

PROGRAM INFORMATION

Academic Year:	2025-2026
Credential:	Ontario College Diploma
Program Delivery:	Full-Time
Duration:	2 years
Length:	4 Semesters
Program Code(s):	M001 - Haileybury School of Mines (HL)

DESCRIPTION

Every industrial process on Earth relies on an instrumentation technician to keep things on track and with Northern's two-year Instrumentation and Control Engineering Technician diploma, your job prospects will include them all. You will master the complex equations used to tune controllers to a particular process. And you will learn to install, maintain, test and calibrate the critical equipment that measures and controls temperature, level, pressure and flow.

Along the way, you will hone your math, science and problem-solving skills. You will cover the fundamentals of electricity and electronics. You will learn troubleshooting techniques and how to interpret drawings. From furnaces and boilers to pulp mills and power plants – you will master the safety protocols that keep everything running smoothly. In all process industries, quantities such as temperature, pressure, level and flow need to be measured and controlled.

Control and measurement are done by various means including electronic, pneumatic, and hydraulic equipment and computers. The technician installs, maintains, tests and calibrates the equipment used to control and measure. The technician works with the process, designers and the work includes troubleshooting control loops, adjusting controllers and systems and programming and troubleshooting computers.

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

CAREER OPPORTUNITIES

Graduates may be employed in electrical power generation (including nuclear), mineral processing, petrochemical, pulp and paper, car manufacturing plants, pharmaceuticals, natural gas compressor stations, or water and wastewater treatment facilities (amongst many others).

- Instrumentation and control engineer
- 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. Comply with current health and safety legislation and regulations, as well as organizational practices and procedures.
2. Select, install, calibrate and troubleshoot equipment used in the measurement and control of process parameters.
3. Select and install components to conform to instrumentation and process control system specifications and related safety requirements.
4. Operate and configure electronic and computer-based controllers to optimize the performance of process control systems.
5. Repair and maintain wireless and wired control system components applying basic electrical, electronic and digital principles to the operating systems and firmware.
6. Assist with the installation of a control system as a member of a multidisciplinary team.
7. Work in compliance with relevant industry standards, codes, policies and procedures.
8. Prepare documentation, technical reports and drawings for instrumentation and process control systems that conform to industry standards.
9. Develop strategies for ongoing professional development to enhance work performance as an instrumentation and control engineering technician.

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.

Semester 1		Hours
CH3023	Chemistry	42
CM1323	Professional Communications	42
EE1055	Electrical Fundamentals I	70
GN1033	Health and Safety	42
IT1004	Basic Techniques	56
IT1015	Measuring Principles I	70
MA1100	Mathematics I	56
Semester 2		
CM2303	Communications in the Workplace	42
EE2024	Electrical Fundamentals II	56
ET2004	Electronics II	56
IN1224	Computer Aided Drafting (CAD) I	56
IT2004	Control Principles	56
IT2024	Measuring Principles II	56
MA2104	Mathematics II	56
Semester 3		
EL1021	General Education Elective	42
IT1024	Introduction to Physics	56
IT3002	Analytical Principles	28
IT3007	Control Techniques	98

IT3014	Digital Principles	56
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
IT4044	Advanced Digital Principles	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 2025
 Sem 2: Winter 2026
 Sem 3: Summer 2026
 Sem 4: Fall 2026

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.

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.

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

- 11 Program Courses
- 2 Communications Courses
- 1 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 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

COURSE DESCRIPTIONS

Semester 1

CH3023 Chemistry

This course is an introductory course in the study of chemistry. This study of analytical chemistry makes use of solution concepts to understand the chemistry on which analytical procedures are based, and how changes in various parameters can affect the equilibrium of the chemical system. Students will be exposed to the various forms of spectroscopy, chromatography, and other analytical methods.

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.

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, magnetism, electromagnetism, alternating current and voltage. Lab experiments are performed to complement theory.

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, rights 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.

IT1004 Basic Techniques

This introductory course teaches basic principles, terminology and techniques used in process control. 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 is strongly reinforced in hands-on lab assignments throughout the semester. 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.

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 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. Prerequisite: CM1323 Professional Communications

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.

Prerequisite: EE1055 Electrical Fundamentals I

ET2004 Electronics II

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

Prerequisite: EE1055 Electrical Fundamentals I

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.

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 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, motors and fans, as well as dampers and feeders are introduced. Auxiliary equipment like regulators and solenoid valves are covered as are relief or safety valves. Lab experiments are performed to complement theory.

Prerequisite: IT1004 Basic Techniques, IT1015 Measuring Principles I

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.

Prerequisite: IT1004 Basic Techniques, IT1015 Measuring Principles I

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 for the student, but in the final analysis, it is the responsibility of the student to ask for help.

Prerequisite: MA1100 Mathematics I

Semester 3**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.

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.

IT3002 Analytical Principles

This course introduces the principles and terminology related to analytical process measurement and the industrial applications of those measurements. Identifies various types of equipment and systems operating on the basis of electrochemical theory, and electromagnetic spectrum in the infrared, ultraviolet and x-ray wavelengths. Evaluates the importance of collecting an accurate sample and the equipment required.

Prerequisite: IT2024 Measuring Principles II

IT3007 Control Techniques

Review of first year material, Interpret loop drawings, troubleshooting techniques, terminology associated with computer and microprocessor control, operation and configuration of digital microprocessor-based controllers,

digital signal transmission protocols including H.A.R.T., Modbus, Profibus, Foundation Fieldbus, Profinet, and industrial Ethernet, Direct Digital Control, SCADA, and Distributed control.

Prerequisite: IT2024 Measuring Principles II, IT2004 Control Principles

IT3014 Digital Principles

This course covers binary number systems, binary, decimal, hexadecimal, Boolean algebra, logic gates including truth tables, combination logic, relay logic, programmable logic controllers including principle of operation and programming techniques.

Prerequisite: EE2024 Electrical Fundamentals II, ET2004 Electronics II

IT3024 Industrial Electronics

This course covers the topics of motor nameplate data and wiring interpretation, three phase and single-phase motor connections, DC motors, DC motor starting circuits, DC generators, three phase power, transformers.

Prerequisite: EE2024 Electrical Fundamentals II, ET2004 Electronics II

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 Mathematics II

Semester 4

EL1022 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

This general education course will provide students with an introduction to Canadian Indigenous Nations' history, sovereignty, land titles, cultural history and current critical issues. Topics addressed include the content of Indigenous rights, economic and social development, community and political processes, and business law and policies, justice & social services. Canadian Indigenous History and Relations is a general education course that has been incorporated into all programs at Northern College.

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.

Prerequisite: MA2104 Mathematics II

IT4007 Control Systems

This course covers topics such as distributed control, furnace control, boiler operation and control, concentrator controls. Other topics include: roaster controls, acid plant controls, pulp mill controls, nuclear

power plant controls, control panels, maintenance scheduling, weighing, pump control, and closed-circuit television.

Prerequisite: IT3007 Control Techniques, IT3002 Analytical Principles

IT4024 Electronic Circuits

This course covers topics such as Single-Phase AC motors, Wound Rotor Induction motors, Reduced Voltage Starters, three-phase multi-speed controllers, Motor Drives, and Motor Maintenance.

Prerequisite: IT3024 Industrial Electronics

IT4044 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, multiplexing analog signals, networking, communications, advanced programmable logic controllers.

Prerequisite: IT3014 Digital Principles

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: MA3105 Mathematics III