

## PROGRAM INFORMATION

**Academic Year:** 2026-2027

**Credential:** Ontario College Diploma

**Program Delivery:** Full-Time

**Duration:** 2 years

**Length:** 4 Semesters

**Program Code(s):** M001 - Haileybury School of Mines (HL)  
Formerly: Instrumentation and Control Engineering Technician

## DESCRIPTION

Northern's two-year Automation and Instrumentation Technician diploma prepares you for a rewarding career at the heart of modern industry. Every industrial process relies on skilled technicians to ensure systems operate safely, efficiently, and accurately - and this program provides you with the expertise to succeed.

### Hands-On Learning & Core Skills

Throughout the program, you will develop the knowledge and practical skills needed to work with equipment that measures and controls key process variables such as temperature, pressure, level, and flow. You will learn how to tune controllers for specific applications and gain hands-on experience installing, maintaining, testing, and calibrating instrumentation systems. You will also gain foundational experience with analytical techniques used to support and monitor process operations.

In addition, you will build a strong foundation in mathematics, science, electricity, and electronics while strengthening your problem-solving and troubleshooting abilities. You will learn to interpret technical drawings and apply industry safety standards, preparing you to confidently tackle real-world technical challenges.

### Technology & Industry Experience

As an automation and instrumentation technician, you will work with a wide range of technologies, including electronic, pneumatic, hydraulic, and computer-based control systems. You will also develop skills in digital communication and networking, preparing you to work with modern connected systems and smart technologies. In this role, you will collaborate with engineers and operators to troubleshoot control loops, optimize system performance, and support automated processes that keep industries running smoothly.

### Co-op Placement Option

Students also have the opportunity to pursue an optional co-op placement, gaining valuable real-world experience in a professional setting. This pathway allows you to apply your skills in industry, build connections with employers, and graduate with a competitive edge.

### A Unique Advantage at Northern

As Instrumentation and Control Technician is a Red Seal trade, Northern College is approved by the Ministry of Training, Colleges and Universities to offer a one-of-a-kind diploma-to-apprenticeship pathway—graduates who pursue the Instrumentation and Control Technician (447A) apprenticeship are exempt from all three levels of in-school apprenticeship training, accelerating their path to certification.

## CAREER OPPORTUNITIES

With strong demand across many sectors, this program opens the door to diverse, stable, and in-demand career opportunities in today's technology-driven workforce. Graduates are well prepared to work in environments such as power generation, pulp and paper, water treatment, manufacturing, and mining operations.

## VOCATIONAL LEARNING OUTCOMES

1. comply with current and relevant legislation, regulations, code of ethics and established industry standards, codes, policies, and procedures in work environments to ensure safety of self and others in the workplace.
2. evaluate and analyze equipment used in the measurement and control of process parameters to ensure accuracy and efficiency.
3. contribute to the design and installation of **automation and instrumentation** systems according to system specifications and safety requirements.
4. contribute to the design and modification of electronic and computer-based **controllers** to optimize the performance of automation systems.
5. analyze and solve complex technical problems associated with wireless and wired automation systems to optimize equipment operation.
6. analyze technical and technology reports, and engineering drawings for **automation and instrumentation** systems to ensure these conform to industry standards.
7. incorporate strategies for ongoing personal and professional development to support competence and currency in the field

## 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 mode which combines classroom sessions with virtual learning activities.

<b>Semester 1</b>		<b>Hours</b>
CM1323	Professional Communications	42
EE1055	Electrical Fundamentals I	70
GN1033	Health and Safety	42
IN1224	Computer Aided Drafting (CAD) I	56
IT1004	Basic Techniques	56
IT1015	Measuring Principles I	70
MA1100	Mathematics I	56
MI1001	Placement Preparation	14
<b>Semester 2</b>		
CM2303	Communications in the Workplace	42
EE2024	Electrical Fundamentals II	56
ET2004	Electronics II	56

IT2004	Control Principles	56
IT2005	Digital Logic	70
IT2024	Measuring Principles II	56
MA2104	Mathematics II	56

### Semester 3

EL1021	General Education Elective	42
IT3004	Analytical Principles I	56
IT3007	Control Techniques	98
IT3012	Networking and Digital Communications	28
IT3015	Advanced Digital Principles	60
IT3024	Industrial Electronics	56
MA3105	Mathematics III	56

### Semester 4

EL1022	General Education Elective	42
GN1443	Indigenous Culture and Awareness	42
IT4003	Statistical Process Control	42
IT4007	Control Systems	98
IT4024	Electronic Circuits	56
IT4064	Analytical Principles II	56
MA4204	Calculus I	56

## PROGRAM PROGRESSION

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

### Fall Intake

Sem 1: Fall 2026  
 Sem 2: Winter 2027  
 Sem 3: Fall 2027  
 Sem 4: Winter 2028

## 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%)
- Grade 12 Physics (C, U) recommended
- Grade 12 Chemistry (C, U) recommended
- 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](mailto:admissions@northern.on.ca).

### **Additional Requirements for International Students**

In addition to the admission requirements, international students must have proof of [English Proficiency](#) and meet the requirements below.

1. Proof of Senior High School Diploma/Certificate with 50% in each equivalents for Mathematics (technical)
2. English Proficiency (we will require one of the following):
  - IELTS Academic (International English Language Testing System – minimum overall score of 6.5 must be achieved with no individual band score under 6.0
  - TOEFL (Test of English as a Foreign Language) – Internet Based Test (iBT) overall minimum score of 88+
  - PTE (Pearson Test of English) Academic 60+.
  - Duolingo: 125+

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](mailto:admissions@northern.on.ca).

## **PROGRAM SPECIFIC REQUIREMENTS & ADDITIONAL INFORMATION**

### **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](#).

## GRADUATION REQUIREMENTS

- 23 Program Courses
- 2 Communications Courses
- 3 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 core course in each semester unless otherwise stated on the course outline. Students should consult departmental policies and manuals for additional details 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](mailto: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.

Josh Dubois, Program Coordinator  
Tel: 705-672-3376 ext. 8836  
Email: [duboisj@northern.on.ca](mailto:duboisj@northern.on.ca)

## **COURSE DESCRIPTIONS**

### **Semester 1**

#### **EE1055 – Electrical Fundamentals I**

This is an introductory course in the study of basic electricity. Its purpose is to develop a foundation for future courses. A clear understanding of basic concepts and their applications to problem solving will be stressed. Lecture topics include electrical quantities, voltage, current, resistance, Ohm's Law and power, series circuits, parallel circuits, series-parallel circuits, alternating current and voltage. Lab experiments are performed to complement theory.

#### **IT1004 – Basic Techniques**

This introductory course teaches basic principles, terminology and techniques used in process control. Fluid power systems, Safety, calibration procedures for instrumentation equipment, and control loop diagrams are core subjects. Theory on measuring and test equipment, and various types of instrumentation equipment such as regulators and solenoids is strongly reinforced. Lab experiments are performed to complement theory.

#### **IT1015 – Measuring Principles I**

This course is split into two modules and introduces theory, applications and equipment of pressure and flow measurement in the process industries. Module One identifies pressure calculations, manometers, pressure elements, gauges, pneumatic and electrical pressure transmitters and differential pressure transmitters. Module Two identifies mechanical, electrical and mass flow meters, using differential pressure transmitters for flow measurement, weirs and flumes for open channel measurements and weighing and belt scales for solids measurements. Lab experiments are performed to complement theory.

#### **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.

#### **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.

#### **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.

#### **MI1001 – Placement Preparation**

Students prepare for the fieldwork co-op placement by identifying specific competencies and requirements for the placement, reviewing the Fieldwork Placement Manual, and examining his/her role in relation to field placement expectations. Policies, processes, roles, responsibilities, and expectations relating to fieldwork placement will be discussed. This course will introduce the student to the concept of reflective practice and

professional development. This course will help the student clarify his/her expectations and prepare for a successful fieldwork placement experience.

**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.

**Semester 2****EE2024 – Electrical Fundamentals II**

This course covers interpretation and application of simple wiring and elementary diagrams, standard electrical symbols, and electrical control pilot devices. Devices covered include relays, contactors, motor starters, timing relays, float switch, flow switch, limit switch, proximity switch, temperature switch, two-wire control, three-wire control, hand-off automatic control, multiple push button stations, jogging control circuits, and time-delay low voltage release relay. Lab experiments are performed to complement theory.

**ET2004 – Electronics II**

This course is divided into two modules. In the first module, capacitors and inductors are introduced as fundamental electronic building blocks. RC, RL and RLC circuits are studied and applications to instrumentation are introduced. In the second module, electronic devices including diodes, transistors and transistor amplifiers, integrated circuits and operational amplifiers and voltage regulation are examined.

**IT2004 – Control Principles**

This course is further study of process control terminology, identifying controller types and modes. Introduces and evaluates the proportional, integral and derivative algorithms used to tune controllers to a process. Identify types, sizes and troubleshooting of valve bodies, valve actuators and valve positioners as the primary choice of final control elements encountered in industry. Other final control elements like variable speed pumps, servomotors, fans, as well as dampers and feeders are introduced. Lab experiments are performed to complement theory.

**IT2024 – Measuring Principles II**

This course is split into three modules and introduces theory, applications and equipment of level, temperature, and misc. measurement in the process industries. Module One identifies differential pressure transmitters used for level measurement, capacitance and conductance probes, ultrasonic, radar, laser and radiation level transmitters. Module Two identifies filled systems, bi-metallic strips, resistance temperature detectors (RTDs), thermocouples (TCs) and pyrometers. Module three introduces vibration monitoring, speed sensors, flame sensors, and noise and sound sensors. Lab experiments are performed to complement theory.

**IT2005 – Digital Logic**

This course covers binary number systems, binary, decimal, hexadecimal, Boolean algebra, logic gates including truth tables, combination logic, programmable logic controllers including principle of operation and programming techniques. Lab experiments are performed to complement theory.

**MA3105 – 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.

**CM2303 – Communications in 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.

**Semester 3****IT3007 – Control Techniques**

This course introduces advanced control techniques, including cascade, ratio, cascade-ratio, and feed-forward control. Students learn to interpret control loop drawings, apply troubleshooting methods, and understand terminology related to computer and microprocessor-based control systems. The course compares the operation and configuration of digital controllers, Programmable Logic Controllers (PLCs), Human-Machine Interfaces (HMIs), Direct Digital Control (DDC), SCADA systems, and Distributed Control Systems (DCS). It also explores digital communication protocols (HART, Modbus, Profibus, Foundation Fieldbus, Profinet, and Industrial Ethernet). Lab experiments are performed to complement theory.

**IT3024 – Industrial Electronics**

This course covers the topics of magnetism, electromagnetism, motor nameplate data and wiring interpretation, three phase and single-phase motor connections, DC motors, DC motor starting circuits, DC generators, DC drives, three phase power, and transformers. Lab experiments are performed to complement theory.

**IT3015 – Advanced Digital Principles**

This course covers topics such as architecture of a basic microprocessor system, data acquisition systems, data address, and control Bus, memory interfacing, and multiplexing analog signals. Students will also learn more advanced programmable logic controller (PLC) and human-machine interface (HMI) programming, functionality, and troubleshooting of these systems. Lab experiments are performed to complement theory.

**IT3004 – Analytical Principles I**

This course introduces fundamental chemistry including atomic theory, stoichiometry, and chemical energy as applied to industrial process analysis. Students examine the operation of spectroscopic, radiant energy, and inferential property analyzers. Emphasis is placed on the practical installation, calibration, maintenance, and troubleshooting of these systems for industrial applications. Lab experiments are performed to complement theory.

**IT3012 – Networking and Digital Communications**

This course introduces students to the fundamentals of communication networks and data transfer methods used in industry. Students will study common network topologies and protocols, their applications, and their limitations. Hands-on activities focus on commissioning and troubleshooting communication cables, connectors, and protocol configurations.

**MA2105 – 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.

**EL1021 – 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.

**Semester 4****IT4007 – Control Systems**

This course examines industrial control systems across a range of process applications. Students study operations and control strategies for systems such as milling, combustion, furnaces, and boilers. The course also covers sector-specific systems including pulp and paper, CANDU nuclear power generation, co-generation, pollution control, water and wastewater treatment, wind, solar, biomass, and HVAC systems. Closed-circuit television (CCTV) systems are also introduced. Lab experiments are performed to complement theory.

**IT4024 – Electronic Circuits**

This course introduces electrical and electronic systems used in motor control applications. Students study the operation and control of single-phase and three-phase AC motors, including squirrel cage and wound rotor induction motors. The course covers reduced voltage starters, three-phase multi-speed controllers, and motor

drive systems, including mechanical drives and variable frequency drives (VFDs). Motor maintenance principles are also examined. Lab experiments are performed to complement theory.

**IT4064 – Analytical Principles II**

This course introduces advanced chemical concepts including ion behavior in liquid solutions, oxidation-reduction reactions, and physical methods of separation as applied to process analysis. Students examine the operation of electrochemical methods such as pH, ORP, conductivity, and dissolved oxygen along with gas and liquid chromatography. Additional topics include measurement of density, chemical metering pumps and sampling systems. Emphasis is placed on the practical installation, calibration, maintenance, and troubleshooting of these systems for industrial applications. . Lab experiments are performed to complement theory.

**IT4003 – Statistical Process Control**

This is an elementary course in SPC with applications relevant to the process industries. Topics include: introduction to quality concepts, measurement and variation concepts, special-cause and common-cause variation, measures of the tendency and spread, organization of data by different graphical techniques, normal probability distribution, variables control charts and attributes control charts and interpretation, and process capability analysis.

**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.

**EL2012 – 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.

**GN1443 – Indigenous Culture and Awareness**

Improving your knowledge and understanding of the history of the Indigenous peoples of what we now call Canada is an important step to enable Indigenous and non-Indigenous people, organizations, and communities to work together more respectfully. Throughout this course you will have the opportunity to learn, discuss and reflect about many topics that are relevant in the learning journey towards reconciliation.