



ELECTRONICS – TECHNICIAN (ELOTN 2021)

Preamble

The Canadian Technology Standards (CTS) are a collection of learning outcomes for Canada's engineering technology and applied science profession at the technician and technologist level.

Stakeholders

The CTS may be utilized by accreditation bodies, provincial professional associations, educational institutions, government agencies, industry and others for the purposes accreditation, certification and other applications.

Educational Programs

The Electronics CTS is relevant to programs including, but not limited to, telecommunications, industrial, control systems; biomedical, avionics, and broadcast at the at the technician level.

Learning Outcomes

This CTS list Discipline Learning Outcomes (DLO) which describe the significant and essential learning that students have achieved and can reliably demonstrate at the time of graduation. Each DLO has a number of Learning Outcome Indicators (LOI), which are examples illustrating, defining and clarifying the level of performance expected. The list of LOI is not comprehensive and there may be other indicators which can be used to assess achievement of learning outcomes.

DLO and their LOI employ only cognitive domain verbs selected from a table of cognitive verbs modeled after a Bloom's cognitive domain table of verbs adapted specifically for engineering technology and applied science disciplines.

Graduate Capability

Students graduating from an accredited program have demonstrated achievement of all general learning outcomes, including a prescribed level of math, and discipline learning outcomes selected by the program.

Having completed a program that is based on applied mathematics and scientific and engineering theory, principles and practices and having acquired the knowledge, skills and attitudes to function in the work place, graduates are;

- able to evaluate assignments, establish objectives, set parameters and determine appropriate procedures and actions.
- able to exercise due diligence in the workplace and adhere to related practices, applicable laws and health and safety practices.
- able to work in accordance with labor-management principles and practices.
- able to work independently or interdependently as part of a discipline or multi-disciplinary team.
- prepared to assume responsibility for their work.

Graduate Career Opportunities

Graduates of Electronics Engineering Technology - Technician programs have career opportunities in such areas as: business, industry, construction, government, and public organizations. They may find employment in careers such as: maintenance of equipment, processes, infrastructure, or systems; preparation of specifications, drawings, or instructions; quality operations; operations and maintenance; field and customer service; estimating; technical sales; supervision of projects; training activities; and many other areas.

Discipline Learning Outcomes (DLOs)

ELOTN01 Drawings

- Communicate information effectively and accurately by analyzing, interpreting, and producing electrical and electronics drawings and other related documents and graphics.

Learning Outcome Indicators include:

- 1.1 Assemble relevant information, data, and materials.
- 1.2 Collaborate to interpret schematics, assembly drawings, related functional specifications, and relevant standards.
- 1.3 Produce engineering drawings using appropriate standards and symbols.
- 1.4 Produce and modify schematic drawings effectively, and produce printed circuit board (PCB) layouts using computer-aided design (CAD).
- 1.5 Prepare project-related documents.
- 1.6 Examine blueprints, design drawings, sketches, and related graphics.
- 1.7 Write and prepare technical proposals, business letters, and memos.
- 1.8 Plan, organize, and deliver oral presentations of technical information using appropriate formats, terminology, visual aids, and demonstration models.

ELOTN02 Electronics Circuits

- Collaborate to test, troubleshoot, and build electronics circuits, equipment, systems, and subsystems to meet job requirements, functional specifications, and relevant standards.

Learning Outcome Indicators include:

- 2.1 Build equipment based on requirements and functional specifications.
- 2.2 Conduct tests on equipment, interpret test results, and debug.
- 2.3 Configure and install equipment and software.
- 2.4 Use appropriate measurement and testing equipment and procedures.
- 2.5 Manage handling and storage of integrated circuits according to manufacturer's specification.
- 2.6 Troubleshoot "real world" problems, such as noise and ground loops.

ELOTN03 Maintain and Repair

- Maintain and repair electronics equipment and systems.

Learning Outcome Indicators include:

- 3.1 Configure, install, and commission equipment.
- 3.2 Conduct tests on equipment, interpret results, and debug as appropriate.
- 3.3 Operate equipment according to functional specifications and safety procedures.
- 3.4 Recognize need to follow regular service schedule.
- 3.5 Maintain safety and health of those operating electronics equipment.

ELOTN04 Design

- Collaborate in the design of electronics equipment, components, and systems.

Learning Outcome Indicators include:

- 4.1 Access clients, manufacturers, consultants, and suppliers to obtain information required to select and purchase appropriate equipment, components, and systems.
- 4.2 Determine requirements and functional specifications of the equipment, components, and systems.
- 4.3 Recommend appropriate equipment, components, and systems.
- 4.4 Collaborate in selecting electronics equipment, components, and systems from manufacturers' specifications, catalogues, and electronics sources.

ELOTN05 Logic and Digital Circuits

- Collaborate to analyze and troubleshoot logic and digital circuits.

Learning Outcome Indicators include:

- 5.1 Perform conversions in and among number systems such as hexadecimal, decimal, octal, binary, and binary-coded decimal.
- 5.2 Demonstrate simplification of Boolean equations.
- 5.3 Collaborate to analyze and troubleshoot circuits that have programmable logic devices.
- 5.4 Collaborate to analyze and troubleshoot combinational logic circuits, sequential logic circuits, and analog-to-digital and digital-to-analog conversion circuits.
- 5.5 Recognize logic family characteristics in digital circuits.
- 5.6 Manage handling and storage of integrated circuits according to manufacturer's specification.
- 5.7 Collaborate to interpret and use timing diagrams.
- 5.8 Collaborate to design fundamental combinational and sequential circuits.

ELOTN06 Passive AC and DC Circuits

- Collaborate to design, analyze, and troubleshoot passive AC and DC circuits.

Learning Outcome Indicators include:

- 6.1 Apply Ohm's Law, loop and nodal analysis, and Kirchhoff's Laws to circuit design and analysis.
- 6.2 Apply Norton's theorem, superposition, and Thevenin's theorems to analyze AC and DC circuits.
- 6.3 Identify, select, and apply passive components in AC and DC circuits to fulfill job requirements and functional specifications.
- 6.4 Resolve phasor and complex number problems.
- 6.5 Collaborate to analyze and design RLC circuits.
- 6.6 Identify, analyze, and distinguish waveform properties.
- 6.7 Collaborate to design passive AC and DC circuits according to relevant standards.

ELOTN07 Active Circuits

- Collaborate to analyze and troubleshoot active circuits.

Learning Outcome Indicators include:

- 7.1 Identify and select analog semi-conducting devices to meet job requirements and functional specifications.
- 7.2 Collaborate to analyze and troubleshoot linear and non-linear amplifiers, oscillators, pulse circuits, and active filters using discrete components and integrated circuits.
- 7.3 Collaborate to analyze and troubleshoot phase-locked loops (PLL) and frequency synthesizers, power supplies, and semiconductor gating circuits.

ELOTN08 Microprocessor-based Circuits

- Collaborate to analyze and troubleshoot microprocessor-based circuits.

Learning Outcome Indicators include:

- 8.1 Collaborate to analyze microprocessor and micro-controller architectures.
- 8.2 Collaborate to analyze and troubleshoot microprocessor and I/O devices following standard approaches and techniques.
- 8.3 Collaborate to analyze memory maps.
- 8.4 Collaborate to analyze and troubleshoot memory storage devices.
- 8.5 Apply knowledge of bus systems and multiprocessor systems.
- 8.6 Collaborate to interpret and use timing diagrams in microprocessor systems.

ELOTN09 Control Systems

- Collaborate to analyze and troubleshoot control systems.

Learning Outcome Indicators include:

- 9.1 Collaborate to analyze and troubleshoot servo-mechanisms and feedback systems to meet job requirements and functional specifications.
- 9.2 Describe electric motor fundamentals and their application to control systems.
- 9.3 Collaborate to analyze control systems.

ELOTN10 Computer Applications

- Use computer programs to support electronics engineering.

Learning Outcome Indicators include:

- 10.1 Resolve technical problems using knowledge of computer systems and application software.
- 10.2 Apply knowledge of application software to maintain effective computer operations.
- 10.3 Access and transfer information using electronics communications.
- 10.4 Use database management, word processing, spreadsheet, graphics, and communication software packages to share work-related information.

- 10.5 Write and debug basic assembly language programs using structural programming techniques.
- 10.6 Write and interpret simple computer programs written in high-level language.
- 10.7 Use operating systems to manage computer operations.
- 10.8 Use simulation software to evaluate circuit response.

ELOTN11 Shop Practices

- Apply knowledge of basic shop practices to electronics engineering workplaces.

Learning Outcome Indicators include:

- 11.1 Use protective equipment and clothing to ensure personal health and safety in workplace.
- 11.2 Operate and maintain hand and power tools safely.
- 11.3 Prepare common wire and cable lists.
- 11.4 Apply safety codes, policies and practices, and accident prevention procedures.
- 11.5 Conduct safety inspections of shop environments to detect and correct hazardous conditions.
- 11.6 Apply recommended procedures for safe-handling, storage, and disposal of hazardous materials.
- 11.7 Apply soldering and de-soldering techniques.
- 11.8 Build printed circuit boards.
- 11.9 Prepare wire and cable assemblies.
- 11.10 Repair sub-assemblies and replace electronics components.

ELOTN12 Quality Control

- Contribute to conducting of quality control and quality assurance programs and procedures.

Learning Outcome Indicators include:

- 12.1 Review functional specifications applicable to electronics equipment.
- 12.2 Collaborate in quality assurance testing.
- 12.3 Report test results in accordance with organizational quality assurance procedures and functional specifications.
- 12.4 Utilize the results of quality-assurance testing as specified to debug electronics equipment, components, circuits, and systems.
- 12.5 Utilize specified procedures, measurement, and testing equipment.

ELOTN13 Documentation

- Prepare and maintain records and documentation.

Learning Outcome Indicators include:

- 13.1 Manage electronics and/or paper-based system to store and retrieve information.
- 13.2 Maintain current, clear, and accurate electronics engineering-related documents.

- 13.3 Use electronics engineering-related records and inventories to prepare reports.
- 13.4 Prepare and maintain parts inventory and installation records.
- 13.5 Prepare and maintain maintenance and service logs.

Copyright in the CTS is owned by Technology Accreditation Canada. Any person may, by acknowledging Technology Accreditation Canada as the source, use, reproduce, display, distribute, disseminate or otherwise make available to the public ("Use") the CTS on a royalty-free non-exclusive basis for any purpose, other than a commercial for-profit purpose primarily intended for or directed towards commercial advantage (a "Commercial Purpose"). Any person wishing to Use the CTS (or any excerpt thereof) for a Commercial Purpose requires the express consent of Technology Accreditation Canada.