



# **Electromechanical Engineering Technology Program Standard**

**The approved program standard for  
Electromechanical Engineering  
Technology program of instruction leading  
to an Ontario College Advanced Diploma  
delivered by Ontario Colleges of Applied  
Arts and Technology (MTCU funding code  
61021)**

Ministry of Advanced Education and Skills Development  
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Inquiries regarding specific Electromechanical Engineering Technology (Ontario College Advanced Diploma) programs offered by colleges of applied arts and technology in Ontario should be directed to the relevant college.

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# Table of Contents

<b>I. Introduction .....</b>	<b>1</b>
Development of System-Wide Program Standards.....	1
Program Standards.....	1
The Expression of Program Standards as Vocational Learning Outcomes.....	2
The Presentation of the Vocational Learning Outcomes.....	2
The Development of a Program Standard.....	2
Updating the Program Standard .....	3
<b>II. Vocational Standard .....</b>	<b>4</b>
Preamble.....	4
Synopsis of the Vocational Learning Outcomes.....	6
The Vocational Learning Outcomes.....	8
Glossary.....	26
<b>III. Essential Employability Skills .....</b>	<b>27</b>
Context.....	27
Skill Categories.....	27
Application and Implementation.....	28
<b>IV. General Education Requirement .....</b>	<b>30</b>
Requirement .....	30
Purpose.....	30
Themes.....	31

# I. Introduction

This document is the Program Standard for the Electromechanical Engineering Technology program of instruction leading to an Ontario College Advanced Diploma delivered by Ontario colleges of applied arts and technology (MTCU funding code 61021).

## 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 Advanced Education and Skills Development have 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 will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Electromechanical Engineering Technology (Ontario College Advanced Diploma) 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](mailto:psu@ontario.ca)

## II. Vocational Standard

All graduates of Electromechanical Engineering Technology programs have achieved the sixteen vocational learning outcomes (VLOs) listed in the following pages, in addition to achieving the essential employability skills (EES) learning outcomes and meeting the general education (GE) requirement.

### Preamble

Today's industrial machinery integrates mechanical, electrical, and electronic/computer systems. The field of electromechanical engineering reflects the integration of four areas of engineering: mechanical, electrical, electronics, and automation. Graduates of Electromechanical Engineering Technology Programs carry out electromechanical engineering technologist functions at an entry level within an engineering environment. Program graduates are able to meet the rapidly changing demands of industrial environments and advanced manufacturing industries through their ability to design, analyze, install, maintain, operate and troubleshoot increasingly sophisticated and automated equipment.

Achievement of the vocational learning outcomes will prepare the graduates of the Advanced Diploma Electromechanical Engineering Technology Programs to specialize in designing, analyzing, troubleshooting, modifying, maintaining, and repairing electromechanical equipment, components, systems, and subsystems. In addition, graduates will be able to assist in project management; to perform purchasing, customer service, quality-control and quality-assurance functions; and to apply communication, documentation, computer applications, and teamwork skills to support the engineering activities of an organization. Program graduates are also able to develop personal and professional strategies and plans to remain current in the field and responsive to emergent technologies and national and international standards.

Graduates of Electromechanical Engineering Technology Programs work in a broad range of employment settings in businesses and industries using electromechanical engineering, in both large and small organizations. Their jobs could involve working with a variety of electromechanical equipment and systems including manufacturing, robotics and automation, systems integration, research and development, design, mobile technology, microprocessor-based, computer, and control systems. Graduates of this program may find employment in areas such as: manufacturing and automated process control equipment maintenance, hydraulic/pneumatic equipment maintenance, building and plant automation, PLC programming, robotic and motion control systems, process instrumentation and control, technical sales and services, renewable energy, field service, and component testing and assembly. Industries include automotive, food processing, packaging, pharmaceuticals, utilities, power generation, and others, as well as government.



There may be opportunities for graduates to pursue further educational qualifications through transfer pathways\* between the colleges and universities or occupational certifications through professional organizations. Graduates should contact individual colleges and professional associations, such as the Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

Endnote<sup>1</sup>: The Ontario Council on Articulation and Transfer (ONCAT) maintains the provincial postsecondary credit transfer portal, ONTransfer and the [Ontario Postsecondary Transfer Guide](#) (OPTG).

# Synopsis of the Vocational Learning Outcomes

## Electromechanical Engineering Technology

The graduate has reliably demonstrated the ability to

1. fabricate and build electrical, electronic, and mechanical components and assemblies in accordance with operating standards, job requirements, and specifications
2. analyze, interpret, and produce electrical, electronic, and mechanical drawings and other related technical documents and graphics necessary for electromechanical design in compliance with industry standards.
3. select and use a variety of troubleshooting techniques and equipment to assess, modify, maintain, and repair electromechanical circuits, equipment, processes, systems, and subsystems.
4. modify, maintain, and repair electrical, electronic, and mechanical components, equipment, and systems to ensure that they function according to specifications and to optimize production.
5. design and analyse mechanical components, processes, and systems by applying engineering principles and practices.
6. design, analyze, build, select, commission, integrate, and troubleshoot a variety of industrial motor controls and data acquisition devices and systems, digital circuits, passive AC and DC circuits, active circuits and microprocessor-based systems.
7. install and troubleshoot computer hardware and programming to support the electromechanical engineering environment.
8. analyse, program, install, integrate, troubleshoot and diagnose automated systems including robotic systems.
9. establish and maintain inventory, records, and documentation systems to meet organizational and industry standards and requirements.
10. select and purchase electromechanical equipment, components, and systems that fulfill job requirements and functional specifications.
11. specify, coordinate, and apply quality-control and quality-assurance programs and procedures to meet organizational standards and requirements.
12. work in compliance with relevant industry standards, laws and regulations, codes, policies, and procedures.
13. develop strategies for ongoing personal and professional development to enhance work performance and to remain current in the field and responsive to emergent technologies and national and international standards.
14. contribute as an individual and a member of an electromechanical engineering team to the effective completion of tasks and projects.
15. design and analyze electromechanical systems by interpreting fluid mechanics and the attributes and dynamics of fluid flow used in hydraulic and fluid power\* systems

16. contribute to project management through planning, implementation and evaluation of projects, and monitoring of resources, timelines, and expenditures as required.

\*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

fabricate and build electrical, electronic, and mechanical components and assemblies in accordance with operating standards, job requirements, and specifications.

### **Elements of the Performance**

- select, operate, and maintain hand and power tools according to standard practice
- apply soldering and de-soldering techniques
- assemble printed circuit boards (PCB)
- prepare wire and cable assemblies
- repair and replace electrical, electronic, and mechanical components
- use basic machine shop skills such as turning, milling, metal bending, drilling, tapping, machining, and cutting according to job specifications
- design, test, and troubleshoot electrical panel assemblies
- analyse components of a breadboard and a PCB
- operate equipment according to job requirements and specifications
- identify the necessary technical criteria and apply engineering principles to design and construct electrical, electronic, and mechanical components and assemblies
- apply knowledge of mechanical, electrical, electronic, and automation technologies to solve design and other complex technical problems and complete electromechanical engineering tasks

2. The graduate has reliably demonstrated the ability to

analyse, interpret, and produce electrical, electronic, and mechanical drawings and other related technical documents, reports and graphics necessary for electromechanical design, in compliance with industry standards.

### **Elements of the Performance**

- produce or reproduce drawings using computer-aided drafting, including, where applicable, PLC ladder logic, and hydraulics and pneumatics in circuit diagrams
- produce and modify drawings effectively, including creating new drawings, legends and templates
- analyse, interpret, prepare, and modify electrical, electronic, and mechanical specifications and project-related documents
- use computer software and other technology to produce effective sketches, diagrams, charts, tables, and graphs
- recognize the role of 3D solid modelling associative software in design
- organize and prepare documents in accordance with recognized standards (e.g., company standards, CSA, ISO, electrical codes)
- prepare, evaluate, and modify project-related documents according to job specifications and requirements
- demonstrate understanding of configuration management, including version control

3. The graduate has reliably demonstrated the ability to

select and use a variety of troubleshooting techniques to assess, modify, maintain, and repair electromechanical circuits, equipment, processes, systems, and subsystems.

### **Elements of the Performance**

- use standard mechanical, electrical, and electronic testing and measurement equipment such as scopes, digital multimeter, protocol analysers, cable testers, calipers, Vernier's, and voltmeters
- use a variety of references including colleagues, manufacturers' manuals, handbooks, and electronic references (e.g., Internet, cloud-based) to complete troubleshooting
- apply mathematical and scientific analysis in accordance with the principles and practices of electromechanical engineering
- solve technical problems using advanced mathematics including differential equations
- apply principles of statistics to engineering problems
- develop mathematical and graphical models to test alternatives and deduce optimal solutions
- use the correct testing equipment and setup for the accurate assessment of equipment performance
- upgrade equipment when appropriate
- follow established service schedules
- diagnose electromechanical system problems using appropriate test instrumentation, schematics, and technical reference manuals
- determine whether a fault is electrical, electronic, software, or mechanical in nature
- recommend appropriate repair process and initiate repair
- develop and conduct Equipment Capability Studies
- follow industry best practices, including controlled documentation
- troubleshoot servomechanisms and feedback systems to meet job requirements and functional specifications

4. The graduate has reliably demonstrated the ability to

modify, maintain, repair and integrate electrical, electronic, and mechanical components, equipment, and systems to ensure that they function according to specifications and to optimize production.

#### **Elements of the Performance**

- install, configure, commission, and integrate components, equipment, and systems
- operate equipment according to functional specifications and safety procedures
- establish and follow regular inspection and service schedules
- select, install, troubleshoot, repair, and modify equipment to keep operations running efficiently
- operate, adjust, and repair common types of instrumentation
- test, troubleshoot, and repair typical electromechanical systems such as replacing wiring, fluid power components, and electromechanical devices
- repair electrical and electronic systems, including devices, subsystems, wiring, and cabling to circuit board level
- replace circuit boards (e.g., motherboards)
- provide creative design and programming solutions to enhance automated and robotics performance.

5. The graduate has reliably demonstrated the ability to

design and analyse mechanical components, processes, and systems by applying engineering principles and practices.

### **Elements of the Performance**

- design, analyze, troubleshoot, source, and select mechanical power transmission components and systems
- recognize the role of kinematics as part of mechanical design
- design and analyse mechanical components and prototypes used in manufacturing processes and systems
- analyse properties of materials and assess their suitability for use in a mechanical system
- apply knowledge of manufacturing techniques to support the manufacturing and handling of components
- apply principles of design for manufacturing
- select and source mechanical systems and components such as electromechanical devices, conveyers, robots, feeders, slides, chucks, cams, fixtures, tooling, and bearings



6. The graduate has reliably demonstrated the ability to

design, analyze, build, select, commission, integrate, and troubleshoot a variety of industrial motor controls and data acquisition devices and systems, digital circuits, passive AC and DC circuits, active circuits and microprocessor-based systems.

### **Elements of the Performance**

- apply knowledge of production and manufacturing systems to increase company's efficiency and productivity.
- design, analyze, modify and integrate electric motor control processes and systems, applying knowledge of electric motor fundamentals, control relays and drives (e.g., variable frequency drive [VFD]), and digital sensors.
- apply electromechanical knowledge to single- and three-phase industrial and domestic electrical distribution
- select and troubleshoot analog and digital circuits and sensors
- design, use, adjust, and maintain instrumentation
- design, analyze, install, test, and troubleshoot Programmable Logic Control (PLC), Programmable Logic Device (PLD) (microcontrollers) and motion control systems, integrating a variety of industrial components and machinery.
- design and program industrial control systems (e.g., supervisory control and data acquisition [SCADA] and distributed control systems [DCS])
- apply knowledge of operator interface (e.g., operator panel) to the design of control systems
- apply knowledge of web-enabled, cloud-based and device-to-device applications to the design of control systems (e.g. Industrial Internet of Things)
- select, program, and troubleshoot vision and radio communication systems (e.g., bar code, RFID).
- analyse and apply electrical/electronic and other sensory devices in various equipment applications
- apply electrical, electronic, and computer fundamentals to programmable equipment and instrumentation
- design and program control systems using Human Machine Interface (HMI) technology (e.g., PC-based visualization software)
- apply knowledge of control system theory (open/closed loop) to design control systems
- recognize and apply knowledge of the technology inherent in devices and machinery to support the electromechanical engineering environment, including systems integration and networking
- design, analyze, build, and troubleshoot combinational and sequential logic and digital circuits, DC and AC passive and active circuits

- apply knowledge of Laplace and Fourier transforms and their application to circuit analysis and behaviour
- design, program, and simulate programmable logic devices using graphical or hardware description languages (HDL)
- interpret and use timing diagrams
- apply Ohm's Law, Kirchhoff's Law, Superposition and Thevenin's theorem to DC and AC circuit design and analysis
- identify and select passive components for AC and DC circuits to fulfill job requirements and functional specification
- identify, analyse, and distinguish waveform properties
- identify and select analog semiconducting devices to meet job requirements and functional specifications
- design, analyse, and troubleshoot circuits such as linear and non-linear amplifiers, oscillators, pulse circuits, and active filters using discrete components and integrated circuits
- design, analyze and troubleshoot microprocessor-based systems
- use microcontrollers to remotely control collection of data
- analyse microprocessor and microcontroller architectures
- interface, analyse, and troubleshoot Microcontroller/SOC and I/O devices following standard approaches and techniques
- design and program circuits using MCU and or SOC

7. The graduate has reliably demonstrated the ability to

install and troubleshoot computer hardware and programming to support the electromechanical engineering environment.

### **Elements of the Performance**

- select, configure, install, implement, and troubleshoot industrial communication networks.
- Troubleshoot and maintain higher level industrial systems such as SCADA, and Historian
- use knowledge of computer systems and application software to resolve design and other complex technical problems
- apply knowledge of hardware and application software to maintain effective computer operations
- develop and debug computer programs in high-level language using structured programming techniques
- install computers as communication devices between components and an industrial system
- analyse and develop programs for programmable controllers used in automated systems
- recognize and apply knowledge of the technology inherent in devices and machinery to support the electromechanical engineering environment, including systems integration and wireless networking

8. The graduate has reliably demonstrated the ability to

analyse, program, install, integrate, troubleshoot and diagnose automated systems including robotic systems.

### **Elements of the Performance**

- analyse, program, commission, integrate, and troubleshoot automated systems including industrial robotic incorporating PLCs, microcontrollers, machine vision systems, PID feedback control and Fluid Power (industrial hydraulics and pneumatics components).
- select, setup, integrate, analyse, program, test, and troubleshoot automated processing systems and motor controls used in manufacturing processes
- integrate data acquisition processes and systems for the purposes of SCADA
- apply the use of analog and digital signals for processing
- design and apply the operation of commonly used types of automated technology, including operator interface and HMI used in modern manufacturing and processing
- analyse the principles and function of the mechanical, electrical, electronic, and fluid power components and assemblies used in automated equipment and instrumentation
- evaluate, select, and apply appropriate robotic technology to a variety of industrial processes
- integrate robotic systems with other automation equipment through discrete/analog I O and real-time networking
- Optimize automated and robotics systems to improve efficiency

9. The graduate has reliably demonstrated the ability to establish and maintain inventory, records, and documentation systems to meet organizational and industry standards and requirements.

### **Elements of the Performance**

- prepare technical documentation such as operator procedures, maintenance procedures, repair procedures, and installation procedures
- interpret and use information from technical manuals
- manage electronic and/or paper-based systems to store and retrieve information
- maintain current, clear, and accurate electromechanical engineering-related documents
- use records and inventories to prepare reports
- prepare and maintain parts inventory and installation records
- prepare and maintain maintenance and service logs
- document clearly work processes such as problem-solving methodologies, troubleshooting procedures, and prototype evolution (e.g., problems, modifications)
- follow established procedures of inventory control
- document the design, testing, modification, and application of electrical, electronic, and mechanical equipment and systems

10. The graduate has reliably demonstrated the ability to select and purchase electromechanical equipment, components, and systems that fulfill job requirements and functional specifications.

### **Elements of the Performance**

- research and identify potential sources of equipment, components, and systems
- select and troubleshoot motors and drives
- contact clients, manufacturers, consultants, and suppliers to obtain information required to select and purchase appropriate equipment, components, and systems
- determine requirements and functional specifications of equipment, components, and systems for procurement
- recommend appropriate equipment, components, and systems
- determine adequate substitutes when necessary
- select equipment, components, and systems by consulting manufacturers' specifications, catalogues, and electronic sources (e.g., Internet, cloud-based)
- research, collect, process, and interpret data necessary to complete the purchasing process
- recognize the importance of using standardized parts to facilitate troubleshooting and reduce spare parts inventory

11. The graduate has reliably demonstrated the ability to

specify, coordinate, and apply quality-control and quality-assurance programs and procedures to meet organizational standards and requirements.

### **Elements of the Performance**

- consider statistical process control (SPC) during the design process and apply principles of SPC to the manufacturing process
- use a recognized approach (e.g., Taguchi) when designing experiments
- establish maintenance schedules and apply preventive and predictive maintenance techniques
- review the specifications applicable to an engineering project and develop procedures where applicable
- observe, record, assess, and report compliance with appropriate quality-assurance procedures and specifications
- review specifications applicable to electrical and electronic circuits, equipment, and systems
- monitor, assess, and report test results in accordance with organizational quality-assurance procedures and specifications
- use the results of quality-assurance testing to improve manufacturing processes and to modify electrical, electronic, and mechanical components, equipment, and systems
- apply knowledge of relevant quality-assurance and quality-control programs to improve work performance and to maintain product quality
- write and review functional specifications, procedures, and relevant standards applicable to electromechanical engineering
- select and use appropriate procedures, measurement, and testing equipment

12. The graduate has reliably demonstrated the ability to

work in compliance with relevant industry standards, laws and regulations, codes, policies and procedures.

### **Elements of the Performance**

- follow appropriate procedures and practices (e.g., Lockout/Tagout Standard) to ensure proper shutdown of equipment before maintenance and servicing activities are performed
- adhere to applicable workplace codes including those relating to electrical and mechanical work environments, explosive environments, hazardous material handling, and safety
- demonstrate understanding of and follow safe working practices for working with high voltage, fault current, bonding, grounding, and arc flash
- comply with all relevant occupational health and safety requirements and applicable sections of the Technical Standards and Safety Authority (TSSA) and the Ontario Electrical Safety Code (OESC)
- follow all relevant policies and practices established by government agencies (e.g., the Occupational Health and Safety Agency, the Ministry of Labour, the Ministry of the Environment)
- test, store, and handle electrical, electronic, and mechanical equipment according to industry standards (e.g., American National Standards Institute, electrical codes)
- demonstrate and apply basic knowledge of control reliability and the design of safety systems to meet international requirements for safe design (e.g., EN ISO 13849)
- demonstrate understanding of the need for and apply knowledge of the process to conduct risk assessments and risk analysis according to international standards (e.g., ISO 12100)
- apply regulatory and licensing requirements (e.g., NEMA ratings) when completing installations, maintenance, and repairs of electrical, electronic, and mechanical equipment
- conduct safety inspections of the workplace to detect, report, and correct, where possible, hazardous conditions
- recognize legal principles affecting contracts with clients
- comply with work specifications and other technical documents
- understand and respect workers' rights, including those related to safety.
- apply knowledge of safety products such as safety relays and safety interlock devices and ground fault circuit interrupters
- respond appropriately to emergency situations according to organizational practices and procedures
- adhere to organizational policies, such as workplace discrimination, harassment and violence prevention policies, that strengthen an inclusive, equitable, respectful, safe and co-operative workplace environment



- maintain all required health and safety training and certification such as, Workplace Hazardous Materials Information System (WHMIS), Fall Arrest Protection and Confined Space Safety training
- apply principles of environmental sustainability to all aspects of electro-mechanical engineering processes

13. The graduate has reliably demonstrated the ability to formulate strategies for ongoing personal and professional development to enhance work performance and to remain current in the field.

**Elements of the Performance**

- apply a systematic approach to career decision making
- keep abreast of changes in the field of electromechanical engineering
- take into account the importance of active participation in professional associations and acquisition of professional certification
- use appropriate self-management techniques (e.g., time management, stress management)
- recognize the importance of ongoing professional development to enhance general job performance

14. The graduate has reliably demonstrated the ability to contribute as an individual and a member of an electromechanical engineering team to the effective completion of tasks and projects.

### **Elements of the Performance**

- Contribute to the achievement of project goals and objectives while honouring the constraints of the project and the roles and responsibilities of other team members
- Use interpersonal skills adapted to the requirements of the project and the team to achieve desired outcomes
- Contribute to a team project or group decision-making process by applying group dynamics, conflict resolution, and negotiation techniques
- Outline the steps that assess the success of a project
- assist in the instruction and supervision of other workers
- apply principles of customer service when dealing with customers
- apply teamwork, self-management, and interpersonal knowledge and skills when communicating and working with clients, coworkers and supervisors as an employee and as a member of diverse local and multinational teams
- willingly accept a variety of assigned tasks
- exhibit cross-cultural awareness and sensitivity in professional interactions and communications
- work as an effective team player to complete tasks while promoting a positive work environment

15. The graduate has reliably demonstrated the ability to

design and analyze electromechanical systems by interpreting fluid mechanics and the attributes and dynamics of fluid flow used in hydraulic and fluid power\* systems.

### **Elements of the Performance**

- apply principles of mechanics, fluid mechanics and engineering to the design and analysis of electromechanical systems.
- design, build, test, and troubleshoot fluid power systems
- solve efficiency, power loss, and energy problems in hydraulic systems by applying knowledge of fluid mechanics
- test and measure fluid pressures and flow characteristics
- specify and assess electrical, electronic, and mechanical controls used in fluid power systems
- solve fluid pressure problems by analysing the attributes and dynamics of fluid flow
- apply knowledge of hydrostatics to analyse hydraulic systems
- apply knowledge of fluid mechanics and engineering principles to integrate motion control and fluid power equipment
- design, install, maintain, and analyse industrial machinery by incorporating mechanical, hydraulic, electronic, and sensor devices
- design and build hydraulic proportional and servo control systems
- integrate PLC or PC-based control systems to hydraulic and pneumatic systems
- apply mathematical analysis to integrate mechanical principles, fluid power applications, and circuit operation
- design and apply necessary control logic diagrams
- use real-time networking to operate electromechanical systems

16.The graduate has reliably demonstrated the ability to

contribute to project management through planning, implementation and evaluation of projects, and monitoring of resources, timelines, and expenditures as required.

### **Elements of the Performance**

- develop cost benefit analyses
- assist in project management including budget control, time-line control, resources management, and personnel management
- take into account economic justification (e.g., payback, return-on-investment, make vs. buy) when developing work plans
- implement technology integration management at both the component and system levels
- chair and participate in meetings in a variety of work-related roles
- analyse work activities in engineering environments through the appropriate use of data sampling and recording methods and the presentation of charts, diagrams, models, and reports
- assist in the orientation and training of employees to analyse equipment used in systems automation
- present a project to the management team for approval and execute the project
- prepare and deliver oral presentations to communicate project information

## Glossary

**Fluid Power** is the study of Hydraulics and Pneumatics. It includes, but is not limited to, the design of control/logic systems and related component/system theory, including the properties of fluids, for both Hydraulic and Pneumatic systems.

### III. Essential Employability Skills

All graduates of the Electromechanical 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.

<b>Skill Category</b>	<b>Defining Skills:</b> Skill areas to be demonstrated by graduates:	<b>Learning Outcomes:</b> The levels of achievement required by graduates.  The graduate has reliably demonstrated the ability to:
Communication	<ul style="list-style-type: none"> <li>• Reading</li> <li>• Writing</li> <li>• Speaking</li> <li>• Listening</li> <li>• Presenting</li> <li>• Visual literacy</li> </ul>	<ol style="list-style-type: none"> <li>1. communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience.</li> <li>2. respond to written, spoken or visual messages in a manner that ensures effective communication.</li> </ol>
Numeracy	<ul style="list-style-type: none"> <li>• Understanding and applying mathematical concepts and reasoning</li> <li>• Analyzing and using numerical data</li> <li>• Conceptualizing</li> </ul>	<ol style="list-style-type: none"> <li>1. execute mathematical operations accurately.</li> </ol>
Critical Thinking & Problem Solving	<ul style="list-style-type: none"> <li>• Analyzing</li> <li>• Synthesizing</li> <li>• Evaluating</li> <li>• Decision making</li> <li>• Creative and innovative thinking</li> </ul>	<ol style="list-style-type: none"> <li>1. apply a systematic approach to solve problems.</li> <li>2. use a variety of thinking skills to anticipate and solve problems.</li> </ol>



<b>Skill Category</b>	<b>Defining Skills:</b> Skill areas to be demonstrated by graduates:	<b>Learning Outcomes:</b> The levels of achievement required by graduates.  The graduate has reliably demonstrated the ability to:
Information Management	<ul style="list-style-type: none"> <li>• Gathering and managing information</li> <li>• Selecting and using appropriate tools and technology for a task or a project</li> <li>• Computer literacy</li> <li>• Internet skills</li> </ul>	<ol style="list-style-type: none"> <li>1. locate, select, organize and document information using appropriate technology and information systems.</li> <li>2. analyze, evaluate and apply relevant information from a variety of sources.</li> </ol>
Interpersonal	<ul style="list-style-type: none"> <li>• Teamwork</li> <li>• Relationship management</li> <li>• Conflict resolution</li> <li>• Leadership</li> <li>• Networking</li> </ul>	<ol style="list-style-type: none"> <li>1. show respect for the diverse opinions, values, belief systems and contributions of others.</li> <li>2. interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.</li> </ol>
Personal	<ul style="list-style-type: none"> <li>• Managing self</li> <li>• Managing change and being flexible and adaptable</li> <li>• Engaging in reflective practices</li> <li>• Demonstrating personal responsibility</li> </ul>	<ol style="list-style-type: none"> <li>1. manage the use of time and other resources to complete projects.</li> <li>2. take responsibility for one's own actions, decisions and their consequences.</li> </ol>

## IV. General Education Requirement

All graduates of the Electromechanical 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 fulfil 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.