research, writing, visual communication and presentation skills related to technical topics.

Prerequisite(s): ENL1813T
Corerequisite(s): none

**GED0317 General Education Elective**

Students choose one course, from a group of general education electives, which meets one of the following five theme requirements: Arts in Society, Civic Life, Social and Cultural Understanding, Personal Understanding, and Science and Technology.

Prerequisite(s): none
Corerequisite(s): none

**MAT8100 Essential Mathematics**

Students review the manipulation of algebraic expressions as a foundation for advanced mathematical concepts. Students solve 2x2 and 3x3 systems of linear equations, and factor algebraic expressions using common factors and techniques for factoring trinomials. They simplify, add, subtract, multiply and divide rational expressions and solve equations involving algebraic fractions. Students study the properties of right triangles and trigonometric functions of obtuse angles. Students graph polynomial and sinusoidal functions using tables of values and stretches, shifts and shrinks. They also add and subtract vectors and convert between complex numbers in rectangular, polar and exponential forms. Delivered in a modular format, this course is equivalent to the completion of all of the following modules in MAT8100 - a, b, c, d, e, f, g and i.

Prerequisite(s): none
Corerequisite(s): none

**MAT8101 Differential Calculus**

Differential Calculus is the mathematical study of rates of change. Students study derivative, its definition and interpretation and its applications. Stud limits and use first principles to find simple derivatives. The product, quotient and chain rules are used to find derivatives of algebraic functions. Students use differentiation rules to find derivatives of transcendental functions. A variety of applications of derivatives, such as curve sketching, finding the tangent to a curve and finding an approximate solution to an equation using Newton’s method, are also studied.

Prerequisite(s): MAT8100 or MAT8100P or MAT8050 and MAT8051 or MAT8050P and MAT8051
Corerequisite(s): none

**MAT8102 Integral Calculus**

Integral calculus is the study of the definitions, properties and applications of two related concepts, the indefinite integral and the definite integral. Students find the area under a curve and the area between two curves. Students calculate both indefinite and definite integrals, and use the Trapezoidal Rule and Simpson’s Rule to perform numerical integrations. Students integrate polynomial, exponential, logarithmic and trigonometric functions by substitution. Integration by parts and partial fractions are employed to perform complex integrations.
Prerequisite(s): MAT8101  
Corerequisite(s): none

**PHY8201 Environmental Impact of Technology**

Every day newspaper headlines, movies, and television have warnings of the dire consequences of some environmental issues, such as global warming, acid rain, climate change and a host of other problems. Students are provided some of the science behind the headlines so they can make informed decisions as citizens, consumers and professionals.

Prerequisite(s): none  
Corerequisite(s): none

**WKT2101E Co-op Work Term Electrical**

This course includes a work placement, a weekly recording of the activities done in a journal and a final summary report of the overall experience to be submitted before returning to school. The placement has to be in an electrical related industry, preferably to electrical engineering. The timing of the placement depends on the progression pattern of the program and cannot be done before completion of the second level of the Electrical Engineering Technician program. The placement is monitored by the College. Feedback from the employer is considered in the final evaluation of the course. All assignments (journal entries and final report) must be provided to pass the course. The College Coop office assist in finding a placement. However, it is the student responsibility to find, apply and get the work term as if they were applying for a job.

Prerequisite(s): none  
Corerequisite(s): none