



Electronics Engineering Technology Program Standard

**The approved program standard for
Electronics Engineering Technology
program of instruction leading to an
Ontario College Advanced Diploma
delivered by Ontario Colleges of
Applied Arts and Technology.
(MTCU funding code 65203)**

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Inquiries regarding specific Electronics Engineering Technology programs offered by colleges of applied arts and technology in Ontario should be directed to the relevant college.

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I. Introduction

This document is the Program Standard for the Electronics Engineering Technology program of instruction leading to an Ontario College Advanced Diploma delivered by Ontario colleges of applied arts and technology (MTCU funding code 65203).

Development of System-Wide Program Standards

In 1993, the Government of Ontario initiated program standards development with the objectives of bringing a greater degree of consistency to college programming offered across the province, broadening the focus of college programs to ensure graduates have the skills to be flexible and to continue to learn and adapt, and providing public accountability for the quality and relevance of college programs.

The Program Standards and Evaluation Unit of the Ministry of Training, Colleges and Universities has responsibility for the development, review and approval of system-wide standards for programs of instruction at Ontario colleges of applied arts and technology.

Program Standards

Program standards apply to all similar programs of instruction offered by colleges across the province. Each program standard for a postsecondary program includes the following elements:

- **Vocational standard** (the vocationally specific learning outcomes which apply to the program of instruction in question),
- **Essential employability skills** (the essential employability skills learning outcomes which apply to all programs of instruction); and
- **General education requirement** (the requirement for general education in postsecondary programs of instruction).

Collectively, these elements outline the essential skills and knowledge that a student must reliably demonstrate in order to graduate from the program.

Individual colleges of applied arts and technology offering the program of instruction determine the specific program structure, delivery methods and other curriculum matters to be used in assisting students to achieve the outcomes articulated in the standard. Individual colleges also determine whether additional local learning outcomes will be required to reflect specific local needs and/or interests.

The Expression of Program Standards as Vocational Learning Outcomes

Vocational learning outcomes represent culminating demonstrations of learning and achievement. They are not simply a listing of discrete skills, nor broad statements of knowledge and comprehension. In addition, vocational learning outcomes are interrelated and cannot be viewed in isolation of one another. As such, they should be viewed as a comprehensive whole. They describe performances that demonstrate that significant integrated learning by graduates of the program has been achieved and verified.

Expressing standards as vocational learning outcomes ensures consistency in the outcomes for program graduates, while leaving to the discretion of individual colleges curriculum matters such as the specific program structure and delivery methods.

The Presentation of the Vocational Learning Outcomes

The **vocational learning outcome** statements set out the culminating demonstration of learning and achievement that the student must reliably demonstrate before graduation.

The **elements of the performance** for each outcome define and clarify the level and quality of performance necessary to meet the requirements of the vocational learning outcome. However, it is the performance of the vocational learning outcome itself on which students are evaluated. The elements of performance are indicators of the means by which the student may proceed to satisfactory performance of the vocational learning outcome. The elements of performance do not stand alone but rather in reference to the vocational learning outcome of which they form a part.

The Development of a Program Standard

In establishing the standards development initiative, the Government determined that all postsecondary programs of instruction should include vocational skills coupled with a broader set of essential skills. This combination is considered critical to ensuring that college graduates have the skills required to be successful both upon graduation from the college program and throughout their working and personal lives.

A program standard is developed through a broad consultation process involving a range of stakeholders with a direct interest in the program area, including employers, professional associations, universities, secondary schools and program graduates working in the field, in addition to students, faculty and administrators at the colleges themselves. It represents a consensus of participating stakeholders on the essential learning that all program graduates should have achieved.

Updating the Program Standard

The Ministry of Training, Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Electronics Engineering Technology Program Standard remains appropriate and relevant to the needs of students and employers across the Province of Ontario. To confirm that this document is the most up-to-date release, please contact the ministry:

psu@ontario.ca

II. Vocational Standard

All graduates of the Electronics Engineering Technology program of instruction must have achieved the fifteen vocational learning outcomes listed in the following pages, in addition to achieving the essential employability skills learning outcomes and meeting the general education requirement.

Preamble

Graduates of Electronics Engineering Technology programs carry out electronics engineering functions within an engineering environment. Graduates have demonstrated achievement of vocational learning outcomes which relate to engineering in general and electronics engineering in particular.

The vocational learning outcomes and their respective elements of performance were articulated to clearly define the range and level of skills, knowledge and attitudes required by graduates in order to be successful as entry-level electronics engineering technologists. Achievement of the vocational learning outcomes will prepare the graduates of the Electronics Engineering Technology programs to design*, analyze* and troubleshoot*, as well as to modify, maintain and repair electronic circuits, devices, equipment, components, systems and subsystems. In addition, graduates will be able to contribute to management functions, quality control* and quality assurance* programs, and to apply communication, documentation, information technology, computer applications, teamwork and leadership skills to support an organization's safe, electronics-related activities.

Graduates of Electronics Engineering Technology programs work in a broad range of employment settings, including environmental and renewable energy industries, as well as settings requiring electronics engineering applications in both large and small organizations. Their jobs may involve working with industrial, scientific and medical instruments, networks and a variety of electronic systems, such as communication systems, embedded microprocessor*-based systems, microcontroller*-based systems, wireless systems and control systems.

Students' learning is significantly enhanced by opportunities to gain and reflect on as much practical experience as is feasible during their studies. This program standard has identified a cluster of common skills, knowledge and attitudes essential to all entry-level employees in the electronics engineering field; however, individual colleges may choose to build on this standard by offering some degree of specialization.

There may be opportunities for graduates to pursue further educational and occupational qualifications; through articulation agreements between the colleges, universities or professional organizations, graduates may be granted credits towards a degree and certification. Students should contact individual colleges for further details of a college's articulation agreements with other institutions or professional associations.

**See glossary*

Synopsis of the Vocational Learning Outcomes Electronics Engineering Technology (Ontario College Advanced Diploma)

The graduate has reliably demonstrated the ability to

- 1. analyze*, interpret, modify, design* and produce electrical and electronics drawings, layouts and reports.**
- 2. analyze* and solve technical problems related to electronics engineering by applying principles of advanced mathematics and science.**
- 3. apply appropriate troubleshooting* techniques to electronic circuits or systems and generate and perform test procedures.**
- 4. design*, build, test and troubleshoot* electronic circuits, equipment, systems and subsystems in accordance with job requirements*, functional specifications* and relevant standards.**
- 5. modify, maintain, repair and recommend electronic equipment and systems in accordance with relevant operational guidelines.**
- 6. determine, select, recommend and justify the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements* and functional specifications*.**
- 7. design*, modify, analyze* and troubleshoot* logic and digital circuits, and embedded microprocessor*-based and microcontroller*-based systems, including assembly and high-level language programs.**
- 8. design*, analyze* and troubleshoot* circuits consisting of passive components by applying appropriate measurement techniques.**
- 9. design*, analyze* and troubleshoot* circuits consisting of low power, high power, active and electromechanical components, and analog integrated circuits.**
- 10. design*, analyze* and troubleshoot* control systems.**
- 11. design*, analyze*, troubleshoot* and repair analog and digital communication systems.**
- 12. apply relevant shop practices* in compliance with safety policies and current regulations for electronics engineering workplaces.**

- 13. collaborate in selecting, co-ordinating and conducting quality control* and quality assurance* programs and procedures.**
- 14. complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.**
- 15. contribute to the planning, implementation, management and evaluation of team projects by applying project management principles.**

**See glossary*

Note: The learning outcomes have been numbered as a point of reference; numbering does not imply prioritization, sequencing, nor weighting of significance.

The Vocational Learning Outcomes

1. *The graduate has reliably demonstrated the ability to*

analyze*, interpret, modify, design* and produce electrical and electronics drawings, layouts and reports.

Elements of the Performance

- assemble relevant information, data and materials
- interpret schematics, assembly drawings, related functional specifications* and relevant standards
- produce, modify and prepare functional specifications*
- produce and modify engineering drawings using appropriate standards and symbols
- produce project-related documents
- interpret, simulate, design* and create drawings, sketches and related graphics
- organize, write and prepare technical reports, business letters, memos and emails
- use terminology suited to different types of situations and the persons involved
- create and review functional specifications* for electronic equipment and systems, with guidance as required
- use database management, word processing, spreadsheet, graphics and communication software applications – including mechanical design* and drafting programs, electronics schematic capture, layout and documentation programs – to create effective sketches, diagrams, charts, tables and graphs

2. *The graduate has reliably demonstrated the ability to*

analyze* and solve technical problems related to electronics engineering by applying principles of advanced mathematics and science.

Elements of the Performance

- use mathematical and scientific analyses as part of the design* process and explain the benefits and the limitations of such analyses
- perform calculations accurately using appropriate mathematics, including and not limited to applied algebra, trigonometry and complex numbers
- use mathematical and scientific terminology accurately
- apply mathematical, common sense and logical analyses to troubleshoot*, maintain and test electronic equipment
- solve technical problems using advanced mathematics, including differential and integral calculus, series expansion, differential equations, Laplace, Fourier and Z-Transforms analysis*
- apply statistical fundamental concepts* to electronics engineering functions
- apply complex software that may include Laplace, Fourier and Z-Transforms to system behaviour and signal analysis*

3. *The graduate has reliably demonstrated the ability to*

apply appropriate troubleshooting* techniques to electronic circuits or systems and generate and perform test procedures.

Elements of the Performance

- analyze* electrical and/or electronic problems and apply established engineering practice to determine practical solutions
- use a variety of resources, including colleagues, industry-approved manuals and handbooks, manufacturer's technical experts and the Internet to generate and perform test procedures that comply with industry and government standards
- troubleshoot* electronic circuits and systems in compliance with standards, procedures, policies and practices of electronics engineering, established by technical associations, government and regulatory bodies
- select, implement, set up and calibrate test equipment for the accurate assessment of electronic equipment and system performance
- recognize when to request additional resources
- find and propose long-term solutions
- identify the functional requirements of test equipment
- complete Canadian Standards Association (CSA) training requirements for safety when working with electrical equipment

4. *The graduate has reliably demonstrated the ability to*

design*, build, test and troubleshoot* electronic circuits, equipment, systems and subsystems in accordance with job requirements*, functional specifications* and relevant standards.

Elements of the Performance

- determine or develop, when necessary, job requirements* and functional specifications* of electronic circuits
- design*, build, modify, troubleshoot* and recommend improvements to electronic circuits, in accordance with job requirements*, functional specifications*, assembly guidelines, engineering drawings and applicable safety standards
- conduct or specify tests on electronic circuits, documenting and interpreting test results, as required
- develop, install, configure and debug hardware and software
- handle and store electronic components and equipment according to manufacturer's specifications, such as thermal and electrostatic discharge (ESD) requirements
- document electronic circuit evolution (e.g., problems, modifications, lessons learned)
- utilize risk assessment techniques to determine any potential danger areas
- design* and fabricate printed circuit board (PCB) assemblies and associated electronic packaging such as cabinetry, heatsinking and interconnect means
- repair sub-assemblies and replace electronic components using knowledge of appropriate through-hole and surface mount package styles

5. *The graduate has reliably demonstrated the ability to*

modify, maintain, repair and recommend electronic equipment and systems in accordance with relevant operational guidelines.

Elements of the Performance

- install, configure and commission equipment and systems
- select and use standard test equipment and verify correct operation
- connect instrumentation to devices for monitoring data acquisition and/or control
- maintain, repair and recommend equipment calibration to standard, and develop and follow a regular service schedule
- modify equipment when appropriate and ensure equipment inspection by the Electrical Safety Authority (ESA) when required
- operate equipment in accordance with functional specifications* and established practices, policies and procedures
- comply with health and safety legislation while operating electronic equipment

6. *The graduate has reliably demonstrated the ability to*

determine, select, recommend and justify the purchase of electronic equipment, components and systems in accordance with code, standards and job requirements* and functional specifications*.

Elements of the Performance

- contact clients, manufacturers, consultants and suppliers to obtain information required to determine, select, recommend and justify the purchase of appropriate electronic equipment, components and systems
- determine for purchase the requirements and functional specifications* of electronic equipment, components and systems by consulting manufacturers' specifications as well as print and electronic media
- recommend adequate substitutes when appropriate
- prepare and evaluate quotes on purchased electronic equipment, components or systems
- apply related quality assurance* principles to the purchase and verification of material and the appropriate standards

7. *The graduate has reliably demonstrated the ability to*

design*, modify, analyze* and troubleshoot* logic and digital circuits, and embedded microprocessor*-based and microcontroller*-based systems, including assembly and high-level language programs.

Elements of the Performance

- perform conversions and calculations in and among number systems, such as hexadecimal, decimal, binary and binary-coded decimal
- recognize logic family characteristics in digital circuits for troubleshooting* tasks
- design*, simulate, analyze* and troubleshoot* combinational and sequential logic circuits as well as analog-to-digital and digital-to-analog conversion circuits
- produce, interpret and use timing diagrams to analyze* and troubleshoot* sequential logic circuits
- design*, analyze*, troubleshoot* and modify circuits which have programmable logic devices, including those using graphical or hardware description languages (VHDL)
- design*, analyze* and troubleshoot* circuits with microprocessors* and microcontrollers*, and write code in assembly and high-level languages using tools such as flowcharts and the V-Cycle
- design*, analyze* and troubleshoot* systems based on microprocessors* and microcontrollers*, and embedded systems interfacing circuitry
- design*, analyze* and troubleshoot* routines in assembly and high-level languages using structured programming techniques
- design*, analyze* and troubleshoot* computer hardware, peripherals and bus architectures

8. *The graduate has reliably demonstrated the ability to*

design*, analyze* and troubleshoot* circuits consisting of passive components by applying appropriate measurement techniques.

Elements of the Performance

- apply Ohm's Law, mesh and nodal analyses and Kirchhoff's Laws to circuit design* and analysis*
- apply superposition, Thevenin's Theorem and Norton's Theorem to design* and analyze* alternative current (AC) and direct current (DC) circuits
- identify, select and apply passive components in AC/DC circuits to fulfill job requirements* and functional specifications*
- solve phasor and complex number problems related to electrical and electronic circuits
- identify, analyze* and distinguish waveform properties
- design*, analyze* and troubleshoot* electrical circuits consisting of resistors (R), inductors (L) and capacitors (C) (referred to as RLC), and passive AC/DC circuits in compliance with relevant standards
- perform real and apparent power calculations on devices and circuits
- simulate circuits consisting of passive components
- apply knowledge of resonance to the analysis* of circuit behaviour
- apply reliability principles identifying performance limitations

9. *The graduate has reliably demonstrated the ability to*

design*, analyze* and troubleshoot* circuits consisting of low power, high power, active and electromechanical components, and analog integrated circuits.

Elements of the Performance

- identify and select active low power and high power, discrete and integrated devices in accordance with job requirements* and functional specifications*
- apply the principles of operation of low power and high power, discrete and integrated devices to the design, analysis*, simulation and troubleshooting* of simple and complex electronic circuits
- design*, analyze* and troubleshoot* electronic circuits and subsystems incorporating active devices and electromechanical sensors and actuators, such as motors
- perform measurements on high power, discrete, integrated and electromechanical circuits to determine power dissipation requirements, and to design* and/or recommend the appropriate power dissipation strategy
- apply knowledge of polyphase AC systems to electronic circuit design* and analysis*

10. *The graduate has reliably demonstrated the ability to*
design*, analyze* and troubleshoot* control systems.

Elements of the Performance

- design*, analyze* and troubleshoot* control and feedback systems in compliance with job requirements* and functional specifications*
- design*, simulate, analyze* and modify control processes using computer-based tools, according to relevant standards
- use, tune and apply algorithms such as the proportional-integral-derivative (PID) algorithm, in single loop control systems
- perform measurements and modifications on control systems
- characterize sensors and actuators used in control systems and apply the derived transfer functions for troubleshooting* or optimizing control systems
- create, modify and maintain control system documentation

11. *The graduate has reliably demonstrated the ability to*

design*, analyze*, troubleshoot* and repair analog and digital communication systems.

Elements of the Performance

- design*, analyze* and troubleshoot* analog and digital communication systems, including computer networks and wireless systems, in compliance with relevant standards and regulations
- select appropriate media for a particular communication system
- implement local-area networks (LAN) and wide-area networks (WAN) using appropriate networking devices
- design*, analyze* and troubleshoot* communication protocols, including the identification of noise sources and the application of noise-control techniques
- relate principles of public carrier telephony to design*, analyze* and troubleshoot* communication systems
- conduct tests on equipment, interpret results and troubleshoot* as required
- operate equipment in compliance with functional specifications* and safety procedures
- relate principles of Internet Protocol (IP) to communication systems, such as Voice over Internet Protocol (VoIP)
- recommend a regular service schedule
- comply with health and safety legislation while operating electronic equipment
- analyze* communications media in terms of transmission lines
- apply the fundamental concepts* of fibre optic systems
- design*, analyze*, construct and troubleshoot* Radio Frequency (RF) (including microwave) circuits, equipment and systems
- comply with legislation and regulations governing the transmission and reception of radio signals

12. *The graduate has reliably demonstrated the ability to*

apply relevant shop practices* in compliance with safety policies and current regulations for electronics engineering workplaces.

Elements of the Performance

- interpret and apply safety codes, policies and practices, and accident prevention procedures
- use protective equipment and wear appropriate clothing to ensure personal health and safety in the workplace
- select, operate and maintain tools safely
- conduct safety inspections of shop environments to detect and correct hazardous conditions
- complete installation, maintenance and repairs of electronic equipment in accordance with regulatory and licensing requirements
- handle, store and dispose hazardous materials safely in accordance with the Workplace Hazardous Materials Information System (WHMIS)
- apply proper handling procedures for electronic components, such as Electrostatic Discharge (ESD) and mechanical handling procedures
- comply with relevant health and safety standards by identifying non-compliance issues

13. *The graduate has reliably demonstrated the ability to*

collaborate in selecting, co-ordinating and conducting quality control* and quality assurance* programs and procedures.

Elements of the Performance

- produce and review functional specifications*, test procedures and standards applicable to electronic equipment
- perform quality assurance* testing or ensure that quality assurance* is completed for electronics manufacturing processes and verify standards compliance
- monitor, evaluate and report test results in compliance with organizational quality assurance* procedures and functional specifications*
- interpret and apply the results of quality assurance* testing to problem-solving functions and recommend improvements to manufacturing or quality monitoring processes
- design*, select and use appropriate procedures for electronics test and electronics measurement equipment used in manufacturing environments
- program test equipment to generate appropriate test vectors
- apply the fundamental concepts* of statistical process control to quality control* functions
- apply the fundamental concepts* of product and inventory control
- design*, install, configure and commission electronic equipment and circuits
- create or recommend a calibration, service and preventive maintenance schedule for electronic equipment and circuits
- apply knowledge of recognized quality standards such as International Organization for Standardization (ISO)
- apply verification, validation, quality control* and quality assurance* to electronics engineering functions
- prepare and maintain parts inventories and installation records
- prepare and update maintenance and service logs

14. *The graduate has reliably demonstrated the ability to*

complete work in compliance with relevant legislation, established standards, policies, procedures and regulations, and ethical principles.

Elements of the Performance

- recognize legal principles affecting contracts with clients
- interpret and comply with projects' functional specifications* and drawings
- act in accordance with legislation, codes and appropriate industry standards, including occupational health and safety and labour laws, such as Workplace Hazardous Materials Information System (WHMIS)
- use equipment and materials that adhere to relevant legislation, standards, codes and bylaws
- follow practices that comply with relevant legislation, standards, codes and bylaws
- promote contributions of technology for the betterment of society
- support equality and diversity* in the workplace
- conduct safety inspections of the workplace to detect, report and correct hazardous conditions, where they may occur
- practice ethical principles
- assume responsibility and accountability
- identify training courses workshops and programs to enhance knowledge of legislation, standards, policies, procedures, regulations and ethical principles as well as other professional topics
- recognize procedures and practices that are non-compliant with legislation, standards, regulations and ethical principles

15. *The graduate has reliably demonstrated the ability to*

contribute to the planning, implementation, management and evaluation of team projects by applying project management principles.

Elements of the Performance

- participate in the planning, identification, scheduling and assigning of tasks and resources involved in a project as required
- contribute to the monitoring of resources and expenditures to maintain cost effectiveness and respect timelines as required
- consolidate project updates regularly
- estimate accurately the time required to complete project elements
- complete project elements according to schedule
- assist in the evaluation of project processes and outcomes
- interpret and use project planning documents (e.g., Gantt Charts, Critical Path Analysis, PERT Charts)
- identify problems which will affect the project timeline and recommend changes as soon as possible
- maintain current, clear and accurate project-related documents, which adhere to organizational and industry standards and procedures
- use relevant project management software

Glossary

Analyze - collect information by studying the component parts of electronic circuits, equipment or systems to understand how component parts are affecting one another.

Design/Designing - the devising and creating of drawings or simple circuits from fundamental components using established reference design and related documentation.

Diversity - diverse populations, including but not limited to age, ethnicity, race, gender, ability, social and economic class, or sexual orientation, and health states representative of the individuals, groups and colleagues with whom graduates will interact.

Functional specifications - detailed and precise presentation describing the structure, performance and other characteristics of electronic circuits, equipment or systems.

Fundamental concepts - underlying, essential, basic theories or principles.

Job requirements - essential conditions necessary for electronic circuits, equipment and systems to function and complete specific tasks properly.

Microcontroller – a microprocessor and peripheral interface electronics on a single integrated circuit that is designed to control dedicated processes with no or minimal peripheral electronics.

Microprocessor - an integrated circuit that contains the arithmetic-logic unit and central processing unit of a computer.

Quality assurance - all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.

Quality control - the operational techniques and activities used to fulfill requirements for quality.

Shop practices - recognized standards for safe installation and operation of electronic devices and instrumentation in workplace labs and manufacturing facilities.

Troubleshoot/Troubleshooting - determine why electronic circuits, equipment, systems or sub-systems are malfunctioning.

III. Essential Employability Skills

All graduates of the Electronics Engineering Technology program of instruction must have reliably demonstrated the essential employability skills learning outcomes listed on the following pages, in addition to achieving the vocational learning outcomes and meeting the general education requirement.

Context

Essential Employability Skills (EES) are skills that, regardless of a student's program or discipline, are critical for success in the workplace, in day-to-day living and for lifelong learning.

The teaching and attainment of these EES for students in, and graduates from, Ontario's colleges of applied arts and technology are anchored in a set of three fundamental assumptions:

- these skills are important for every adult to function successfully in society today;
- our colleges are well equipped and well positioned to prepare graduates with these skills;
- these skills are equally valuable for all graduates, regardless of the level of their credential, whether they pursue a career path, or they pursue further education.

Skill Categories

To capture these skills, the following six categories define the essential areas where graduates must demonstrate skills and knowledge.

- Communication
- Numeracy
- Critical Thinking & Problem Solving
- Information Management
- Interpersonal
- Personal

Application and Implementation

In each of the six skill categories, there are a number of defining skills, or sub skills, identified to further articulate the requisite skills identified in the main skill categories. The following chart illustrates the relationship between the skill categories, the defining skills within the categories and learning outcomes to be achieved by graduates from all postsecondary programs of instruction that lead to an Ontario College credential.

EES may be embedded in General Education or vocational courses, or developed through discrete courses. However these skills are developed, all graduates with Ontario College credentials must be able to reliably demonstrate the essential skills required in each of the six categories.

SKILL CATEGORY	DEFINING SKILLS: Skill areas to be demonstrated by graduates:	LEARNING OUTCOMES: The levels of achievement required by graduates. The graduate has reliably demonstrated the ability to:
COMMUNICATION	<ul style="list-style-type: none"> • Reading • Writing • Speaking • Listening • Presenting • Visual literacy 	<ol style="list-style-type: none"> 1. <i>communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience.</i> 2. <i>respond to written, spoken or visual messages in a manner that ensures effective communication.</i>
NUMERACY	<ul style="list-style-type: none"> • Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data • Conceptualizing 	<ol style="list-style-type: none"> 3. <i>execute mathematical operations accurately.</i>
CRITICAL THINKING & PROBLEM SOLVING	<ul style="list-style-type: none"> • Analyzing • Synthesizing • Evaluating • Decision making • Creative and innovative thinking 	<ol style="list-style-type: none"> 4. <i>apply a systematic approach to solve problems.</i> 5. <i>use a variety of thinking skills to anticipate and solve problems.</i>

SKILL CATEGORY	DEFINING SKILLS: Skill areas to be demonstrated by graduates:	LEARNING OUTCOMES: The levels of achievement required by graduates. The graduate has reliably demonstrated the ability to:
INFORMATION MANAGEMENT	<ul style="list-style-type: none"> • Gathering and managing information • Selecting and using appropriate tools and technology for a task or a project • Computer literacy • Internet skills 	<p>6. <i>locate, select, organize and document information using appropriate technology and information systems.</i></p> <p>7. <i>analyze, evaluate and apply relevant information from a variety of sources.</i></p>
INTERPERSONAL	<ul style="list-style-type: none"> • Teamwork • Relationship management • Conflict resolution • Leadership • Networking 	<p>8. <i>show respect for the diverse opinions, values, belief systems and contributions of others.</i></p> <p>9. <i>interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.</i></p>
PERSONAL	<ul style="list-style-type: none"> • Managing self • Managing change and being flexible and adaptable • Engaging in reflective practices • Demonstrating personal responsibility 	<p>10. <i>manage the use of time and other resources to complete projects.</i></p> <p>11. <i>take responsibility for one's own actions, decisions and their consequences.</i></p>

IV. General Education Requirement

All graduates of the Electronics Engineering Technology program must have met the general education requirement described on the following pages, in addition to achieving the vocational and essential employability skills learning outcomes.

Requirement

The General Education Requirement for programs of instruction is stipulated in the Credentials Framework (Appendix A in the Minister's Binding Policy Directive *Framework for Programs of Instruction*).

In programs of instruction leading to either an Ontario College Diploma or an Ontario College Advanced Diploma, it is required that graduates have been engaged in learning that exposes them to at least one discipline outside their main field of study and increases their awareness of the society and culture in which they live and work. This will typically be accomplished by students taking 3 to 5 courses (or the equivalent) designed discretely and separately from vocational learning opportunities.

This general education learning would normally be delivered using a combination of required and elective processes.

Purpose

The purpose of General Education in the Ontario college system is to contribute to the development of citizens who are conscious of the diversity, complexity and richness of the human experience; who are able to establish meaning through this consciousness; and who, as a result, are able to contribute thoughtfully, creatively and positively to the society in which they live and work.

General Education strengthens students' essential employability skills, such as critical analysis, problem solving and communication, in the context of an exploration of topics with broad-based personal and/or societal importance.

Themes

The themes listed below will be used to provide direction to colleges in the development and identification of courses that are designed to fulfill the General Education Requirement for programs of instructions.

Each theme provides a statement of Rationale and offers suggestions related to more specific topic areas that could be explored within each area. These suggestions are neither prescriptive nor exhaustive. They are included to provide guidance regarding the nature and scope of content that would be judged as meeting the intent and overall goals of General Education.

1. Arts in Society:

Rationale:

The capacity of a person to recognize and evaluate artistic and creative achievements is useful in many aspects of his/her life. Since artistic expression is a fundamentally human activity, which both reflects and anticipates developments in the larger culture, its study will enhance the student's cultural and self-awareness.

Content:

Courses in this area should provide students with an understanding of the importance of visual and creative arts in human affairs, of the artist's and writer's perceptions of the world and the means by which those perceptions are translated into the language of literature and artistic expression. They will also provide an appreciation of the aesthetic values used in examining works of art and possibly, a direct experience in expressing perceptions in an artistic medium.

2. Civic Life:

Rationale:

In order for individuals to live responsibly and to reach their potential as individuals and as citizens of society, they need to understand the patterns of human relationships that underlie the orderly interactions of a society's various structural units. Informed people will have knowledge of the meaning of civic life in relation to diverse communities at the local, national and global level and an awareness of international issues and the effects of these on Canada, as well as Canada's place in the international community.

Content:

Courses in this area should provide students with an understanding of the meaning of freedoms, rights and participation in community and public life, in addition to a working knowledge of the structure and function of various levels of government (municipal, provincial, national) in a Canadian and/or in an international context. They may also provide an historical understanding of major political issues affecting relations between the various levels of government in Canada and their constituents.

3. Social and Cultural Understanding:

Rationale:

Knowledge of the patterns and precedents of the past provide the means for a person to gain an awareness of his or her place in contemporary culture and society. In addition to this awareness, students will acquire a sense of the main currents of their culture and that of other cultures over an extended period of time in order to link personal history to the broader study of culture.

Content:

Courses in this area are those that deal broadly with major social and cultural themes. These courses may also stress the nature and validity of historical evidence and the variety of historical interpretation of events. Courses will provide the students with a view and understanding of the impact of cultural, social, ethnic or linguistic characteristics.

4. Personal Understanding:

Rationale:

Educated people are equipped for life-long understanding and development of themselves as integrated physiological and psychological entities. They are aware of the ideal need to be fully functioning persons: mentally, physically, emotionally, socially, spiritually and vocationally.

Content:

Courses in this area will focus on understanding the individual: his or her evolution; situation; relationship with others; place in the environment and universe; achievements and problems; and his or her meaning and purpose. They will also allow students the opportunity to study institutionalized human social behaviour in a systematic way. Courses fulfilling this requirement may be oriented to the study of the individual within a variety of contexts.

5. Science and Technology:

Rationale:

Matter and energy are universal concepts in science, forming a basis for understanding the interactions that occur in living and non-living systems in our universe. Study in this area provides an understanding of the behaviour of matter that provides a foundation for further scientific study and the creation of broader understanding about natural phenomena

Similarly, the various applications and developments in the area of technology have an increasing impact on all aspects of human endeavour and have numerous social, economic and philosophical implications. For example, the operation of computers to process data at high speed has invoked an interaction between machines and the human mind that is unique in human history. This and other technological developments have a powerful impact on how we deal with many of the complex questions in our society.

Content:

Courses in this area should stress scientific inquiry and deal with basic or fundamental questions of science rather than applied ones. They may be formulated from traditional basic courses in such areas of study as biology, chemistry, physics, astronomy, geology or agriculture. As well, courses related to understanding the role and functions of computers (e.g., data management and information processing) and assorted computer-related technologies should be offered in a non-applied manner to provide students with an opportunity to explore the impact of these concepts and practices on their lives.