ELECTRICAL – TECHNICIAN (ELITN 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 Electrical CTS is relevant to programs including, but not limited to, electrical power generation, power transmission, electrical protection, power distribution and utilization, industrial telecommunications, electrical maintenance and installation, and control systems 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 Electrical 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; construction supervision, operations and maintenance; field and customer service; estimating; technical sales; supervision of projects and training activities and many other areas.

Discipline Learning Outcomes (DLOs)

ELITN01 Drawings

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

Learning Outcome Indicators include:

1.1 Produce or reproduce drawings on CAD selecting appropriate tools and equipment.
1.2 Produce drawings applying standards and standard symbols.
1.3 Modify and produce drawings effectively using computers.
1.4 Present technical data in the performance of the job producing graphics such as single line drawings, schematics, and assembly drawings.
1.5 Interpret, prepare, and modify electrical specifications and project-related documents as part of the team.
1.6 Employ freehand sketching techniques.

ELITN02 Maintain Equipment

- Apply, calibrate, and maintain instrumentation and test equipment.

Learning Outcome Indicators include:

2.1 Use a variety of instrumentation equipment safely including signal generators, frequency counters, oscilloscopes, basic bridge instruments, and meters.
2.2 Perform basic measurements including power, voltage, resistance, and current.
2.3 Troubleshoot circuits using instrumentation equipment.
2.4 Troubleshoot and test basic electrical, electronic, digital, and computer circuits using appropriate instrumentation.

ELITN03 Troubleshooting

- Implement established procedures to verify acceptable function and use a variety of troubleshooting techniques to identify problems with electrical circuits, equipment, and systems.

Learning Outcome Indicators include:

3.1 Identify problems in circuits and equipment by using establishing practices.
3.2 Use standard electrical and electronic test equipment.
3.3 Use available resources such as the internet, manuals, and handbooks to complete troubleshooting.
3.4 Apply problem-solving techniques.
3.5 Test, maintain, and repair equipment.
3.6 Manage the upgrading of equipment when appropriate.
3.7 Operate equipment according to job requirements and specifications.
3.8 Implement established service schedules.
3.9 Troubleshoot a variety of electrical systems and fiber-optic equipment.
3.10 Troubleshoot a variety of power supplies and sources.

ELITN04 Electrical Circuits

- Assemble and commission electrical circuits and equipment that fulfill the job requirements and specifications.

Learning Outcome Indicators include:

4.1 Determine requirements and specifications of the equipment.
4.2 Assemble and test the equipment based on requirements and specifications.
4.3 Test, configure, and install automation and control systems.
4.4 Install a variety of programmable logic controls.
4.5 Install and set-up fiber-optic equipment.
4.6 Install equipment protective devices such as fuses, circuit breakers, sensing current transformers, and relays.

ELITN05 Rotating Electrical Machines

- Collaborate to commission and troubleshoot rotating electrical machines.

Learning Outcome Indicators include:

5.1 Collaborate to test, analyze, and install motors and generators and their control systems for specified applications.
5.2 Maintain rotating electrical machines and equipment.
5.3 Collaborate to ensure the safe operation of rotating electrical machines in a variety of environments.
5.4 Collaborate to select, specify, and commission electrical equipment based on knowledge of industrial standards.

ELITN06 Electrical Cabling

- Collaborate to select and apply electrical cabling requirements and verify system grounding for a variety of applications.

Learning Outcome Indicators include:

6.1 Collaborate to interpret electrical drawings related to cabling and system grounding.
6.2 Apply electrical cabling and wiring practices in accordance with applicable electrical and safety codes.
6.3 Apply knowledge of codes, procedures, and processes to verification of system grounding.
6.4 Troubleshoot systems faults, instabilities, and harmonics.

ELITN07 Design of Electrical Circuits

- Contribute to the design of electrical circuits, equipment, components, and systems.

Learning Outcome Indicators include:

7.1 Apply knowledge of a variety of electrical circuits.

7.2 Use test equipment as appropriate.
7.3 Use computers to test designs.
7.4 Collaborate to analyze electric motors, generators, and transformers in order to measure given output requirements applying knowledge of a variety of electromechanical systems.

ELITN08 Electrical and Electronic Circuits

- Collaborate to analyze and troubleshoot electrical circuits and electronic circuits.

Learning Outcome Indicators include:

8.1 Collaborate to analyze AC and DC networks.
8.2 Collaborate to analyze AC circuits, RCL circuits, parallel and series DC circuits, and pulse circuit properties and characteristics.
8.3 Resolve problems relating to electrical circuits.
8.4 Select inductors and capacitors for given applications.
8.5 Resolve impedance matching problems by determining transformer ratios and efficiencies.
8.6 Resolve problems relating to analog-to-digital and digital-to-analog conversion circuits, flip-flop circuits, digital multiplexing circuits, combinational logic circuits, and logic circuits.
8.7 Troubleshoot and construct power supplies, operational amplifiers, active filter circuits, IC oscillator circuits, PLL, synthesizers, and small signal and large signal amplifier.
8.8 Construct IC waveform generators, and coupling and decoupling networks for small signal amplifiers.
8.9 Test and construct series and shunt diode clippers, diode clamping circuits, transistor switching circuits, SCR, triggering devices, and thyristor and triac circuits.
8.10 Troubleshoot typical diode and zener diode circuits.

ELITN09 Control Systems

- Collaborate to analyze and troubleshoot a variety of control systems.

Learning Outcome Indicators include:

9.1 Collaborate to test, troubleshoot, apply, and install PLC systems.
9.2 Collaborate to test solid state switching circuits and electronic control devices.
9.3 Collaborate to analyze digital control systems, and open and closed loop control systems.

9.4 Collaborate to test and troubleshoot motor speed controls, servomechanism systems, and feedback systems.
9.5 Collaborate to troubleshoot, commission, and ensure safe operation of rotating electrical machine control systems.

ELITN10 Computer Applications

- Utilize computers to support the electrical environment.

Learning Outcome Indicators include:

10.1 Resolve technical problems by applying knowledge of computer systems and application software.
10.2 Access and share information using electronic communications.
10.3 Use appropriate application software.

ELITN11 Quality Control:

- Contribute to conduction quality control and quality assurance procedures.

Learning Outcome Indicators include:

11.1 Review specifications applicable to electrical circuits, equipment, and systems.
11.2 Monitor and report test results in accordance with organizational quality assurance procedures and specifications.
11.3 Conduct quality control testing as directed.
11.4 Use appropriate measurement and testing equipment.
11.5 Apply knowledge of quality assurance programs relevant to the industry.

ELITN12 Documentation Systems

- Prepare and maintain records and documentation systems.

Learning Outcome Indicators include:

12.1 Use an electronic and/or paper-based system to store and retrieve information.
12.2 Maintain current, clear, and accurate electrical engineering-related documents.
12.3 Use electrical engineering-related records and inventories to prepare reports.
12.4 Implement established procedures of inventory control.
12.5 Document the testing, modification, and implementation of electrical systems.

ELITN13 Troubleshooting

- Apply principles of networking, microprocessor systems, instrumentation, telecommunications, and other related technologies.

Learning Outcome Indicators include:

13.1 Collaborate to analyze and troubleshoot microprocessor-based programmable devices.
13.2 Collaborate to analyze and troubleshoot interfaces between microprocessors and supporting devices.
13.3 Collaborate to analyze functional requirements for industrial telecommunication systems.
13.4 Collaborate in the implementation of local-area and wide-area networks using appropriate devices.
13.5 Collaborate to analyze and specify cabling and wiring for communication

systems.

13.6 Collaborate to analyze and troubleshoot computer networking or electronic data processing cabling, fiber-optic cabling, and building management systems cabling and wiring.
13.7 Collaborate to analyze and troubleshoot emergency and security communication systems.
13.8 Collaborate to test audio, video, and inter-communication systems.
13.9 Collaborate to analyze and troubleshoot UPS Systems.
13.10 Apply knowledge of LANs and WANs to analyze and troubleshoot a variety of communication systems.

ELITN14 Safety

- Apply knowledge of appropriate safety procedures and standard shop practices to electrical engineering workplaces.

Learning Outcome Indicators include:

14.1 Utilize protective equipment and clothing to ensure personal health and safety in the workplace.
14.2 Operate, and maintain hand and power tools safely.
14.3 Prepare common wire and cable lists.
14.4 Apply safety codes, policies and practices, and accident prevention procedures.
14.5 Conduct safety inspections of shop environments to detect and correct hazardous conditions.
14.6 Apply regulatory and licensing requirements when completing installations, maintenance and repairs of electrical equipment.
14.7 Apply recommended procedures for the safe handling, storage, and disposal of hazardous materials.
14.8 Apply soldering and de-soldering techniques.
14.9 Prepare wire and cable assemblies.
14.10 Repair sub-assemblies and replace electrical components.