Apprenticeship Manitoba

Manitoba

Construction Electrician
Level 4

04-2025

Apprenticeship Manitoba

Construction Electrician

Unit: D1 Advanced Electrical Code

Level: Four

Duration: 105 hours

Theory: 105 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with advanced knowledge about the electrical code. The unit begins with coverage of installation in hazardous locations, and high-, low-, and extra low-voltage installations. Part of the unit covers protective systems and renewable energy system installations. Finally, the unit covers installations in specialty locations and various service calculations.

Objectives and Content: **Percent of Unit Mark (%)**

1. Identify hazards and describe safe work practices pertaining to advanced electrical code applications. **5%**

2. Describe installations in hazardous locations. **20%**

a. CEC requirements
b. Classification of areas, including:
   - Gas locations
   - Dust locations
   - Wet/corrosive locations
c. Equipment requirements
d. Wiring methods and sealing requirements
e. Perform related calculations

3. Describe high voltage installations. **10%**

a. CEC requirements
b. Indoor and outdoor substations
c. Grounding and bonding requirements
d. High voltage conductors construction and terminations, including:
   - Stress cones
   - Potheads
   - Corona and tracking
   - Conductor shielding
e. High pot testing
f. Perform related calculations

4. Describe low and extra low voltage installations. **15%**

a. CEC requirements

b. Class 1 and Class 2 systems
c. Emergency systems, including:
   - Nurse call systems
   - Public address (PA) and intercom systems
   - Card access and security systems
d. Perform related calculations

5. Describe different types of protective systems. 5%

a. CEC requirements
b. Lightning arresters
c. Neutral grounding devices
d. Perform related calculations

6. Describe renewable energy system installations. 20%

a. CEC requirements
b. Fuel cells
c. Wind (turbines)
d. Solar (photovoltaic cells)
e. Tidal

7. Describe installations in specialty locations, including lifting and transporting equipment. 10%

a. CEC requirements
b. Types, such as:
   - Patient care
   - Parking lot
   - Vehicular charging stations
   - Elevators
c. Perform related calculations

8. Perform various service calculations. 15%

a. CEC requirements

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Unit: D2 Power Quality

Level: Four

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about power quality. This unit covers power quality issues, harmonics and ground fault protection. This unit also covers uninterruptible power supply.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify hazards and describe safe work practices pertaining to power quality.	**5%**
2. Describe power quality issues. a. Key considerations b. Types • Voltage sag and swell • Over and under voltage condition • Voltage fluctuation • Voltage transient. • Interruptions c. Mitigation methods • Surge suppression	**30%**
3. Describe harmonics. a. Characteristics • Frequency of different order harmonics b. Causes • Linear and non-linear loads • Negative, positive and zero sequence harmonics in transformers, circuit breakers and neutral conductors • Harmonic currents in motors, capacitors and sensitive electronic equipment c. Mitigation Methods	**30%**
4. Describe Ground Fault Protection (GFP). a. Purpose and application b. Systems	**20%**

5. Describe uninterruptible power supply (UPS). 15%

a. Operation and application
b. Test procedures
c. Standby generators

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Unit: D3 Automation

Level: Four
Duration: 90 hours
Theory: 20 hours
Practical: 70 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about building automation and automated controls, such as programmable logic controllers (PLCs). The unit begins with coverage of PLC operation and programming of ladder logic. Part of the unit covers analog inputs/outputs and control system diagrams. Finally, the unit covers installing, troubleshooting and commissioning of building automated systems.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify hazards and describe safe work practices pertaining to automation.	**5%**
2. Describe and demonstrate operation of programmable logic controllers (PLCs). a. Purpose b. Types c. Components • Central processing unit (CPU) • Memory storage systems • Input/output (I/O) section • Power supply • Programming devices d. Operation and applications • Distributed control systems	**5%**
3. Describe and demonstrate programming of ladder logic. a. Purpose b. Types c. Configurations d. Programming and wiring considerations, including: • Memory limitations • Networks • Program Scan • Contact Nesting • Master control relay • Stop and emergency stop push buttons • Program documentation • Overcurrent protection	**10%**

4. Define and describe analog I/O's, their applications and external components. 10%

a. Purpose
b. Components
   - Transducers
   - Transmitters
   - Voltage sensing modules
   - Current sensing modules
c. Applications
   - Resolution/Scaling
   - Binary conversion
d. Wiring methods
e. Perform related calculations

5. Design and analyze control system diagrams. 30%

a. Programming relay type instructions
b. Programming discrete inputs
c. Programming outputs
d. Timers
e. Counters
f. Function blocks

6. Demonstrate and perform troubleshooting methods. 15%

a. Purpose
b. Key considerations, including:
   - Bonding connections
   - Controller (including self diagnostics)
   - LED indicators
   - Power supplies
   - I/O modules (discrete, analog and specialty)
   - Search functions
   - Force/Disable functions
   - External inputs and outputs
   - Internal relays/contacts

7. Install, troubleshoot and commission automated control circuits. 25%

a. Common building applications
   - Security systems
   - Surveillance systems
b. Other applications, such as:
   - Traffic signal lights
   - Alternating pumps

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Unit: D4 Fire Alarms

Level: Four

Duration: 30 hours

Theory: 10 hours

Practical: 20 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about fire alarms. This unit covers installation, maintenance and troubleshooting practices for fire alarm and ancillary systems.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify hazards and describe safe work practices pertaining to fire alarms.	**5%**
2. Describe installation and maintenance practices for fire alarm and ancillary systems. a. Codes • CEC requirements • Canadian Standards Association (CSA) requirements • National Building Code (NBC) requirements b. Systems • Addressable and non-addressable • Single and two-stage • Wet and dry sprinkler systems c. Class A and B wiring methods d. Devices • Initiating • Signaling • Monitoring • Ancillary e. Troubleshooting considerations	**25%**
3. Perform installation and troubleshooting procedures of fire alarm and ancillary systems. a. Wiring practices b. Troubleshooting techniques	**70%**

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Unit: D5 Blueprints and Project Planning

Level: Four
Duration: 25 hours
Theory: 10 hours
Practical: 15 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about blueprints and project planning. This unit covers residential, commercial and industrial blueprints and their use**.**

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe residential, commercial and industrial blueprints.	**40%**
a. Types, including: • Electrical • Mechanical • Site plan • Floor plans • Elevations • Sections • Reflected ceiling b. Symbols and terminology c. Related documents • Specifications • Addendums • Change notices • Shop drawings d. Project planning and worksite preparation considerations • Environmental (such as land x-ray and seismic restraint) • Safety • Scheduling (including installation sequencing) • Estimate budget and cost control • By-laws • Site meetings • Organizing materials and tools e. Site amendments (as-builts)	
2. Demonstrate use of blueprints and related documents.	**60%**
a. Scaling	

b. System layout practices
c. As-built procedures

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Unit: D6 Journeyperson Trainer

Level: Four

Duration: 10 hours

Theory: 10 hours

Practical: 0 hours

Overview:

Level One in-school technical training offers an entry-level orientation to the challenges of apprenticeship training as it relates to the development of core tasks and skill requirements, as well as social competencies. This unit introduces senior apprentices to the responsibilities of workplace training that they will assume as supervising journeypersons. Most trades have a rich tradition of refreshing and sharing their trade skills from one generation of trade practitioner to the next. This unit orients senior apprentices to some of the practical and conceptual tools that can enable them to contribute to this trade heritage when they become certified journeypersons and, ultimately, journeyperson trainers.

The journeyperson's obligation to assist entry-level apprentices to develop skills and knowledge is complex and challenging. It involves safety considerations, employer expectations, provincial regulations, as well as the tradition of skills stewardship that links modern practice with the long history of workplace teaching and learning that defines the apprenticeable trades. The ability to offer timely and appropriate support to apprentices is itself an important area of trade learning. This unit presents material intended to help refine this ability through reflection and discussion by senior apprentices, and discussion with their in-school instructor and journeyperson trainer.

This content reflects Manitoba and Canadian standards prescribed for journeyperson-level supervisory capabilities, as well as key topics in current research on the importance of workplace training in apprenticeship systems. These detailed descriptors represent suggested focal points or guidelines for potentially worthwhile exploration, and are neither mandatory nor exhaustive.

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a 'Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Compare/contrast role-options and responsibilities of the supervising journeyperson. a. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used b. Accountability for results: e.g. journeyperson is/is not required to prepare performance evaluation that could affect apprentice's employability or wage-rate, etc. c. Long-term vs. short-term supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes d. Formally vs. informally structured – e.g. supervision assignment is part of a prescribed cycle of assignments involving coordination among multiple journeypersons; apprentice is trained according to an individual training plan negotiated with employer	**n/a**

e. Types of supervisory role options and what is implied by each:
   - Journeyperson Trainer (JT) role: often initiated by someone other than apprentice, and limited to a particular skill set, task, or production requirement
   - Mentor role: often initiated by apprentice, and relatively open-ended regarding content, duration, etc.
   - Peer role: typically involves individual upgrading or cross-training of one journeyperson by another; can include senior apprentice assisting less-experienced trade learner
   - Coordinator role: often a senior-level journeyperson appointed by an organization to assume responsibilities for monitoring progression of groups of apprentices
   - Other roles: may be improvised by journeyperson, such as combination or multiple roles of the above

2. Describe and demonstrate common requirements about providing journeyperson level supervision. **n/a**

a. Apprenticeship learning adapted to journeyperson supervision assignments and a journeyperson perspective
   - Application of adult education concepts to trades teaching and learning (e.g. responsibilities and expectations of senior-level apprentices)
   - Practical significance of 'styles' of adult learning and teaching
   - Helping senior-level apprentices integrate in-school technical training and on-the-job practical training experiences
   - Providing help and guidance about new tasks and skills
   - Providing help and guidance about fixing mistakes
   - Learning and teaching "the ropes" – socialization of apprentice within a community of trade practice (e.g. how to borrow a tool, interrupt a journeyperson, seek advice of experienced co-workers)
   - Coverage and documentation of prescribed tasks and subtasks where applicable
   - Discuss the limits of the journeyperson trainers' own responsibilities and competence (e.g. scope, willingness to train, etc.)
   - Benefits of maintaining a personal record of achievements, ideas, and needs as a journeyperson trainer (e.g. resume, portfolio, training credentials, logbook, etc.)

b. Individual reflection and guided group discussion about personal experiences of workplace learning as an apprentice
   - Identification of best and worst practices of journeyperson trainer
   - Identification of workplace and other factors that can contribute to good and bad trades teaching/learning experiences
   - Development of professional standards and work ethics about responsibility to share one's knowledge and skill with others in the workplace (e.g., use/misuse of humour, rigour, discretion, craft-pride, etc.)
   - Qualities of a good journeyperson trainer
   - Components of workplace journeyperson training
   - Processes and recommended practices re: journeyperson training
   - Troubleshooting problems re: supervision assignments

c. Role of assessment in supervising, coaching, or guiding other people to learn or improve their skills (e.g. formative and summative evaluation), and how this might contribute to how the journeyperson-level supervision task is approached in future

d. Compare and contrast discussion results with current knowledge and resources about workplace training methods as they apply to journeyperson-level supervision assignments

e. Other (as may be specified by instructor)

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Unit: D7 Pre-Interprovincial Exam Review

Level: Four

Duration: 70 hours

Theory: 70 hours

Practical: 0 hours

Overview:

This unit offers senior apprentices a systematic review of skills and knowledge required to pass the Inter-Provincial Examination. It promotes a purposeful personal synthesis between on-the-job learning and the content of in-school technical training. The unit includes information about the significance of Provincial certification and the features of the Inter-Provincial Examination.

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a 'Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	**Percent of Unit Mark (%)**

1. Describe the significance, format and general content of Inter-Provincial (IP) Examinations for the trade of Construction Electrician. — **n/a**

a. Scope and aims of Inter-Provincial certification; value of certifications

b. Obligations of candidates for Inter-Provincial certification
   - Relevance of Inter-Provincial Examinations to current, accepted trade practices; industry-based provincial and national validation of test items
   - Supplemental Policy (retesting)
   - Confidentiality of examination content

c. Multiple-choice format (four-option) item format, Red Seal standards for acceptable test items

d. Government materials relevant to the Inter-Provincial Examinations for apprentice Construction Electricians
   - Red Seal Occupational Standard (RSOS) for Construction Electrician; prescribed scope of the skills and knowledge which comprise the trade
   - RSOS "Pie-chart" and its relationship to content distribution of Inter-Provincial Examination items
   - Apprenticeship Manitoba Technical Training package

2. Identify resources, strategies and other considerations for maximizing successful completion of written examinations. — **n/a**

a. Personal preparedness
   - Rest
   - Nutrition
   - Personal study regimen
   - Prior experience in test situations (e.g., Unit Tests)

b. Self-assessment, consultation and personal study plan
   - Self-assessment of individual strengths/weaknesses in trade related skills and knowledge
   - Approved textbooks
   - Study groups

3.	**Review program content regarding the major work activity of performs common occupational skills.**	**n/a**
4.	**Review program content regarding the major work activity of installs, services and maintains generating, distribution and service systems.**	**n/a**
5.	**Review program content regarding the major work activity of installs, services and maintains wiring systems.**	**n/a**
6.	**Review program content regarding the major work activity of installs, services and maintains motors and control systems.**	**n/a**
7.	**Review program content regarding the major work activity of installs, services and maintains signalling and communication systems.**	**n/a**

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