

Technologist Certification Exam Handbook Electronics Engineering Technology

Offered by:



CTTAM
*Certified Technicians & Technologists
Association of Manitoba*

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Introduction

The Electronics Technologist Certification Exam Handbook has been prepared for electronics engineering technologists who are required to pass a certification exam to achieve registration as a Certified Engineering Technologist or Applied Science Technologist. The handbook is designed to provide candidates with essential information regarding the certification examination.

Examination Information

Purpose of Examination

The purpose of the Electronics Technologist Certification Examination is to identify competent electronics engineering technologists who possess technical competencies in their discipline, as outlined in a discipline-specific competency profile (**see Appendix A**). The ultimate goal is to protect the public by granting designations only to those professionals who have the skill and knowledge necessary to perform their job in a safe and competent manner.

Examination Development Process

The Electronics Technologist Certification Examination consists of 100 multiple-choice questions, including questions with graphs, diagrams, and schematics and questions that require calculations. Each multiple-choice question has four answer options, only one of which is correct. Exam questions vary in the level of cognitive difficulty.

A rigorous exam development process was implemented to ensure that the resultant exam meets professional testing standards as specified in the Standards for Educational and Psychological Testing. Exam development involved numerous consultations with experienced electronics engineering technologists, as well as education providers and industry representatives. These individuals contributed their expertise to seven stages of exam development, including: 1) competency development; 2) exam blueprinting; 3) item writing; 4) group item review; 5) pilot testing; 6) standard setting; and 7) exam form assembly.

Examination Content

The Electronics Technologist Certification Examination tests candidates' competencies in four areas (**see Table 1 and Appendix A for detailed information on examination content**).

Technical Analysis: In this competency area, candidates are expected to be able to apply electronics knowledge, equipment, and tools to analyze technical problems and provide solutions that meet technical specifications, industry standards, local codes, and requirements of internal and external clients.

Technical Design: This competency area deals with candidates' ability to design under supervision electronic components and systems that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.

Technical Evaluation: In this competency area candidates are expected to be able to install, maintain, troubleshoot, and evaluate electronic components and systems in accordance with technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.

Project Management: This competency area deals with candidates' ability to assist in the implementation of projects to ensure the quality of deliverables, customer satisfaction, and adherence to schedules and budgets.

Table 1. Description of Examination by Competency Area

Competency Area	Percentage of Questions	Number of Questions
1. Technical Analysis	35%	35
2. Technical Design	20%	20
3. Technical Evaluation	35%	35
4. Project Management	10%	10
Total	100%	100

Table 2 provides the breakdown of exam questions by cognitive level. “Knowledge” questions require that candidates recall information and provide its interpretation. “Application” questions require that candidates apply their knowledge to practical situations, while “Critical thinking” questions require that candidates analyze complex situations and provide solutions.

Table 2. Description of Examination by Cognitive Level of Questions

Cognitive Level	Percentage of Questions	Number of Questions
Knowledge	45%	45
Application	45%	45
Critical Thinking	10%	10
Total	100%	100

As can be seen in Table 3, 40% of exam questions have an image (e.g., a graphic, figure, table, or a schematic).

Table 3. Description of Examination by Images

Images	Percentage of Questions	Number of Questions
Questions with Images	40%	40
Questions without Images	60%	60
Total	100%	100

Examination Registration

Applicants who are required to complete the Electronics Technologist Certification Examination will be required to register for the examination at the time of application. Please see the ASET website or CTTAM website for current information on examination dates, fees, and policies.

Study Resources for Examination

The following resources may be of use to candidates interested in refreshing their knowledge prior to writing the examination. Candidates are not expected to study each of these resources. Rather, candidates may wish to review particular content areas in which they feel they would like to update their current knowledge. For detailed information on the content areas covered on the exam, candidates should refer to **Appendix A**.

Alberta EGP ACT. (2009). ASET Regulation (Section 49). Retrieved from http://www.qp.alberta.ca/documents/Regs/2009_282.pdf

Alberta OHS ACT. (2013). OHS Regulation (Sections 7 & 8). Retrieved from <http://www.qp.alberta.ca/documents/Acts/O02.pdf>.

Dorf, R. C., & Svoboda, J. A. (2010). Introduction to electric circuits. Hoboken, NJ: John Wiley & Sons.

Frenzel, L. E. (2008). Principles of electronic communication systems. Boston, MA: McGraw-Hill.

Government of Alberta. (2013). Occupational Health and Safety Regulations. Retrieved from http://www.qp.alberta.ca/documents/Regs/2003_062.pdf

Government of Alberta. (2013). Workers' Compensation Act. Retrieved from <http://www.qp.alberta.ca/documents/Acts/W15.pdf>

Government of Canada. (2014). Maintenance and elementary work performance rules. (Section 571.02). Retrieved from the Justice Laws Website <http://laws-lois.justice.gc.ca/eng/regulations/sor-96-433/page-150.html>

Manko, H. H. (1998). Soldering handbook for printed circuits and surface mounting (2nd ed.). Van Nostrand Reinhold, Netherlands: Kluwer Academic Publishers.

Miller, G. M. & Beasley, J. S. (2002). Modern electronic communication (7th ed.). Upper Saddle River, NJ: Pearson Education.

Paynter, B., & Boydell, T. (2009). Electronics technology fundamentals: Conventional flow (3rd ed.) Upper Saddle River, NJ: Pearson Education.

RapidTables Online Reference & Tools. (2014). Electrical Symbols & Electronic Symbols. Retrieved from http://www.rapidtables.com/electric/electrical_symbols.htm

Schultz, M. E. (2011). Grob's basic electronics. New York, NY: McGraw-Hill.

Streib, W. J. (1990). Digital circuits. South Holland, IL: Goodheart-Willcox.

Tocci, R. J., Widmer, N. S., & Moss, G. L. (2005). Digital systems: Principles and applications. Upper Saddle River, NJ: Pearson/Prentice Hall.

Wang, L., Chang, Y., & Cheng, K. (2009). Electronic design automation. Burlington, MA: Morgan Kauffman Publishers.

Wheeler, P. E. (1989). *Electronic fundamentals*. Saint Joseph, MI: Heathkit/Zenith Educational Systems.

Workers' Compensation Board. (2014). *Alberta Employer Handbook*. Retrieved from http://www.wcb.ab.ca/pdfs/workers/WCB-003_Worker_Handbook.pdf

Exam Accommodations for Candidate with Disabilities

According to Canadian human rights legislation and test industry standards, exam developers are responsible for providing candidates with disabilities with exam accommodations where appropriate and feasible. Exam accommodations are designed to remove barriers related to individual characteristics of candidates that may prevent them from demonstrating their technical competencies on the exam. “An appropriate accommodation is one that that responds to specific individual characteristics but does so in a way that does not change the construct the test is measuring or the meaning of scores.”¹

Candidates with disabilities should request accommodations to write the certification exam at the time of application. To protect the integrity of the examination, documented evidence of the candidate's disability must be submitted to ASET or CTTAM along with the application form. Such evidence includes a formal detailed diagnosis of the specific disability from an appropriate professional (e.g., physician, psychologist, rehabilitation counsellor) and supporting documentation citing the need for exam accommodations and what accommodations the candidate received in the past.

ASET or CTTAM will review the candidate's written request for accommodation and determine if it can be supported. Depending on the candidate's individual needs, ASET or CTTAM may modify exam material or exam administration conditions, including exam setting, exam presentation, or the addition of individuals to the exam (e.g., readers, scribes). Each request will be reviewed on a case-by-case basis.

Below is a list of reasonable exam accommodations for candidates with a disability.

1. **Separate Room**

A separate room is provided to candidates who due to the nature of their disability require an exam environment that minimizes distractions resulting from noise or movement or process information by talking aloud.

2. **Additional Time**

Extending additional time to candidates is a frequently used exam accommodation that is used with a variety of disability-related conditions. Often candidates are offered time-and-one-half to complete the exam (e.g., a 3-hour exam is extended to 4.5 hours).

3. **Interpreter**

Candidates with hearing impairment may request an interpreter who has proficiency in sign language.

¹ American Educational Research Association (2014). *Standards for Educational and Psychological Testing*. Washington, DC (p. 67).

4. Reader

A reader is an individual who reads exam instructions and/or exam questions to a candidate. Candidates with visual impairment or those with a learning disability may benefit from services of a reader during the examination.

5. Recorder

A recorder is an individual who fills in the answers for a candidate who has difficulty writing independently.

Costs related to exam accommodations will be the responsibility of the candidate.

Examination Administration

The Electronics Technologist Certification Examination will be administered on a computer in one of Yardstick's exam centers in Alberta or Manitoba. Generally, exam centers are located in colleges and universities. An experienced proctor will oversee the examination.

Admissions to the Exam Centre

ASET and CTTAM provide Yardstick with a list of examination candidates for each exam sitting. When an exam appointment is made, candidates will receive a booking confirmation email from Yardstick. **It is important that candidates bring this email with them to an examination center on the day of the examination.**

Upon entering the examination center, candidates will be asked to register with the proctor. The following information will need to be provided to the proctor.

- Candidate's first and last name
- Valid government-issued photo ID
- Candidate's booking email as provided by Yardstick

After the initial verification of identity, candidates will be asked to sign a roster.

Candidates' personal belongings, such as bags and jackets, will be stored in a designated area. Electronic devices, including but not limited to cell phones, tablets, and reference books, may not under any circumstances be brought into the exam center. The only exception to this rule is personal calculators. The proctor is responsible for inspecting candidate's calculators prior to the exam.

Candidates may bring with them into the exam center water, juice, coffee or another drink in a spill proof container with no label and, only if approved by the proctor, a sweater without pockets, and disposable ear plugs.

The use of scratch paper is permitted. The proctor will provide scratch paper to the candidates before the exam and collect it after the exam.

Taking the Exam

At the beginning of the examination, candidates will hear verbal examination instructions from the proctor and read the Candidate's Statement of Understanding and/or Non-disclosure

Agreement in the software. Failure to comply with the regulations outlined in these documents will result in the candidate's results being invalidated. Candidates will not be able to begin the examination without agreeing to the conditions outlined in the document.

Next, exam candidates will be given written exam instructions in the software. These exam instructions will emphasize the fact that some exam questions contain images and/or require calculations. If the images appear too small on the screen, candidates will be advised to hover their mouse over them to get an expanded view.

Following exam instructions, there will be a tutorial available to candidates before they proceed to the exam.

After the Examination

Upon submitting their exam responses, candidates will be offered an opportunity to provide feedback on exam material and exam administration conditions by completing a short online survey. Then, candidates will submit their scrap paper to the proctor, sign out from the candidate roster, and leave the examination center.

Examination Scoring and Reporting

Multiple-choice examination questions are scored dichotomously, using a score of "0" for an incorrect response and a score of "1" for a correct response. The Technologist Certification Examinations are criterion-referenced exams, which means that a candidate should obtain a score that is equal or higher than an exam pass mark to pass the examination.

Each Certification Examination has its own pass mark. The pass mark for the Electronics Technologist Certification Examination was determined by the Exam Committee, which took into account the difficulty of exam questions and the expected level of performance for a minimally competent engineering technologist. A psychometrically acceptable standard-setting methodology was used to set examination pass marks.

The examinations are electronically scored. Candidates can expect to obtain their exam score and the associated pass/fail decision within four to six weeks after the date of exam administration. Unsuccessful candidates will also receive a performance report indicating a failure to pass, their score, and areas of strength and weakness in the four tested competency areas. The unsuccessful candidates will be able to retake the exam.

Review and Appeal Process

A candidate who fails the Certification Examination may request that their exam score be verified. Due to the automated scoring and extensive quality control procedures, errors in scoring are extremely unlikely. However, candidates may request that ASET or CTTAM manually rescore their exam to verify the original score. The candidate will be responsible for any expenses incurred during the review and appeals process.

Appendix A: Electronics Technologist Professional Competencies

Role Description

Entry-level electronics engineering technologists design or modify electronic components and systems under supervision. They perform technical tests of electronic components and systems to identify problems and troubleshoot them. **Entry-level electronics engineering technologists** integrate, maintain, and upgrade electronic components and systems in accordance with technical specifications, regulatory requirements, industry standards, local codes and requirements of internal and external clients. They also document final configurations of electronic systems and procedures used to implement them.

Competency Name:

Technical Analysis (Electronics Engineering Technologists)

Competency Definition:

Apply electronics knowledge, equipment, and tools to analyze technical problems and provide solutions that meet technical specifications, industry standards, local codes, and requirements of internal and external clients.

#	Competency Indicators
1.1	Collect quantitative and qualitative information to better understand technical problems and develop solutions.
1.2	Identify the scope of work in consultation with one's supervisor.
1.3	Assess site safety before collecting data.
1.4	Identify appropriate technical tests and criteria.
1.5	Conduct appropriate technical tests of electronic components and systems.
1.6	Consult equipment manuals and data sheets.
1.7	Examine analog and digital circuits using appropriate instrumentation, such as spectrum analyzers, logic analyzers and oscilloscopes.
1.8	Consider the limitations of data collection methods for conclusions drawn from test results.
1.9	Assess information to develop solutions and identify opportunities for improvements.
1.10	Calibrate equipment to improve accuracy.
1.11	Perform calculations to determine expected outcomes.
1.12	Compare test results to technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.
1.13	Use appropriate software or programs to analyze results.
1.14	Record test results using appropriate media (e.g., an electronic spreadsheet).
1.15	Develop technical solutions.
1.16	Evaluate advantages and disadvantages of technical solutions.
1.17	Document technical solutions for approval and implementation.

Competency Name:	
Technical Design (Electronics Engineering Technologists)	
Competency Definition:	
Design under supervision electronic components and systems that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.	
#	Competency Indicators
2.1	Assist in creating technical specifications for electronic components.
2.2	Comply with standards that apply to the design.
2.3	Identify potential technical, health, and environmental risks associated with the implementation of specific technical solutions.
2.4	Interpret circuit schematics and drawings of electronic components and systems.
2.5	Create circuit schematics and drawings of electronic components and systems.
2.6	Apply electronics knowledge, such as: 1) Digital circuits; 2) Analog circuits; 3) Microprocessors; 4) Microcontrollers; 5) Communication protocols; 6) Radiofrequency circuits; 7) Logic systems; 8) Control systems.
2.7	Apply programming skills, such as: 1) Assembly language; 2) C-language.
2.8	Assist in building prototypes to verify the design.
2.9	Set up and operate test equipment to evaluate prototypes.
2.10	Evaluate prototypes to ensure compliance with technical specifications.
2.11	Design equipment layout, such as rack configuration.
2.12	Collaborate with a multi-disciplinary team to solve technical problems.

Competency Name:	
Technical Evaluation (Electronics Engineering Technologists)	
Competency Definition:	
Install, maintain, troubleshoot, and evaluate electronic components and systems in accordance with technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.	
#	Competency Indicators
3.1	Observe lock-out and tag-out procedures.
3.2	Identify safety hazards associated with installation, maintenance, troubleshooting, and repairs of electronic equipment.
3.3	Use certified and calibrated equipment to install, maintain, troubleshoot or repair electronic components and systems.
3.4	Perform supervised design validation by comparing technical specifications to the requirements of internal and external clients.
3.5	Perform supervised design verification by testing electronic systems against technical specifications: 1) Prototype tests; 2) Functional and/or operational tests; 3) Tests specified by industry standards and/or regulatory organizations.
3.6	Maintain records of the design validation and verification procedures.
3.7	Conduct the installation and operation of electronic equipment and systems such as: 1) Analog and digital communication circuits and systems; 2) Digital networks; 3) Microprocessor controlled equipment and programmable logic controllers; 4) Computers, computer controlled equipment and computer networks; 5) Radio and television broadcasting equipment; 6) Instrumentation; 7) Electronic sensors, circuits and systems involved in manufacturing processes.

3.8	Repair defective or improperly functioning electronic components and systems using appropriate tools.
3.9	Perform supervised commissioning of electronic components and systems after repairs and installation.
3.10	Perform preventative maintenance of electronic components and systems using technical specifications.
3.11	Provide feedback on maintenance schedules.
3.12	Perform calibration of electronic components and systems.
3.13	Report situations where technical specifications do not apply to the field.
3.14	Troubleshoot electrical connections (e.g., cables and connectors).
3.15	Troubleshoot microprocessors, electronic instruments, equipment, or systems, using electronic test equipment, such as logic analyzers.
3.16	Use a systematic approach to identifying faults when troubleshooting.
3.17	Maintain accurate and complete documentation on maintenance, installation, and troubleshooting activities (e.g., work orders).
3.18	Provide technical support and recommendations for installation, maintenance, upgrades, or enhancements.
3.19	Verify that technical documentation is written in accordance with organizational quality control standards.
3.20	Assist in identifying the non-conforming electronic components and systems.
3.21	Provide sketches of field changes and discrepancies for engineering corrections and drawings.
3.22	Assist in identifying lessons learned in the project.
3.23	Create technical procedures for operation and maintenance of equipment.

Competency Name:	
Project Management (Electronics Engineering Technologists)	
Competency Definition:	
Assist in the implementation of projects to ensure the quality of deliverables, customer satisfaction, and adherence to schedules and budgets.	
#	Competency Indicators
4.1	Assist in identifying parts, material, and equipment for projects.
4.2	Prioritize own work activities to ensure that project objectives are met on time and on budget.
4.3	Research equipment or component needs, sources, competitive prices, delivery times, or operational costs.
4.4	Assist in calculating cost, material, and resource estimates for projects.
4.5	Prepare schedules for deliverables.
4.6	Quantify the work that is completed to-date.
4.7	Assist in monitoring compliance with technical specifications.
4.8	Assist in communicating project information to internal and external clients.
4.9	Establish and maintain effective working relationships with internal and external clients.
4.10	Explain the value of workplace safety legislation.
4.11	Comply with workplace safety legislation.
4.12	Complete project management documentation, such as progress reports.