



ARCHITECTURAL, BUILDING AND CONSTRUCTION – TECHNOLOGIST (ARCTY 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 Architectural, Building and Construction CTS is relevant to programs including, but not limited to, architectural, building and construction at the at the technologist 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 Architectural, Building and Construction Engineering Technology - Technologist programs have career opportunities in such areas as: business, industry, construction, government, and public organizations. They may find employment in careers such as: design of structures, or building systems; interpretation or preparation of specifications, drawings, or instructions; interior design; building services design; quality management; construction management, construction contract inspection and administration; operations and maintenance of the built environment; field and customer service; quantity surveying and estimating; architectural and construction layout; management and project management ; technical sales; supervision of projects; and training activities.

Discipline Learning Outcomes (DLOs)

ARCTY01 Architectural Drawings

- Create complete sets of architectural drawings for residential and commercial construction/renovation projects.

Learning Outcome Indicators include:

- 1.1 Interpret and clarify needs of project stakeholders.
- 1.2 Create, analyze, and modify construction documents including drawings and specifications.
- 1.3 Create and demonstrate graphic information using current codes, regulations, and appropriate drawing elements, symbols, and conventions.
- 1.4 Create and present project-related information in oral and written formats.
- 1.5 Generate hand-drawn sketches delineating plans, sections, elevations (facades), plan details, section details, and elevation details.
- 1.6 Generate criteria-oriented schedules and schedules of accommodation and spaces requirements.
- 1.7 Evaluate and record modifications to graphics to reflect as-built conditions, site measurements, reverse engineering, and sketching, and then record.

ARCTY02 Building Design

- Apply basic architectural principles in building design and detailing.

Learning Outcome Indicators include:

- 2.1 Apply principles of noise abatement, color, and lighting in design of interior spaces, acoustics, and human perception of architectural space in relation to color and light.
- 2.2 Apply Universal Design Standards and barrier-free design principles, as defined by building codes and impact on cost, additional areas needed, and fire risk.
- 2.3 Develop, apply, and evaluate human form, scale, and spatial perception.
- 2.4 Evaluate climatic factors and principles and their influence on building design and detailing.
- 2.5 Use presentation techniques, both oral and drawn.

ARCTY03 Stakeholder Communication

- Communicate effectively with clients, contractors, other building professionals, and municipal authorities.

Learning Outcome Indicators include:

- 3.1 Interpret prepare, communicate, and defend technical drawings and architectural models.
- 3.2 Communicate technical information to diverse groups with varying interests and limited technical knowledge.
- 3.3 Generate proposals and contract documents using technical writing.
- 3.4 Create accurate and timely site reports.

ARCTY04 Sustainable Design

- Interpret and analyze sustainable design and building.

Learning Outcome Indicators include:

- 4.1 Interpret and analyze municipal, provincial, and federal regulations that pertain to the environment.
- 4.2 Select and evaluate green design strategies.
- 4.3 Research and interpret the environmental impact of various building techniques and materials (e.g., LEED).
- 4.4 Justify and present preferred materials and methodologies.
 - 4.4.1 Analyze capital and life cycle costs of energy use reduction strategies.

ARCTY05 Building Science

- Assess, design, and detail construction projects applying principles of building science and construction engineering.

Learning Outcome Indicators include:

- 5.1 Evaluate and apply processes used to design, layout, and construct projects.
- 5.2 Resolve and anticipate technical problems in project design, detailing and construction using systematic approaches.
- 5.3 Design and detail projects applying appropriate mathematical and scientific principles.
- 5.4 Design and detail construction problems applying knowledge of building materials, methods, building envelope, and environmental controls.
- 5 Demonstrate understanding of and resolve building science problems by creating details that consider construction sequence, construction methods, and construction materials to prevent damage or maintain performance of the building.
- 5.6 Resolve building science problems by identifying and analyzing principles for addressing them.

ARCTY06 Equipment and Materials

- Evaluate methods employed and equipment and materials utilized in implementing and completing construction/renovation projects.

Learning Outcome Indicators include:

- 6.1 Evaluate and apply performance properties, potential, and limitations of equipment and materials.
- 6.2 Evaluate and apply operational safety and accuracy of equipment repairs.
- 6.3 Evaluate and select methods used to implement and complete construction projects in safe, effective, and efficient manner.
- 6.4 Plan and facilitate testing and quality assurance of materials, methods, and equipment.
- 6.5 Evaluate and interpret constructability impacts throughout duration of the project.

ARCTY07 Bid/Contract Documents

- Interpret, analyze and create bid/contract documents.

Learning Outcome Indicators include:

- 7.1 Interpret and apply basic legal principles affecting the review and administration of contracts.
- 7.2 Interpret types and elements of contracts, contract offers, and acceptance.
- 7.3 Create project specifications using the NMS.
- 7.4 Validate specifications with drawings.
- 7.5 Appraise and receive bids and prepare award recommendations.
- 7.6 Generate and issue addenda as required.

ARCTY08 Building Systems

- Analyze and coordinate relationship between architectural, structural, mechanical, electrical, and environmental building systems.

Learning Outcome Indicators include:

- 8.1 Apply relevant architectural, structural, mechanical, electrical, and environmental theory and scientific (applied) research when assisting in designing, detailing, implementing, and evaluating construction projects.
- 8.2 Analyze and coordinate role of and relationship between the architectural, structural, mechanical, electrical, and environmental disciplines as they relate to construction projects.
- 8.3 Resolve problems by communicating with Engineering Consultants.
- 8.4 Validate clearances, locations, and interferences between architectural, structural, mechanical, environmental, and electrical services.
- 8.5 Assess and coordinate work relationships with other building professionals.

ARCTY09 Codes, Bylaws, and Regulations

- Interpret and apply applicable codes, zoning bylaws, and regulations.

Learning Outcome Indicators include:

- 9.1 Interpret and apply the function and organization of applicable codes.
- 9.2 Analyze and design gross building areas.
- 9.3 Interpret and prepare building code reports.
- 9.4 Interpret analyze, and apply the principles behind code regulations with respect to the protection of occupants, emergency assistance providers, and property.

ARCTY10 Renovation/Restoration

- Evaluate existing buildings and prepare renovation/restoration proposals.

Learning Outcome Indicators include:

- 10.1 Generate field measurements of existing buildings.
- 10.2 Create measured drawings of existing buildings.
- 10.3 Interpret, plan, and coordinate the collection of field data.

- 10.4 Interpret and generate reports, cost estimates, and project documentation.
- 10.5 Organize, write, and produce feasibility reports.

ARCTY11 Estimating

- Prepare preliminary and final cost estimates.

Learning Outcome Indicators include:

- 11.1 Evaluate and create different types of cost estimates and schedules of profitable costs.
- 11.2 Evaluate time studies and quantity surveys to produce accurate unit prices of construction activities.
- 11.3 Create and appraise cost plans, elemental estimates, budget forecasts, and project estimates applying principles of cost accounting
- 11.4 Plan and organize measurement and recording of quantities.

ARCTY12 CAD Systems

- Select, interpret and apply computer software programs including word processors, CAD, database, electronic messaging, and information/data.

Learning Outcome Indicators include:

- 12.1 Demonstrate currency with changes in technology that affect architectural and engineering work.
- 12.2 Interpret, select, and apply electronic systems to store and retrieve information.
- 12.3 Evaluate processes to select and retrieve information from existing sources by using computerized techniques.
- 12.4 Evaluate and utilize electronic communications effectively to access and share information.
- 12.5 Solve construction problems by selecting, interpreting, and applying computers and application software.
- 12.6 Design and illustrate projects using latest technology.
- 12.7 Manipulate, import and integrate data between architectural drawings and database applications.
- 12.8 Interpret evaluation of software used in architectural construction projects.
- 12.9 Organize effective management of electronic drawing files.
- 12.10 Plan safe storage and retrieval of electronic documents in a timely manner.

ARCTY13 Project Management

- Plan, schedule, and monitor architectural and construction projects.

Learning Outcome Indicators include:

- 13.1 Assess, record, and report progress of construction projects.
- 13.2 Generate and issue meeting minutes, site reports, site instructions, price requests, change orders, and certification for payment.
- 13.3 Generate and monitor project schedules.

- 13.4 Identify inspection requirements, schedule site visits, and ensure inspection of construction projects.
- 13.5 Organize notes and prepare necessary reports.
- 13.6 Interpret and use results of quality assurance testing to make adjustments or changes to project schedules.
- 13.7 Assess projects comparing activities and results to data from a variety of sources, including reports, minutes, field data and field notes, site inspections, established criteria, site and weather demands, schedule, projected cost estimates, and actual costs.
- 13.8 Resolve construction problems related to materials, scheduling, resources, and budgetary concerns in order to implement and complete construction projects.
- 13.9 Create deficiency lists and take appropriate actions to resolve deficiencies.

ARCTY14 Structural Design

- Design and analyse structural components and systems necessary for construction engineering including wood, steel, concrete, and foundations.

Learning Outcome Indicators include:

- 14.1 Determine allowable loading combinations as identified by the National Building Code, including live and dead loads and other regional considerations.
- 14.2 Resolve and analyze structural problems applying principles of Limit States Design.
- 14.3 Design structural elements such as beams, columns, walls, and floor systems in structural steel, timber, and reinforced concrete.
 - 14.3.1 *Calculate the effects of flexural and axial loads applied in combination with elements in 14.3 above.*
 - 14.3.2 *Discuss bolted or welded connections in steel and standard connections in timber.*
- 14.4 Analyse construction drawings for structural steel, reinforcing steel layouts, and formwork/falsework designs and assess their conformity with design practices and applicable codes.
 - 14.4.1 *Interpret working drawings to assess construction activities and ensure compliance of work.*
- 14.5 Design forms for concrete footings, walls, beams, slabs, and columns, including shoring and bracing according to the regulations of the National Building Code.
- 14.6 Design reinforced concrete slab, simple and continuous beams, cantilevered beam, and/or slab, including selection and placement of reinforcing steel applying strength design concepts and procedures, including that of balanced design.
- 14.7 Plan placement drawings and bar lists for reinforcing steel with placement drawings for reinforced concrete structures demonstrating knowledge needed to verify steel placement.
 - 14.7.1 *Plan and coordinate shop drawings for concrete designs.*
- 14.8 Classify soils and rock using systems such as the Unified Soil Classification System, Canadian System of Soils Classification, or a system approved by a given jurisdiction, and confirm the classification using standard ASTM test methods.
 - 14.8.1 *Identify when a soil engineer should be involved in the process.*
- 14.9 Assess soils reports for settlement, bearing capacity, and safety factor requirements for foundation designs and prepare reports.

- 14.10 Determine appropriate foundation design for application by calculating relationships between soil conditions, foundation types, and loads.
- 14.10.1 *Design simple shallow spread footings for wall and column units and pile foundations.*

ARCTY15 3-D Computer Graphics

- Create computer generated 3-dimensional architectural virtual models, still renders, animations, and Building information Modelling (BIM) documents for residential and commercial projects.

Learning Outcome Indicators include:

- 15.1 Create solid, surfaced, and mesh models of complex/detailed architectural forms.
- 15.2 Apply materials to architectural computer models, using material libraries, custom-created materials, and material mapping.
- 15.3 Apply exterior and interior lighting to architectural computer scenes.
- 15.4 Create views of computer models using cameras.
- 15.5 Create photo-realistic still render graphics of complex architectural forms.
- 15.6 Animate objects and cameras to produce computer movie files of architectural scenes using Arch Comp Vis or other appropriate or current software.
- 15.7 Create photo-realistic views of architectural renderings using still image post-production techniques and Arch Comp Vis or other current or appropriate software.
- 15.8 Create animated movies of architectural solid models using post-production techniques and Arch Comp Vis or other current or appropriate software.
- 15.9 Design complex/detailed buildings and produce contract documents of those buildings using BIM software.

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.