

PROGRAM INFORMATION

Academic Year	2024 - 2025
Credential	Advanced Diploma
Program Delivery	Full - Time
Duration	3 Years
Length	6 Semesters
Program Code	T074 - Timmins Campus

DESCRIPTION

An advanced diploma in Electrical Engineering Technology will set you up as an industry leader – with the opportunity to continue your studies at university level. After two years of the Electrical Engineering Technician program, you'll specialize in year three – taking on a series of independent projects, and further honing the math, communication and reporting skills that will be critical to your success.

You'll master advanced programming techniques. You'll dive deeper into the operation of power utility systems, protective relaying, and power system controls and protections. And you'll harness the latest technology to design residential, commercial and industrial installations that measure up to exacting industry standards. After that, you'll be ready to chart your own course in a high-tech field.

The first two years of the Electrical Engineering Technician program are identical to that of this program. Students who want to specialize in electrical technology continue studies an additional year to receive a greater depth of training and knowledge in Protection and Control, Control Systems, Electrical Design, Power Utility Systems and Programmable Logic Controls.

Students also complete a two semester Technical Report Project in third year. This crucial project integrates all acquired knowledge, requiring students to develop and adhere to a project schedule and produce a functional outcome, demonstrating their practical and theoretical proficiency.

Students receive extensive hands-on instruction in several state-of-the-art laboratories. They learn how to select, design, install, maintain, program and troubleshoot modern industrial, electrical and electronic systems.

Graduates from our Technician or Technology programs may obtain certification through the Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

CAREER OPPORTUNITIES

Northern College graduates currently work in positions ranging from apprentice electricians to electrical department superintendents in all industrial sectors including public and private power utilities.

Electrical engineering technologists work individually, assist engineers, or supervise other technologists or technicians in the design, construction, testing, installation, repair or marketing of electrical apparatus for electrical utilities, telecommunications and the information technology industries.

- Electrical engineering technologist
- Employed by electrical utilities, communications companies, manufacturers of electrical and electronic equipment, consulting firms and in government agencies in a variety of manufacturing, processing and transportation industries.

VOCATIONAL LEARNING OUTCOMES

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 qualified people.
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.

PROGRAM COURSES

The following reflects the planned course sequence for full-time offerings of the program. Programs at Northern College are delivered using a variety of instruction modes. Courses may be offered in the classroom or lab, entirely online, or in a hybrid (electives?) mode which combines classroom sessions with virtual learning activities.

Semester 1

	Hours
CM1323 Professional Communications	42
EE1206 Electrical Fundamentals I	84
EE3203 Measuring Instruments	42
GN1033 Health and Safety	42
IT1024 Introduction to Physics	56
MA1100 Mathematics I	56

Semester 2

CM2903 Communications for the Workplace	42
EE1204 Residential Wiring and Methods	56
EE2206 Electronics Fundamentals	84
IN1224 Computer Aided Drafting (CAD) I	56
MA2104 Mathematics II	60
General Education Elective	42

Semester 3

EE1034 Digital Circuits	56
EE3014 Three-Phase Theory	56
EE3114 Electrical Motor Control	56
MA3105 Mathematics III	56
IN3263 Embedded Programming and Networks	42
General Education Elective	42

Semester 4

EE2014 Electrical Machines I	56
EE4013 Data Cabling	42
EE4043 Programmable Logic Control I	42
EE4103 Power Systems	42
EE5003 Instrumentation	42
MA4204 Calculus I	56
ME3004 Energy Systems I	56

Semester 5

CM5032	Technical Report I	28
EE5203	Protection and Control I	42
EE5213	Power Utility Systems	42
EE6202	Electrical Design CAD II	28
EL5002	Electrical Design/Code	28
IN5003	Embedded Programming II	42
MA5005	Calculus II	70

Semester 6

CM6022	Technical Report II	28
EE5043	Programmable Logic Control II	42
EE6003	Control Systems	42
EE6203	Protection and Control II	42
ET5003	Electronics Communications I	42
MA6023	Statistics	42

PROGRAM PROGRESSION

The following reflects the planned progression for full-time offerings of the program.

Fall Intake

Sem 1: Fall 2024

Sem 2: Winter 2025

WORK INTEGRATED LEARNING OPPORTUNITIES

N/A

ARTICULATION/TRANSFER AGREEMENTS

A number of articulation agreements have been negotiated with universities and other institutions across Canada, North America and internationally. These agreements are assessed, revised and updated on a regular basis. Please contact the program coordinator for specific details if you are interested in pursuing such an option. Additional information can be found at [Articulation Agreements](#).

ADDITIONAL INFORMATION

Graduates of this program may be eligible to enroll in the Electrical Engineering degree program at Lakehead University. Electrical Engineering Technology graduates may have entry into the McMaster Bachelor of Technology Energy Engineering Technologies stream.

PROGRAM SPECIFIC REQUIREMENTS

N/A

ADMISSION REQUIREMENTS

- Ontario Secondary School Diploma (OSSD)
- Grade 12 English (C, U)
- Grade 12 Math (C, U) (MCT4C preferred; MAP4C is accepted with a minimum GPA of 60%)
- Or equivalent

Academic prerequisites for this program may be obtained free of charge through [Academic Upgrading](#). Applicants who do not have a high school diploma or equivalent and will have reached the age of 19 years on or before the start of the program must undergo academic testing and may be required to complete [Prior Learning Assessment & Recognition \(PLAR\)](#) process to demonstrate equivalency of admission requirements prior to admission into a program. For more details, please contact the Admissions Office at 705-235-7222 or admissions@northern.on.ca.

Additional Requirements for International Students

In addition to the general admission requirements, international students must have proof of English Proficiency and meet the requirements below.

1. Proof of Senior High School Diploma/Certificate
2. English Proficiency (we will require one of the following):
 - IELTS Academic International English Language Testing System
 - a minimum overall score of 6.0 must be achieved with no individual band score under 6.0; however, we will accept one band at 5.5.
 - TOEFL (Test of English as a Foreign Language) – Internet Based Test (iBT) overall minimum score of 79
 - PTE (Pearson Test of English) Academic – Graduate Diploma: 58+

If your country of citizenship has English as its official language, we may accept alternate proof of English Proficiency. All educational documents must be submitted in English and will be dependent on the country of citizenship. For more information, please contact admissions@northern.on.ca.

GRADUATION REQUIREMENTS

- 34 Program Courses
 - 2 Communications Courses
 - 2 General Education Courses

GRADUATION ELIGIBILITY

To graduate from this program, a student must attain a minimum of 60% or a letter grade of CR (Credit) in each course in each semester unless otherwise stated on the course outline. Students should consult departmental policies and manuals for additional detail and exceptions.

GRADUATION WINDOW

Students unable to adhere to the program duration of two years (as stated above) may take a maximum of four years to complete their credential. After this time, students must be re-admitted into the program, and follow the curriculum in place at the time of re-admission.

CONTACT INFORMATION

For questions about being admitted into the program, please contact Northern College Admissions at admissions@northern.on.ca or by phone at 705-235-3211 ext. 7222. For questions about the content of the program, contact the Program Coordinator.

Marc Veilleux, Program Coordinator

Tel: 705-235-3211 ext. 2116

Email: electrical@northern.on.ca

COURSE DESCRIPTIONS

Semester 1

CM1323 Professional Communications

In this course, students will learn essential skills for success in college and the workplace. This course focuses on developing and strengthening oral and written communication skills, and critical thinking ability. During this course, students will engage in a variety of forms of communication with a focus on upholding the principles of academic integrity. Students will develop the skills necessary to create discipline-specific documents, practice business etiquette and professionalism, and apply critical thinking strategies to practical scenarios. Upon successful completion of this course, students will be able to plan and draft concise, coherent and well-organized writing assignments that are tailored to specific audiences and purposes.

EE1206 Electrical Fundamentals I

This course is the learner's first introduction to the world of electricity. Fundamental concepts are covered which are essential to the understanding of all concepts in the Electrical Engineering Technician and Technology programs. The course begins with an overview of physical quantities and measurement systems. The nature of charge, current, voltage, and resistance are then investigated. The relationships between these values are used to develop circuit analysis techniques for both AC and DC circuits. This course is the learner's first introduction to the world of electricity. Fundamental concepts are covered which are essential to the understanding of all concepts in the Electrical Engineering Technician and Technology programs. The course begins with an overview of physical quantities and measurement systems. The nature of charge, current, voltage, and resistance are then investigated. The relationships between these values are used to develop circuit analysis techniques for both AC and DC circuits.

EE3203 Measuring Instruments

This is an introductory course for third semester Technician and Technology students. Most common measuring instruments, including voltmeter, ammeter, ohmmeter, wattmeter, meggers and oscilloscope will be studied and some will be designed. Measuring Instruments are the eyes of the electrician. An understanding of how measuring instruments operate is very important to anyone working in the electrical field. They provide the electrician with the ability to evaluate problems in the job through the use of technical tools. They also enable an electrician to correctly determine electrical values of voltage, current, resistance, power and many others. In this course, D'Arsonval meter movement and digital display will be used to design different types of meters. Loading of different instruments and their high frequency characteristics will be discussed.

GN1033 Health and Safety

This course introduces the student to health and safety in their home, in society and within an occupational setting. Students learn about the social and personal benefits of safe work practices and the methods to best prevent accidents or injuries. Students will review the role, right and responsibilities of an individual in today's health and safety conscious world. Students also learn how to read and interpret the Occupational Act and Regulations.

IT1024 Introduction to Physics

This course is an introductory course into the study of physics. It consists of 6 theory units and a corresponding laboratory component. The topics covered include: measurement, motion, forces, work and energy, fluids and heat. The lab component gives students the opportunity to connect with the acquired theory.

MA1100 Mathematics I

This course covers basic algebra properties, graphing the straight line, basic geometry and trigonometry, and solving a system of equations graphically and algebraically. It also covers vector addition by components and by the cosine and sine laws.

Semester 2

CM2303 Communications for the Workplace

In this course, students will develop professional communication skills required for success in the workplace. Students will continue to develop and strengthen their oral and written communication skills and critical thinking abilities. During this course, students will use various modes of communication to complete assignments designed to meet program and professional expectations. Students will utilize a variety of technologies for the purpose of creating a professional presence in a digital environment. Students will develop the necessary skills to create polished workplace documents such as letters, resumes, cover letters and reports tailored to specific audiences. Students will learn to conduct themselves with professionalism in both workplace interviews and job searches. Upon successful completion of this course, students will be able to create clear, concise and coherent workplace and employment documents that are error-free and designed for specific audiences and purposes.

EE1204 Residential Wiring and Methods

This course introduces students to the installation & design of various residential circuits used in a common household. Also, students will be working on actual installations of basic household circuits and electrical services used in the workplace. Topics include: introduction to the electrical code, symbols, service calculations, & installations, wiring methods, grounding.

EE2206 Electronics Fundamentals

This is an introductory course in electronics in which students learn the operation of electronic devices and their application in basic electronic circuits. Devices studied are diodes of all types, bipolar junction transistors, silicon controlled rectifiers, TRIACs, operational amplifiers, and field effect transistors. Students will construct, test and analyze basic electronic circuits such as power supplies and basic amplifier circuits.

General Education Elective

General Education Courses are selected online each semester by the student from a list provided and exposes students to a related area of study outside of their immediate academic discipline. Certain programs have predetermined electives.

IN1224 Computer Aided Drafting (CAD) I

This is an introductory course designed to teach students the basics of using the AutoCAD drafting software to create 2 dimensional drawings. Lessons include using the draw, modify, layering and annotation commands.

MA2104 Mathematics II

MA2104 is the second course in the math stream for students in an Engineering Technician / Technology program. The emphasis of this course is on solving equations relating to quadratics, logarithms, exponentials, with sections on factoring, fractional equations, manipulating exponent and radical expressions, and complex

numbers, and for some programs studying systems of linear equations and determinants. Applications of the basic concepts, to particular fields of study, will be covered.

The second semester Mathematics course is designed to give the student the mathematical tools required to function in his/her special field of study.

Students are encouraged to seek help after class hours if problems are encountered in the course. Every effort will be made to identify problem areas to the student, but in the final analysis, it is the responsibility of the student to ask for help. Prerequisite: MA1100 – Mathematics I (with 60%)

Semester 3

EE1034 Digital Circuits

The concepts involved in Digital Circuits are fundamental to the understanding of our digital world. Familiarity with different numbering systems and logical operations is key to understanding a broad range of topics including PLCs, digital communications, protection and control, electrical motor control, and others. This course will prepare the student to use the tools of logic to solve problems and optimize their solutions.

EE3014 Three-Phase Theory

This course extends upon the concepts learned in Electrical and Electronics Fundamentals and establishes the core material required for power systems and protection & control courses. The course covers fundamental concepts in AC power, transformers and three-phase circuits. Topics include a review in complex numbers; three-phase theory ideal transformer, transformer losses and testing methods, special transformers such as distribution transformers, autotransformer, current and potential transformers and three phase transformers. The course is 50% theory and 50% practical.

EE3114 Electrical Motor Control

This course is intended to help the students understand the principal operation of many control components and circuits used by industry. This course will provide the students with the basic knowledge required for the PLC course being delivered in the winter semester.

MA3105 Mathematics III

This course covers topics such as: graphs of trigonometric functions; trigonometric identities and equations; the study of analytic geometry and the study of inequalities. The students will also be introduced to the rate of change and its relation to graphs and the tangent line. Prerequisite: MA2104

General Education Elective

General Education Courses are selected online each semester by the student from a list provided and exposes students to a related area of study outside of their immediate academic discipline. Certain programs have predetermined electives.

IN3263 Embedded Programming and Networks

The first part of this course introduces the learner to the fundamentals of computer and how they are networked. Topics include a basic overview of computer/network equipment, networking fundamentals and standards, and network design. The second part of the course provides the learner with an introduction to computer programming using embedded systems. Topics covered include syntax, variables, equations, data types, loops, conditional statements, logical statements, and ADC interfacing.

Semester 4

EE2014 Electrical Machines I

This course covers the fundamental principles of operations of DC and AC motors and generators. Topics include; DC generators, DC motors, efficiency and heating of electrical machines, electrical machine maintenance, three-phase induction motors, synchronous motors/generators, and single phase motors.

EE4013 Data Cabling

The course focuses on cabling issues related to data, voice, video communications and provides an understanding of the industry and its worldwide standards, types of media and cabling, physical and logical networks, as well as signal transmission. Cabling and networking equipment and consumable bundles are used to teach the hands-on portion of the curriculum. This provides the student with a basic understanding of networking and telecommunication cabling, communication standards, and how to properly plan and understand the different uses of technology examples (Power over ethernet, understanding connecting wireless networks, Fiber networking), install and test the data/telecommunication mediums and different types of networking equipment.

EE4043 Programmable Logic Control I

This course will introduce the student to the control of motors, through the use of programmable logic controllers. The course will demonstrate the differences between mechanical relaying and computer relaying. It will show the student why this type of motor control is in such demand in industry. The student will gain exposure to PLCs through troubleshooting and design exercises.

EE4103 Power Systems

This course builds a profound understanding of various utility power systems and renewable energy systems used in Ontario. The students will learn the principle operation and components of the generating stations followed by learning the fundamentals of low voltage distribution systems and high voltage distribution system and its challenges. Then we look at the cost of electricity and DC transmission systems. This course introduces the student to electrical power systems and is designed to cover generation, distribution and transmission of electric power.

EE5003 Instrumentation

This is an introductory course in instrumentation and process control. Transducers and their application in pressure, flow, level and temperature systems is discussed. Basic instrumentation theory, equations and calculations are introduced in order to understand the interaction between physical processes and their transducers.

MA4204 Calculus I

This is a basic introductory course in Calculus. Students learn the language of calculus and apply the rules to simple engineering problems. The course includes the derivative of algebraic functions with applications to trajectory motion and minimum and maximum problems. An introduction to integration, with algebraic functions, is also taught with some basic applications to area, volumes of revolution, displacement-velocity-acceleration and other applied engineering problems.

Prerequisite: Mathematics III (MA3105 or MA3033) with 60%

ME3004 Energy Systems I

The skyrocketing demand for clean, abundant energy has resulted in a need for comprehensive information that can be used by builders, technicians, energy industry professionals, and anyone else that wants to learn about alternative forms of energy and their everyday uses. This course explores solar, wind, and other sources and the technology available to harness them. Students will gain a better understanding on how these systems work as well as how they are put together.

Semester 5

CM5032 Technical Report I

Technical Report I and II concentrate on the completion of an independent technical project. This course mirrors working conditions that are frequently encountered in industry; that is, it is a self-directed, comprehensive study of a specific topic in the student's field, not (necessarily) one covered in other courses. In Technical Report I, students prepare a detailed project schedule, meet with faculty advisors, prepare progress reports, and deliver a formal technical project proposal. Students begin work on the project in this course in preparation for project completion in Technical Report II.

EE5203 Protection and Control I

This course introduces the student to power system protection and control. The course introduces fundamental concepts in protection and control including fuses, circuit breakers, power utility DC control circuits and protective relays. This course will prepare the student for further study in protection and control where the emphasis will be on protective relay programming and applications.

EE5213 Power Utility System(s plural)

This course focuses on topics related to power utilities. The student will build upon concepts learned in previous power systems courses to gain a more detailed understanding of power utilities and their operation.

EE6202 Electrical Design CAD II

This course consists of two parts; electrical design and CAD II. It provides the student with the basic knowledge necessary to design electrical installations for residential, commercial and industrial establishments and to improve their CAD skills. Topics include service load estimation, receptacles, feeder and branch circuit design; transformer selection and installation requirements; panel boards; grounding, lighting design and layout; and distribution system types. The purpose of this course is to provide students with the necessary knowledge to design electrical installation for commercial and industrial establishments. Topics include: grounding, protection of feeders, branch circuits, motor circuits and motor control centres. Extensive use is made of the Ontario Electrical Code. All drawings will be completed in AutoCAD.

EL5002 Electrical Design/Code To Be updated

IN5003 Embedded Programming II

This course builds upon the concepts learned in IN3263 Embedded Programming and Networks with a focus on project work that reinforces the concepts covered. By completing this course, learners will be able to identify the processing and hardware needs of a project in order to select the appropriate controller. They will also be able to use advanced microcontroller programming techniques such as bitwise operators, polled loops and interrupts, inter-device communication (UART, SPI, I2C, CAN, etc), hardware timers, external displays, motor

controllers, and both analog and digital sensors. A focus on debugging and troubleshooting techniques will complement each topic.

MA5005 Calculus II

This course is a continuation of Calculus I. The course expands the concepts of differential and integral calculus including derivatives of trigonometric, logarithmic and exponential functions. Topics covered include: methods of integration, use of integration to find areas under a curve, volumes of revolution, as well as other technical applications.

Semester 6

CM6022 Technical Report II

This course is a continuation of the prerequisite course CM5032 Technical Report I. During the winter semester, students complete all further development and present the project in an oral presentation and in a written presentation before the given deadline. The project must be presented in accordance with required industrial or engineering standards.

EE5043 Programmable Logic Control II

This course will introduce the student to the installation, setup, troubleshooting and special instructions in programmable logic controllers. Advanced topics such as alternate languages and HMIs are covered.

EE6003 Control Systems

This course is designed to provide Electrical Engineering Technology students with a background in Process Control Systems and the tools necessary to analyze, design, interpret and modify open and closed loop control systems using analogue techniques. The design and implementation of well-tuned and stable controllers will be developed through an investigation of the following topics: systems, signals, transfer functions, first-order systems, second-order systems, and continuous time controllers (P, PI, PD, PID). Term projects will revolve around real control systems including DC motor speed and position controllers as well as heating systems. The projects will proceed in parallel with the in-class theory.

EE6203 Protection and Control II

This course is a continuation of Protection and Control I that will focus on protective relaying and applications as applied to industry and power utilities. Protective relay elements, trip logic and relay programming and testing will be the primary focus.

ET5003 Electronics Communications I

The purpose of the Electronic Communication I course is to introduce the student to the field of communication utilized in today's telecommunication. The course covers the operating principles, analysis, design, and construction of AM and FM transmitters and receivers.

MA6023 Statistics

This course will cover such topics as: classification of data using Excel, x-y graphs, bar graphs and pie charts; organization of data into frequency distributions, calculation of the mean, the median, variance and standard deviation for grouped data; probability and frequency distributions, binomial and normal distributions,

estimation of population means, standard deviation and proportions within a given confidence interval; control charts for statistical process control; and regression and correlation analysis.

Pre-requisites: MA1100 Mathematics I