curriculum standard

apprenticeship

NOVA SCOTIA
APPRENTICESHIP
AGENCY

Powerline Technician 2010

Based on the New Brunswick Curriculum Standard
pg. 6 for Program Structure

NOVA SCOTIA

Version #2.3
First Version Published: N/A

Acknowledgments

Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of this Apprenticeship Training Standard. Without their dedication to quality apprenticeship training, this document could not have been produced. A sincere thank you.

This Apprenticeship Training Standard was approved by the Nova Scotia Director of Apprenticeship in October 2002.

Preface

This Apprenticeship Training Standard is based on the 1996 edition of the National Occupational Analysis for the Powerline Technician trade and the New Brunswick Powerline Technician provincial curriculum. This document describes the curriculum content for the Powerline Technician apprenticeship training program and outlines each of the technical training courses necessary for completion of apprenticeship.

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Task 11	Maintains transmission towers.
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Task 16	Constructs underground distribution systems.
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Task 20	Installs system protection equipment.
Task 21	Installs pole and underground transformers.
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Program Structure - Nova Scotia Apprenticeship Program

The courses listed below are required technical training in the Nova Scotia Powerline Technician Apprenticeship Program.

Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Course Units	Page No.
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Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Course Units	Page No.
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			PLT-1261 Distribution Line Construction	56
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			PLTA-1001 Communication Systems *(NS Specific)*	62
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			PLT-2021 Electromagnetic Induction	66
			PLT-2031 Cycles and Frequency	67
			PLT-2041 Sine Wave	68
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Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Course Units	Page No.
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Nova Scotia Powerline Technician Apprenticeship Program: All Courses are Required				

LEVEL 1

MENT-1801 Workplace Mentoring I

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for learning workplace skills.
- Demonstrate strategies to assist in learning skills in the workplace.

Objectives and Content:

1. Describe the importance of your own experiences.
2. Identify the partners involved in apprenticeship.
3. Describe the shared responsibilities for workplace learning.
4. Determine your own learning preferences and explain how these relate to learning new skills.
5. Describe the importance of different types of skills in the workplace.
6. Describe the importance of essential skills in the trade.
7. Identify different ways of learning.
8. Identify your learning preferences.
9. Identify different learning needs and strategies to meet learning needs.
10. Identify techniques for effective communication.
11. Identify strategies to assist in learning a skill.

Resource:

- Recommended resource to use in the delivery of this unit: www.apprenticeship.nscc.ca/mentoring/apprentice.htm

PLT-1021 Safety

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of safety regulations.
- demonstrate knowledge of fire safety and equipment.
- demonstrate knowledge of hazardous workplace materials.

Theory:

1. Identify and explain fire safety regulations.

2. Describe classes of fire and associated fire fighting equipment.

3. Describe the Occupational Health and Safety Act and Regulations as they apply to the trade.
   - employer and employee responsibilities
   - obstacles to health and safety
   - personal protective equipment
   - safe movement of workers
   - safe use of ladders, scaffolds and rigging

4. Describe safety measures for locking out equipment.
   - lockout system
   - code of practice

5. Describe confined space working conditions and associated safety procedures.
   - duty of employer and employees
   - emergency intervention
   - work permit
   - safety watch
   - traffic control

6. Describe fall protection equipment and associated safety practices.
   - fall protection plan
   - control zone and safety monitors
   - lifelines and lanyards
   - safety harnesses
   - fall-arresting and shock absorbing devices
   - inspection and maintenance

7. Describe the safety measures related to electricity.

8. Describe procedures for adhering to manufacture's specifications and Material Safety Data Sheets (MSDS).

9. Describe the safety issues specific to the following environments.
   - residential
   - commercial
   - industrial

10. Describe, from the perspective of safety, the limitations of work carried out by the Powerline Technician trade and coordination with the work of other trades.

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1011 Trade Orientation

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- have an understanding of the job functions performed by a Powerline Technician.

Theory:

QUALIFICATIONS AND STANDARDS

1. Describe powerline technician occupation qualifications and standards.
    - occupational qualifications and standards
        - physical fitness
        - mental condition
        - academic capabilities

TRAFFIC CONTROL

2. Explain the importance of signalers.
    - responsibility
    - warn the public

3. Identify where and when signalers are needed.
    - safe travel path
    - construction equipment

4. Define signaler’s uniforms and codes.
    - qualifications
    - signaling procedures

5. Explain proper dress and equipment for signalers.
    - daylight
    - dark

6. Identify proper position for signaler.
    - traffic lane
    - additional signalers

7. Identify examples of types of communication between signalers.
    - visual

- field telephone
- traffic light system
- two-way radios

8. Define standards for size and type of paddle.
   - standard paddle
   - mounted on staff

9. Demonstrate how to stop traffic.
   - stop traffic in daytime
   - stop traffic at night

10. Demonstrate how to direct traffic.
    - slow traffic
    - move traffic

11. Outline general instructions for signalers.
    - advance warning signs
    - do’s
    - don’ts

CUSTOMER SERVICE

(NS specific)

1. Describe professional working practices.
   - documentation
   - communication
   - workplace behavior
   - appearance
   - care of tools and equipment
   - prevention of property damage
   - quality control

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1321 Pole Safety

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- be aware of the importance of pole inspections, prior to their climbing and working on these structures.

Theory:

1. Explain the importance of pole inspection.
   - visual inspection
   - physical inspections

2. Explain process for determining “bending moment” on poles.
   - calculation of bending moment
   - straight poles
   - leaning poles

3. Identify procedures for supporting “broken poles”.
   - why not pike poles
   - temporary guying and holdfasts

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1331 Rescue At Heights

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- use the proper procedure for performing a successful rescue.

Theory:

1. Identify important factors of rescue at heights.
    - why
    - safety and speed is essential
    - this plan should include
    - when all factors are considered
    - the confusion and excitement
    - chance of a comeback

2. Explain procedures for pole top rescue.
    - basic steps for rescuing an employee from a pole
    - assuming that you know the basics of first aid treatment
        - evaluate the situation
        - call for help
        - provide for your protection
        - climb to the rescue position
        - determine the victim's condition
            - if the victim is conscious
            - if the victim is unconscious but breathing
            - if the victim is unconscious and not breathing
    - approved method for lowering an injured worker
        - the safety of this method...
        - when you must lower an injured worker
            - position the handline
                - positioning the handline over a cross-arm
                - positioning the handline over a screw-driver
                - positioning the handline over your posibelt
            - tie the victim
            - remove the slack in the load line
            - cut the victim's posibelt
            - lower the victim
    - approved method for lowering a conscious worker

3. Explain pole top rescue using a bucket.
   when a worker is injured while working aloft...
   if you are able to use a boom...

4. Explain procedures for tower rescue.
   - Rescue equipment and procedures must be in place . . .
   - Different methods . . .
     - using the shepherd hook and rescue rope
     - using a rope-snubbing bracket on the victim's
     - using a rescue rope attached to the back "D" ring

5. Explain approved procedures for bucket evacuation.
   - in the event of equipment failure . . .
   - the approved figure "8" bucket escape kit
   - the following are the basic steps to follow...
     you are now ready to make-shift your harness

6. Explain approved procedures bucket rescue.
   - In the event that a worker aloft is unable to operate the upper boom controls
     - two types of buckets
       - basic steps for buckets that cannot be tipped
       - basic steps for buckets that can be tipped

7. Summarize hazards and precautions of rescue at heights.
   - hazards and precautions

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1301 Tree Pruning

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- be aware of the importance of proper “tree pruning procedures”, which when carried out, increases reliability of the electrical system and ensures maximum safety to every member of the public.

Theory:

1. Explain the importance of public awareness - customer contact.
   - historical, sentimental, aesthetic significance
   - identify hazards to tree
   - identify hazards to the overhead power lines
   - identify hazards to the public

2. Explain definitions.
   - right-of-way
   - easement
   - brush
   - pruning
   - cutting
   - danger tree
   - danger branch
   - drop cut
   - felling
   - ornamental tree
   - line clearance

3. Introduce basic tree shapes.
   - natural shapes
   - upright
   - spreading
   - horizontal

4. Explain tree pruning techniques.
   - topping
   - side pruning
   - directional pruning
   - drop-crotching

- protecting the bark
- removing branches
- tree wound dressing
- corrective pruning
- disease control
- shaping
    - 90-3-90 rule

5. Introduce guidelines for utility line clearing.
    - safe working clearance
    - procedures and guidelines

6. Explain applying clearances.
    - joint use construction practice, tree clearing and trimming
    - common sense

7. Explain removal and disposal procedures.
    - tree removal
    - limb and tree disposal

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1041 Tools And Equipment

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- properly care for and use personal equipment and tools.

Theory:

1. Identify clothing specific to the powerline technician.
    - boots
        - winter footwear
    - pants or bib overalls
    - other clothing
    - hard hats
    - gloves & mitts
    - jewelry

2. Identify climbing equipment.
    - fitting the climbers
    - inspection and maintenance of climber gaffs
    - the pole cutout test
    - fitting the body belt
        - the pad measurement
        - the belt measurement
    - pole strap
    - storing climbing tools
    - body harness

3. Identify personal protective equipment.
    - rubber protective equipment
    - head protection
    - eye protection and improved vision program

4. Demonstrate ability to climb.
    - learning to climb
    - safe climbing practices
    - scheduled climbing sessions

5. Demonstrate using ropes properly.
    - rope splices

- tying knots

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

2. Sharpen gaffs.

PLT-1105 Rigging

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon the successful completion of this course, the apprentice will be able to:
- use lifting and rigging procedures.
- demonstrate knowledge of synthetic and wire rope.
- demonstrate knowledge of basic mechanics.

Theory:

1. Define terms relating to mechanical advantage.
   - mechanical advantage and effects of friction
   - application of the basic mechanisms
   - the inclined plane
   - the wedge
   - the screw
   - the lever
   - the wheel and axle
   - pulley
   - hydraulic - introduction
   - fundamentals of rigging power transmission
   - friction

2. Describe the types, construction and use of ropes.
   - uses of ropes
   - safety procedure
   - inspect rigging fibre rope
   - safety factor
   - synthetic fibre rope
   - nylon rope
   - Dacron rope
   - saran rope
   - fibre glass rope
   - Orlon rope
   - polyethylene rope
   - how to care for a rope
   - OHSA

3. Demonstrate knots, bends, and hitches used for lifting and moving equipment.
   - common knots
   - backlash or back splice

- overhand knot
- figure-eight knot
- half-hitch
- double half-hitch
- bowline knot
- running bowline
- square or reef knot
- snubbing hitch
- snubbing hitch with double half-hitch
- clove hitch
- timber hitch
- barrel hitch
- fibre rope knots used as slings
- angle of sling
- safety reminders when using fibre rope

4. Describe how to select and use the appropriate sling to perform a given task.
   - general
   - rope compared to fibre rope
   - wire rope clips
   - safety clips - J-Bolt type
   - U-Bolt clips
   - wire rope slings
   - common slings and end-rigging for wire rope
   - rigging precautions
   - safe operating precautions
   - inspection of slings and removal from service

5. Describe types and uses of rigging hardware items and method of installing them.
   - introduction
   - eye bolts
   - shackles
   - points concerning shackles
   - snatch blocks
   - rope blocks

6. Describe the procedures for lifting, moving, and securing equipment.
   - OHSA requirements
   - protecting your back

7. Describe how to select and use various chain blocks and rope falls.
   - common hoists
   - chain hoists
   - inspection
   - good safety practices
   - cable winch and pull-lift hoists

8. Describe the different types of jacks and their uses.
   - jacks
   - screw jacks
   - ratchet jacks
   - hydraulic jack with integral pump
   - hydraulic ram jack with separate pump
   - safety and proper use of jacks
   - selecting the proper jack

9. Describe how to recognize and use standard crane signals.

10. Describe how to select and properly use ladders and scaffolds.
    - ladders
    - ladders safety
    - tubular steel sectional scaffolding
    - advantages of steel scaffolding (ease of erection, common hoists)
    - diving boards

Practical:

Suggested learning activities are assigned to enhance the participant's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Hands-on hoisting/lifting projects.

PLT-1101 Basic Mechanics

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon the successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of basic mechanics.

Theory:

1. Understand the mechanics of simple machines.
   - simple machines
   - W = F x D (Work = Force x Distance)
   - techanical advantage

2. Explain the mechanical principles of levers.
   - first class lever
   - second class lever
   - third class lever

3. Explain the mechanical principles of blocks and tackles.
   - mechanical advantage of tackle blocks
   - friction in tackle blocks
   - load on the fall line
   - size of blocks and rope
   - reeving
   - care of blocks
   - coiling tackle blocks

Practical:

Suggested learning activities are assigned to enhance the participant's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1311 Synthetic and Wire Rope

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon the successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of synthetic and wire rope.

Theory:

1. Identify importance of rope.
    - usage
    - maintenance

2. Explain types and advantages of various synthetic ropes.
    - types and sizes
        - nylon
        - polyester
        - polypropylene
        - polyethylene
        - other fibers
    - construction
        - twisted construction
        - plaited construction
        - braided construction
        - parallel fibre construction
        - conductor ropes
        - composite
    - handling
        - uncoiling, unreeling and coiling
        - twisting, kinking and hockling
        - whipping
        - hardware
        - shock loading and overloading
        - foreign substances
        - bending radius
    - care and inspection
        - care
        - inspection
    - safe working strength

3. Explain rope throwing.
    - method

4. Identify wire ropes.
    - type and size
    - construction
        - rope lay
        - preforming
        - core
    - care and inspection
        - care
        - inspection
    - safe working strength
    - clamping

Practical:

Suggested learning activities are assigned to enhance the participant's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1071 Chain Saw Familiarization

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be abe to:
- properly care for and use a chainsaw.

Theory:

1. Demonstrate knowledge of safety features of power chainsaws.
   - throttle lock-outs
   - chain brakes
   - safety chains
   - chain catcher post
   - hand guards
   - anti-vibration shock absorbers
   - spark arrester
   - on/off switch
   - bar tip sprocket

2. Identify personal protective equipment.
   - hard hat, ear and eye protection
   - safety pants/chaps
   - safety boots
   - gloves
   - pressure bandage
   - emergency whistle
   - fire extinguisher

3. Demonstrate knowledge of how to prepare to work with a chainsaw.
   - safe starting methods
   - fuel mixing and starting
   - chain oil

4. Demonstrate basic knowledge of cutting with a chainsaw.
   - cutting with the pushing chain
   - cutting with the pulling chain
   - the kick back zone

5. Identify felling procedures.
   - pre-felling procedures

- front notch
- back cut
- holding wood
- spring poles/lodged tree
- limbing

6. Identify maintenance procedures.
    - spark plug trouble shooting
        - check gap - 20 to 25 thousandth
        - blue spark
        - white spark
    - daily maintenance
        - air filter
        - chain break
        - bar and chain
    - filing theory and practical
        - filing position
        - file guide
        - filing angles
        - chain tension
    - periodic maintenance procedures
        - air and gas filters
        - pull cord/spring assembly
        - spark plug adjustment and/or replacement
        - cleaning cooling fins, etc.
        - bar/chain/sprocket
    - tool kit
        - flat and round files
        - throttle screwdriver
        - tooth brush/detergent
        - spark plug wrench/screwdriver (scrench)
        - guide bar cleaning tool
        - assortment of spare parts

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1351 Material Handling And Aerial Devices

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate a basic knowledge of hydraulic equipment.

Theory:

1. Explain basic factors of a hydraulic system.
    - force
    - pressure
    - flow
    - friction
    - energy
    - work
    - power
    - mechanical advantage

2. Describe the characteristics of fluids.
    - density
    - shape
    - compressibility
    - viscosity
    - stability

3. Explain components.
    - power take-off
        - six bolt
        - eight bolt double gear
        - full-torque
    - hydraulic pump
    - governor
        - electronic governor
    - hydraulic oil reservoir
    - hydraulic oil
        - hydraulic oil checks
    - filters and strainers
    - hoses, tubing and fittings
        - hose
        - tubing

        - fittings
    - valves
        - control valve
        - pressure relief valve
        - holding valve
    - actuators
        - hydraulic cylinder
        - hydraulic motors
    - basic hydraulic system
        - schematic diagram
        - specific items
            - outriggers
            - lift cylinder
            - extension cylinder
            - bucket leveling cylinder
            - digger motor and auger

4. Explain safe operation of the hydraulic system.
    - general
    - pre-operating inspection
    - stability
    - boom loading
    - boom operation
        - traffic control
        - work site inspection and vehicle position
        - vehicle grounding
        - operators platform
        - outriggers
        - engine speed
        - boom capacity
            - boom rotation - king boom
            - boom rotation - pitman boom
            - boom lowering
    - auger operation
    - accessories
        - anchor tools
        - winch
        - pole puller
        - tamper
        - take-up reel
        - power tools

5. Identify do’s and don’ts.

6. Outline preventative maintenance schedule.
   - daily
   - weekly
   - monthly
   - quarterly
   - annually

7. Illustrate importance of troubleshooting.
   - identify cause of malfunction
   - light maintenance

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-0125 Direct Current (DC) Theory

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will:
- become familiar with the direct current circuit theory foundation.

Theory:

1. Describe atomic structure.
   - matter
   - atoms
   - electric charge
   - protons, electrons, neutrons
   - conductors, insulators

2. Describe different sources of electricity.
   - friction
   - heat
   - light and solar energy
   - piezoelectric
   - mechanical (magnetism)
   - chemical (primary and secondary cells, the action of the lead-acid cell)

3. Describe useful applications and hazards caused by static charges.
   - negative charge
   - positive charge
   - law of charges
   - electrostatic field (dielectric field)
   - applications

4. Describe the effects of electricity.
   - introduction
   - heat effect
   - magnetic effect
   - psychological and physiological effects

5. Define electrical absolute values.
   - unit prefixes
   - electrical absolute values (resistance, pressure, flow, power, etc.)

- basic look at Ohm's Law

6. Describe the types and the components of electrical circuits.
   - the electron path
   - the load
   - the source
   - the control
   - electron current flow
   - conventional current flow
   - closed circuit
   - open circuit
   - short circuit

7. Explain how to compute values of electrical energy and power.
   - introduction to mechanical power, energy, etc.
   - combining the power formula and Ohm's Law
   - kilowatts and horsepower

8. Explain how to use electrical measuring instruments.
   - ammeter
   - voltmeter
   - ohmmeter
   - multi meter
   - testers

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1130 Series And Parallel Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- determine the absolute values of devices connected in series, parallel or any combination of these two.

Theory:

1. Describe how to analyze and measure amperage and voltage in series DC circuits.
   - current relationships
   - resistance relationships
   - voltage relationships
   - circuit fault analysis
   - circuit applications

2. Describe how to analyze and measure amperage and voltage in parallel DC circuits.
   - current relationships
   - resistance relationships
   - voltage relationships
   - circuit fault analysis
   - circuit applications

3. Describe how to analyze and measure amperage and voltage in combination DC circuits.
   - series/parallel circuits
   - parallel/series circuits
   - voltage and current relationships in complex circuits

4. Describe how to analyze and measure resistance and/or continuity in basic DC circuits.

5. Describe how to analyze and measure power consumption in basic DC circuits.

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities.

Suggested learning activities include exercises on:

1. Voltage, current, and Ohm’s Law.
2. Equivalent resistance.
3. Power in DC circuits.
4. Series and parallel circuits.

PLT-1131 Sources of AC Energy

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- understand that several sources of energy can be used to move electrons, thus producing electricity.

Theory:

1. Identify sources of energy and explain the principles behind them.
   - friction
   - piezoelectric
   - electromagnetic induction
   - chemical
   - thermoelectric couple
   - photoelectric effect

Practical

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1141 Electromotive Force

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- be familiar with what is meant by electromotive force (e.m.f.) and to familiarize the Powerline technician with the unit of measurement of an e.m.f. known as the “volt”.

Theory:

1. Explain electrical pressure.
   - unit of measurement
   - mechanical pressure

2. Explain how voltage is measured.
   - voltmeter
   - using a voltmeter

Practical

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1151 Electric Current

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of electric current.

Theory:

1. Explain how electric current is measured.
   -measurement of electric current

2. Identify current flow direction.
   -conventional current flow
   -electron theory of current flow

3. Explain the electrical properties of materials.
   -conductors
   -semi conductors
   -poor conductors

4. Explain the heating effect of electric current.
   -atoms in motion
   -effect of e.m.f. electrons
   -increased resistance - increased heat
   -increased current - increased heat

Practical

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1161 Resistance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- understand how resistance affects the flow of electricity in conductors.

Theory:

1. Define resistance.
   - current flow
   - opposition to current flow

2. Identify unit of measurement for resistance.
   - ohm
   - ohm defined

3. Identify factors affecting the resistance of a conductor.
   - measurement of resistance

4. Explain factors affecting resistance of conductor joints.
   - factors affecting resistance of joints

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT - 1171 Symbols And Definitions

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician Occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of the symbols used to represent voltage, current and resistance in an electric circuit.

Theory:

1. Identify electrical symbols.
   - amperage
   - resistance
   - voltage

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1181 Ohm's Law

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of Ohm's Law in terms of its use for making direct-current circuit calculations.

Theory:

1. Explain Ohm's Law.
   - relationship between quantities

2. Define Ohm's Law.
   - definition

3. Demonstrate the E., I., and R. relationship.
   - Current = $\frac{\text{Voltage}}{\text{Resistance}}$
   - $I = \frac{E}{R}$

4. Demonstrate procedures for solution of basic problems.
   - diagram the circuit
   - label the diagram
   - list and identify known values
   - determine unknown value(s)
   - use appropriate form of Ohm's Law
   - solve by substituting known values
   - conclude with definite statement

5. Identify symbols used in electrical diagrams.
   - various electrical symbols

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1191 Types Of Electric Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of the different types of electric circuits and show how to make circuit calculations using fundamental laws.

Theory:

1. Explain electric circuits.
   - electromotive force
   - load

2. Explain a simple circuit.
   - definition

3. Define a closed circuit.
   - continuous path

4. Define an open circuit.
   - broken path

5. Define a short circuit.
   - circuit resistance bypassed

6. Explain a series circuit.
   - laws
   - calculation

7. Explain a parallel circuit.
   - laws
   - calculation

8. Explain conductance.
   - reciprocal of resistance
   - mho’s

9. Explain series-parallel circuit.
   - rules

- calculation

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1201 Power And Energy

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain what is meant by the terms “power” and “energy” and to show how they are used to further analyze electric circuits.

Theory:

1. Explain mechanical power and energy.
   - force
   - work
   - power
   - horsepower
   - energy

2. Explain electrical power and energy.
   - watt
   - kilowatt
   - kilowatt hour

3. Explain efficiency.
   - input
   - output
   - efficiency

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1211 Direct Current Meters

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- describe the basic electrical measuring instruments used to determine the various quantities contained in a direct-current circuit.

Theory:

1. Identify basic electrical measuring instruments for a direct-current circuit.
   - multimeters
   - electro-mechanical meters

2. Explain basic construction and operating principles.
   - galvanometer
   - voltmeter
   - ammeter
   - ohmmeter
   - ground megger
   - wattmeter

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1221 Three Wire 120/240 Volt Systems

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain the purpose of the three-wire system and to describe the method of calculating various quantities in an operating circuit.

Theory:

1. Explain the three-wire system.
   - two-wire circuits
   - three-wire service
   - neutral conductor

2. Demonstrate ability to perform calculations for three-wire system.
   - with balanced loads
   - with unbalanced loads

3. Demonstrate ability to perform calculations for three-wire system with a broken neutral.
   - unbalanced circuit with open neutral
   - table comparisons

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1231 Alternating Current Meters

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the basic electrical measuring instruments used to determine various quantities contained in an alternating-current circuit, and to explain the application and care of the instruments commonly used by the Powerline Technician.

Theory:

1. Identify basic electrical measuring instrument movements for an alternating-current circuit.
    - magnetic vane attraction
    - inclined coil
    - repulsion
    - repulsion-attraction
    - dynamometer

2. Explain basic construction and operating principles.
    - voltmeter
    - ammeter
    - wattmeter
    - watt hour meter

3. Demonstrate ability for the application and care of measuring instruments.
    - clamp-on meters
    - clip-on meters
        - portable ac voltmeter
        - phasing testers
        - phase sequence indicator
        - leakage meters
        - potential indicator
    - recording meters
        - clamp-on recording voltmeter
        - circular-chart recording voltmeter
        - digital recording meters

4. Identify uses of energy meters.
    - domestic
    - commercial
    - industrial
    - totalizing meters
    - electronic meters
    - testing

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1061 Distribution Line Design

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be abel to:

- have a basic understanding of what is involved when designing distribution lines and facilities which should also help the apprentice become familiar with the common terminology used in the line trade.

Theory:

1. Identify how to select the route.
    - ground profile
    - paralleling a highway

2. Identify methods of preserving support structures.
    - poles

3. Identify types and uses of guys and anchors.
    - guys
        - single down buy
        - overhead guys
        - single overhead and down guy
    - steel guy strand
    - anchors
        - log anchor
        - swamp anchor
        - cross plate anchor
        - power installed screw anchor
        - rock type anchor
        - heel and tow anchor
        - push brace

4. Identify requirements of electrical design.
    - insulators
        - pin type
        - suspension types
        - post type
    - electrical characteristics of insulators
    - mechanical characteristics of insulators
        - suspension type

    - pin type
  - cross arms
  - hardware

5. Identify types of structures.
   - single pole (with conductors only)
     - tangent
     - angle
     - dead-end
     - take-off (or tap)
     - joint use construction
     - self-supporting wood poles

6. Identify types of equipment and apparatus structures.
   - transformer installation poles
   - installation s⌀ and 3⌀ switching points
   - oil reclosers
   - voltage regulators
   - capacitor installations
   - clearances
   - public safety

7. Identify electrical distribution system.
   - distribution system
     - single-phase circuit
     - three-phase circuit
   - identifying the neutral

8. Identify underground distribution facilities.
   - types of cables
   - duct systems
   - direct buried systems
   - connectors and splices
   - terminations
     - pothead type
     - slip-on type
   - padmount transformers
   - pad-mounted switch gear

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1251 Grounds Plus 3 Test Theory, Personnel & Structure, Vehicle

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the theory and practice relating to the installation of both “permanent system grounds” and “temporary safety grounds”.

Theory:

1. Explain grounding.
    - ground rods
    - earth as conductor

2. Explain isolated circuits.
    - simple isolated circuit
    - safety concerns

3. Explain system grounds.
    - single conductor circuit
    - multi-grounded systems

4. Explain safety grounds.
    - new circuits or apparatus can become re-energized
    - theory of safety grounding
        - short circuit conditions
        - grounding all sides of the work area
        - equipotential grounding
        - comparison of the two grounding methods
    - temporary grounding for personnel on structures
        - the purpose of safety grounding
        - the preferred ground
        - approved methods of safety grounding
        - grounding equipment
        - grounding practices
        - procedure for equipotential grounding
        - procedure for grounding all sides of the work area
    - vehicle grounding
        - purpose of vehicle grounding
        - the preferred ground

- grounding equipment
- grounding practices
- grounding procedures

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1261 Distribution Line Construction

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- apply the proper methods of installation of support apparatus and supporting structures.

Theory:

1. Identify support apparatus for distribution line construction.
   - support structure
   - poles, guys and conductors

2. Explain specifications for pole classification.
   - classifications and dimensions
   - breaking strength
   - pole strength classes

3. Identify procedures for good pole storage.
   - steps to prevent decay

4. Identify procedures for pole hauling.
   - the pole pile
   - loading operation
   - binding the load
   - transporting
   - unloading
5. Explain methods for hole digging.
   - manual method
   - hydraulic method
   - backhoe method

6. Explain procedures for pole setting.
   - facing poles
   - erecting poles
     - piking method
     - gin pole method
     - derrick method
   - backfilling and tamping

7. Explain methods for pole straightening.
    - pole straightening hazards and solutions

8. Identify standards for stubbing and reinforcing poles.
    - suitable poles
    - pole inspection
    - wooden reinforcing members
    - galvanized steel reinforcing members

9. Explain guying and anchoring.
    - guy tension
        - guy wire sizes, grade strengths, mass
        - types of guys
    - anchors
        - types of anchors

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1271 Conductors

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of conductors, conductor connections, conductor splicing and the tools associated with splicing and connections.

Theory:

1. Identify different types of conductors.
   - solid conductors
   - stranded conductors
   - ACSR
   - ASC
   - AASC
   - ALPAC ACSR
   - SDC
   - copper
   - copper-weld

2. Explain the storing, handling and maintenance of conductors.
   - unloading
   - damage to conductors
   - wire reels
   - lifting reels
   - care of conductors

3. Demonstrate insulator ties.
   - tie wire
   - preformed ties
   - clamping

4. Explain conductor connections.
   - factors concerning conductor connections
     - contact resistance
     - creep
     - surface oxide
     - corrosion
     - thermal effects

5. Explain splices.

- importance
- types of splices
    - full tension splices
    - jumper splices (non-tension)
    - repair splices (non-tension)
    - service lead splices
- types of sleeves
    - automatic tension splice
    - one piece sleeve
    - two piece sleeve

6. Explain types of conductor vibration.
    - aerolian
    - galloping

7. Explain types of mechanical presses.
    - OH-25 hand tool
    - MD6-8 hand tool
      adjustment of MD6-8

8. Explain types of hydraulic presses.
    - Y35 & Y35-2 hydraulic tool
        - care of the Y35
        - fluid loss of hydraulic press
        - refilling the tool reservoir
    - hydraulic pump

9. Explain ampact tool.
    - tools and shells
    - tool maintenance
        - daily servicing
        - inspection of stress area
        - weekly servicing breech cap assembly
        - power unit
        - power unit cleaning
    - safety instructions
    - the “fail safe” mechanism
    - the safety sleeve

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1281 Conductor Sizes And Measurements

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- be aware of the importance of the proper selection of the conductor (in relation to sizing) when designing and constructing distribution and transmission facilities.

Theory:

1. Identify factors in conductor selection.
   - current carrying capacity
   - voltage drop

2. Explain unit of measurement.
   - gauge sizes
   - circular mil sizes

3. Execute calculations for conductor resistance.
   - formula method
   - approximation method

4. Explain conductor charts.
   - reading charts

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1291 Sagging Conductors

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- be aware of the importance of sagging conductor according to the specifications established by the engineering department in conjunction with the specifications indicated in the “Standard Construction Practice Manual”.

Theory:

1. Explain sagging of conductors.
   - conductor sag
   - span
   - design tension
   - ruling spam
   - initial sag
   - final sag

2. Results of conductor damage.
   - elastic limit
   - permanent deformation
   - temperature
   - sag tables

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLTA-1001 Communication Systems

(Nova Scotia Unit of Instruction)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

-

Theory:

(Pending)

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

LEVEL 2

PLT-2011 Magnetism

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain magnetism as the fundamental entity in the production of alternating electric current.

Theory:

1. Identify the uses of direct and alternating current.
    - direct current
    - alternating current
    - electro-magnetic induction

2. Identify the origin and nature of magnetism.
    - definition
    - loadstone
    - natural magnets

3. Identify the types and construction of magnets.
    - types
        - natural magnets
        - artificial magnets
            - permanent
            - temporary
    - construction
        - permanent
        - temporary

4. Explain magnetic fields.
    - about a magnet
    - about the earth
    - reluctance, permeability, magnetomotive force
    - about a straight conductor
        - right hand rule
    - about a solenoid
        - right hand rule

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2021 Electromagnetic Induction

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate how the relative motion between a conductor and a magnetic field induces a voltage in the conductor.

Theory:

1. Explain electromagnetic induction.
   - basic law
   - right hand rule for generators
     - factors affecting induced voltage

2. Describe the generation of induced voltage.
   - purpose of a generator
   - construction and operation of a generator
   - output of a generator

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2031 Cycles And Frequency

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- expand on the terms, “cycles and frequency,” and to show how they relate to electricity production.

Theory:

1. Explain how cycles and frequency relate to electricity production.
   - one cycle

2. Demonstrate how the frequency of the induced voltage can be measured.
   - formula
   - calculations

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2041 Sine Wave

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- show that alternating currents and voltages have a definite wave form
- explain how they are developed and related.

Theory:

1. Explain that alternating currents and voltages have a definite wave form.
   - graph of voltage

2. Develop a “sine wave”.
   - schematic diagram
   - instantaneous values
   - effective value

3. Demonstrate how current and voltage are related.
   - in phase
   - out of phase
   - lag
   - lead

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2121 Resonance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain what is meant by resonance and to show how the frequency at which the A.C. circuit becomes resonant may be obtained.

Theory:

1. Describe resonance.
   - changing reactance values
   - changing frequency

2. Explain ferro resonance.
   - special case
   - detect, minimize and prevent ferro resonance

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2131 Power in AC Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the three types of power associated with A.C. circuits and to show their relationship to one another.

Theory:

1. Explain the three types of power associated with A.C. circuits and to show their relationship to one another.
   - true power
   - reactive power
   - apparent power

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2141 Power Factor

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- learn what is meant by the term power factor.

Theory:

1. Explain what is meant by power factor.
   - definition
   - formula
   - the power triangle
   .- combining power factors

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2151 Power Factor In Station And Line Operation

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the cause and effect of low power factor in electric utility circuits and to explain the methods that are used to improve low power factor conditions.

Theory:

1. Identify different types of loads.
    - resistive-type loads

2. Explain load characteristics of motors and transformers.
    - inductive loads
        - induction motor
        - transformer
        - welding transformer
        - flourescent light

3. Explain characteristics of capacitive type loads.
    - transmission lines
    - distribution lines
    - capacitor
        - out of phase current
        - magnetizing current
    - capacitor banks

4. Explain possible procedures to improve efficiency of station and line operation.
    - line loss
    - special meters for large consumers
    - watt-var recording meters

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2051 Inductance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain inductance as an important effect in alternating current circuits.

Theory:

1. Explain the importance of inductance in alternating current circuits.
   - principle
   - definitions
   - self induction
   - skin effect
   - counter electromotive force
   - Lenz's Law

2. Define mutual induction.
   - undesirable effect used to advantage

3. Explain measurement of inductance in a circuit.
   - the "henry"
   - symbol for inductance . . . "L"

4. Explain the relationship between current and voltage in an induction coil.
   - inductances in a series circuit
   - inductances in a parallel circuit

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2061 Inductive Reactance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain inductive reactance and show its effect in both series and parallel circuits.

Theory:

1. Define inductive reactance.
   - unit of measurement
   - formula

2. Identify the effect of inductive reactances in a series circuit.
   - formula
   - total inductive reactance

3. Identify the effect of inductive reactances in a parallel circuit.
   - formula
   - equivalent inductive reactance

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2071 Capacitors and Capacitance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- describe the basic construction, principles of operation and capacity of a capacitor.

Theory:

1. Describe a capacitor.
   - definition
   - powerline capacitors
   - pcb contamination

2. Explain the process of charging a capacitor.
   - potential difference

3. Explain how the electric field develops.
   - electrostatic force
   - overcharged

4. Explain the process for discharging a capacitor.
   - discharge current
   - discharge path

5. Explain capacitance.
   - ability to store electrical energy
   - dielectric constants-various materials
   - dielectric strengths-various materials
   - unit of measurement-forad
   - symbols - f, uf, uuf

6. Identify the relationship between current and voltage.
   - capacitances in a series circuit
   - capacitances in a parallel circuit

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2081 Capacitive Reactance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain capacitive reactance and show its effects in both series and parallel circuits.

Theory:

1. Explain capacitive reactance.
   - unit of measurement
   - formula

2. Identify the effects of capacitive reactance in a series circuit.
   - total capacitive reactance
   - formula

3. Identify the effects of capacitive reactance in a parallel circuit.
   - equivalent capacitive reactance
   - formula

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2091 Impedance

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain the term impedance and to show how to determine the impedance of an A.C. circuit.

Theory:

1. Explain impedance.
   - definition

2. Identify the total opposition offered by a circuit to the flow of operating current.
   - unit of measurement
   - symbol
   - formulas

3. Explain the impedance triangle.
   - series circuit formula
   - parallel circuit formula

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2101 Quantities and AC Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain the use of vectors in analyzing A.C. circuits and to develop a formula.

Theory:

1. Explain vector representation.
   - definition
   - vector diagrams

2. Describe voltage, current and impedance in series circuits.
   - series resistance and inductive reactance
   - series resistance and capacitive reactance
   - series resistance, inductive reactance and capacitive reactance

3. Describe voltage, current and impedance in parallel circuits.
   - parallel resistance and inductive reactance
   - parallel resistance and capacitive reactance
   - parallel resistance, inductive reactance and capacitive reactance

4. Demonstrate various electrical symbols.
   - diagram symbols

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2111 Inductance And Capacitance In Transmission And Distribution Lines

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain inductance and capacitance in terms of how they are most commonly encountered by the power line technician in practice.

Theory:

1. Examine the effect of self induction, skin effect, mutual induction and capacitance on transmission and distribution lines.
   - skin effect
   - mutual induction
   - capacitive reactance
   - conductor impedance
   - transmission lines
   - distribution lines

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2161 Single-Phase Revenue Metering

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the various types of single-phase watthour meters and to explain the procedures involving meters.

Theory:

1. Describe various types of single-phase A.C. watthour meters.
    - types of meters
        - meter mounting arrangement
        - type of service
        - energy or energy and demand
        - self-contained or transformer-rated
    - calibration, testing, and sealing
    - ratings
    - meter multipliers
    - identifying numbers
    - records

2. Explain the application of meters for single-phase, two-wire circuits and single-phase, three-wire circuits.
    - single-phase, two-wire circuit
    - single-phase, three-wire circuit

3. Identify responsible installation and customer service procedures.
    - dispute tests
    - installation practices
    - servicing meters
        - installation
        - disconnect
        - removal
        - reconnect
        - meter changes
    - reading meters
        - energy meter register
        - demand reading

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2171 Switches And Protective Devices

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the basic types of switches and protective devices and to show how they are applied to the electrical system.

Theory:

1. Describe the basic classes of switches and protective devices.
    - air break devices
        - air circuit breaker
        - air break disconnect switches
            - non-load-break devices
            - load break devices
            - loadbuster tool
        - fuses
    - oil devices
        - oil circuit breaker
        - oil circuit recloser
        - oil switch
    - vacuum devices
        - vacuum interrupters
        - vacuum recloser
    - de-ionizing gas devices
        - gas circuit breaker
        - circuit switcher
    - lightning arresters
        - expulsion type
        - valve type
        - mov type

2. Explain over current protective device co-ordination.
    - protection scheme
    - time current characteristics
    - temporary faults
    - permanent faults

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2201 System Operating Practices

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- define the requirements for operating or working on the transmission and distribution systems, the division of responsibility and the types of protection available.

Theory:

1. Identify procedures for the manual operation of switches and protective devices to accomplish various objectives.
    - opening and closing switches and protective devices
    - altering protective devices
    - transmission system operations
    - distribution system operations

2. Explain the standard protection code.
    - hold-off
        - purpose
        - identification
    - work permit
        - purpose
        - identification
    - radial permit
    - clearance permit
    - conditional permit

3. Introduce one-line diagram manuals.
    - transmission and substation diagrams manual
    - distribution one-line diagrams manual
    - sample diagrams
    - sample switching report
    - tags

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2191 Street Lighting

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the construction, operating principles and installation procedures for street lights and dusk to dawn lighting units.

Theory:

1. Discuss the history and development of the high intensity discharge lamp.
   - mercury lamp
   - flourescent lamps
   - metallic halide
   - high pressure sodium

2. Identify street light fixture components.
   - cast aluminum case
   - hinged door
   - adjustable slip fitter
   - bird stop

3. Identify internal circuit components.
   - terminal block
   - ballast
   - threaded lamp socket
   - reflector
   - refractor
   - photoelectric control

4. Identify street light installation procedures.
   - clearances from energized conductors and apparatus
   - grading of street lights

5. Identify dusk to dawn lighting unit installation procedures.
   - clearances from energized conductors and apparatus
   - grading of dusk to dawn lighting units.

6. Identify current street lighting fixture type
   - basic lamp information
     - lamp construction
   - high pressure sodium

        - theory of operation
    - ballast
        - why use a ballast
        - ballast functions
    - retrofit kits
        - the nameplate information
        - the transformer
        - capacitor
        - arrangement
    - street light test unit
        - testing photo cells
        - testing bulbs
        - fused power supply
    - street light control and retrofit kit
        - photo control receptacle
        - photo electric control
        - transformer
        - capacitor
        - ignitor or starter

7. Explain types of street lighting system connections.
    - series circuit
    - parallel circuit

8. Identify the types of street light control systems.
    - multiple controls
        - pilot wire
        - cascade
        - individual
    - photo electric control

9. Explain procedures for processing customer requests for lighting.
    - municipal street lighting requests
    - customer requests for lighting
    - Christmas lighting requests

10. Explain construction and procedures for repairing street lights and dusk to dawn lights.
    - troubleshooting high intensity lighting systems
    - corrective maintenance

11. Identify standard work methods for street light and retrofit kit repairs.
    - street light repairs
    - retrofit kit repairs

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2211 Live Line Protective Cover-Up

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the application and care of protective equipment commonly used by powerline technicians, and to stress the importance of their use.

Theory:

1. Identify the types of protective equipment.
    - powerline technician's blankets
        - inspection
        - care and storage
    - line hose
        - low voltage
        - high voltage
            - care and storage
            - field checking line hose

2. Explain corona effects on rubber.
    - definitions
        - corona
        - corona cutting
        - corona resistant materials

3. Identify the uses of polyethylene cover-up equipment.
    - conductor and insulator covers
    - hardware and crossarm covers
    - pole bracket and insulator base cover
        - stand off cover
        - metal arm cover
        - crossarm cover
    - conductor and insulator covers (rated 46 kv phase to phase)

4. Identify the uses of pole covers.
    - raising or lowering a pole between energized lines
    - rubber glove maintenance

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-2181 Live Line Work

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- perform basic live line hot stick and rubber glove work.

Theory:

1. Identify the tools and equipment necessary for live line hot stick work.
    - standard kit
    - tool ratings
    - care and use
    - testing

2. Identify safety concerns and methods employed in hot stick work.
    - safety rules
    - do's and don'ts
    - tailboard conference
    - hold-off
    - protection from second point of contact
    - back-up assemblies
    - conductor reference chart
    - conductor weight calculation
    - conductor tension calculation
    - forces acting on a deadend pole
    - determining the angle of a corner
    - bisect tension
    - application of calculation of forces to rigging
    - wire tong application

3. Identify the tools and equipment necessary for live line rubber glove work.
    - history of rubber gloving
    - basic rubber glove kit
    - rubber protective equipment - classification, types and ratings
    - equipment testing
        - shop testing
        - field checks
    - equipment use, care and storage

4. Identify safety concerns and methods employed in rubber glove work.
   - safety in rubber glove work
     - safety rules
     - do's and don'ts
     - tailboard conference
     - hold-off
     - protection from the second point of contact
     - back-up assemblies
   - rubber glove work methods

5. Identify procedures to consider for bare hand live line work (345 kV).
   - bond-on
   - conductive shield

6. Explain background theory to consider when conducting live line work (345 kV).
   - electrostatic induction
   - electromagnetic induction
   - insulation from ground
   - leakage current
   - grounding
   - shielding and bonding

7. Identify safety procedures to followed when conducting bare hand live line work (345 kV).
   - job method
   - tailboard conference
   - personal readiness and teamwork
   - working clearances
   - do's and don'ts

8. Identify the tools and equipment required to perform bare hand work on the 345 kV system.
   - 345 kV Kit
   - conductive clothing
   - ladders
   - aerial devices
   - non-conductive rope

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1292 Transmission Lines Familiarization

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- identify different transmission lines by design and voltage level.

Theory:

1. Introduction.
   - definition
   - characteristics

2. Necessity for higher voltage.
   - losses

3. Interconnection.
   - a difference between distribution and transmission lines

4. Rights of way.
   - another difference between distribution and transmission lines

5. Sample structures.
   - 69 KV single pole
   - 69 KV “H” - Frame
   - 138 KV “H” - Frame
   - 138 KV “H” - Frame with overhead ground wire
   - 138 KV Steel Tower
   - 230 KV Gulfport
   - 345 KV Guyed Portal

6. Insulation.
   - identify design voltage level with an insulator

7. Overhead ground wire.
   - purpose
   - various sizes

8. Maintenance.
    - dead line
    - live line
        - hot sticks
        - bare hand

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

LEVEL 3

PLT-3011 Transformers

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes

Upon successful completion of this course, the apprentice will be able to:

- describe all of the transformer types which may be encountered by the powerline technician as well as to describe their basic operating principles.

Theory:

1. Explain importance of and purpose of transformers.
    - purposes of transformers
    - transformer windings
    - transformer types

2. Identify the basic components contained in the construction of distribution transformers.
    - core
    - windings
    - oil
    - bushings
    - gaskets
    - tank
    - cover
    - taps and tap changer
    - mounting brackets

3. Identify the principles of transformation in distribution transformers.
    - transformer operation
    - transformer losses and efficiency
    - transformer ratio
        - turns
        - voltage
        - current
        - calculations
    - polarity

4. Identify the importance of considering transformer ratings when deciding on a specific application.
    - voltage
    - capacity

- impedance

5. Identify the requirements that must be met before transformers can be paralleled.
   - voltage ratios
   - impedance
   - polarity
   - connections

6. Identify the purpose of transformer fusing and the factors that influence the selection of a transformer fuse size.
   - protection
   - factors
   - standard types “T” and “K”
   - purposes of a transformer fuse

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3061 Voltage Regulation

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the purpose, basic construction, operating principles and use of “voltage regulators” and “auto boosters”.

Theory:

1. Identify devices, including their merits, that can be used to modify distribution circuit voltage levels or modify voltage as a product of a different function.
   - voltage booster transformer
   - shunt capacitors
   - series capacitors
   - transformer load tap changer
   - induction voltage regulator
   - step voltage regulator
   - auto booster

2. Identify importance of and procedures for operating voltage regulators.
   - purpose of voltage regulators
   - theory of voltage regulator operation
   - physical features of a typical regulator
   - the control panel and function of control
   - trouble shooting checks
   - the automatic sequenced bypass switch
   - putting the voltage regulator in the neutral position
   - placing the voltage regulator “in” service
   - removing the voltage regulator “from” service

3. Identify importance of and procedures for operating auto-boosters.
   - major differences between an auto-booster and a voltage regulator
   - the control panel and function of controls
   - physical features of the auto-booster
   - trouble shooting checks
   - placing the auto-booster in the neutral position
   - placing the auto-booster “in” service
   - placing the auto-booster “from” service

4. Identify importance of proper application of voltage regulators and auto-boosters.
   - regulating devices in series
   - reversing the source of a regulating device

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3071 Management of Hazardous Materials

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain the requirements and procedure for handling, containment and disposal of materials considered to be an “environmental hazard”.

Theory:

1. Identify importance of management of hazardous materials.
   - legislation
   - due diligence

2. Describe the management of mineral oils, insulating oils and petroleum products.
   - oil spill contingency
   - sample collection
   - insulating oils and petroleum products
   - management of other equipment

3. Describe the management of PCB contaminated material (< 50 ppm, 50-500 ppm).
   - spill contingency
   - special substances
   - chemical substances
   - transportation and storage
   - electrical equipment

4. Explain operating practices for corrective actions:
   - reporting
   - incident investigation
   - storage
   - precautions

5. Describe requirements and procedures for special circumstances.
   - ROW travel
   - solid waste disposal

4. Describe environmental work methods.

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3081 Underground Construction

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe underground facilities including methods of installation and policies and practices governing its use.

Theory:

1. Identify uses and consideration for underground systems.
    - uses
        - urban system
        - underground residential distribution
        - underground dips
    - considerations
        - co-ordination
        - planning
        - financial
        - design and layout
        - surveying and staking of route
        - right-of-way and easements
        - installation

2. Identify major components of underground systems.
    - cables
        - physical and mechanical properties of cables
            - dimension and weight
            - flexibility
            - pulling stress
        - cable protection
            - mechanical protection
            - protection from corrosion
        - handling cable
            - storage during installation
            - storage during cold weather
            - installation practices
    - duct systems
            - types of ducts
            - design considerations
            - duct installation

        - manholes
        - cable installation
    - direct-buried systems
    - system grounds
    - transformer installations
        - padmount
        - transclosures
        - vault
        - submersible
    - switches and switchgear
        - in transformers
        - in vaults
        - in special locations
    - cable connections
        - splices
        - connections
        - terminations
            - pothead
            - slip-on termination
            - modular type
            - cold-shrink terminator
            - taped termination
            - load-break elbow
        - taps
            - primary taps
            - secondary taps

3. Identify underground policy responsibilities.
    - responsibilities

4. Explain underground system identification procedures.
    - line diagrams
    - geographic maps

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3091 Underground System Operation

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the methods and apparatus associated with operating an underground system.

Theory:

1. Identify important characteristics of underground primary cable construction.
    - cable insulations
    - cable construction
    - cable termination
        - stress cone
        - modular slip-on terminator
        - modular slip-on terminator application
        - terminator mounting bracket
    - cable grounding
    - commissioning cables

2. Identify operating practices for switching underground systems.
    - live-front pad-mounting apparatus
        - pad-mounted switchgear
            - operation of S & C pad-mounted gear
            - operation of mini-rupter switches in S & C gear
            - replacing of S & C fuses.
        - pad-mounted transformers
            - arc-strangler switches
            - operation of an arc-strangler
            - S & C switches
            - transclosures
    - apparatus installed in a vault
    - dead-front pad-mounted apparatus
        - operating the bayonet fuse
    - overhead devices for underground circuits
    - precautions and safety rules

3. Locating cables
    - method

4. Locating cable faults
   - method

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3021 Polyphase Generation

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain the principles of three-phase generation.

Theory:

1. Identify the principles and advantages of three-phase systems.
   - three single-phase circuits combined
   - advantages of three-phase systems

2. Identify the principles of two-phase generation.
   - two coils
   - 90 mechanical degrees

3. Identify the principles of three-phase generation.
   - three coils
   - 120 mechanical degrees

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3031 Three-Phase Connections

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain how three-phase generator and transformer connections may be varied to achieve different effects.

Theory:

1. Identify the two most common three-phase connections.
   - star or wye connection
   - delta connection

2. Identify the principles of the star or wye connection.
   - voltage values
   - current values
   - advantages of a star-connected system

3. Identify the principles of the delta connection.
   - voltage values
   - current values

4. Identify the principles of the open-delta connection.
   - voltage values
   - current values

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3041 Power In Three-Phase Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- explain how calculations are accomplished in the star system, the delta system and the open delta system.

Theory:

1. Identify methods for finding power in a three-phase system.
   - phase valves
   - line values

2. Explain importance of and perform calculations for power factor.
   - formula
   - power factor correction
   - advantages of improved power factor

3. Explain importance of and perform calculations for line losses.
   - voltage drop
   - power loss
   - conductor size

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-3051 Transformer Banking

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the various connections available for the application of single-phase distribution transformers to three-phase systems and the implications of each connection.

Theory:

1. Requirements for banking single-phase transformers.

2. Identify types of transformer connections.
    - the delta-delta connection
    - the wye-wye connection
    - the delta-wye connection
    - the wye-delta connection
    - the open-delta open-delta connection
    - the open-wye open-delta connection

3. Identify various operating hazards.
    - single phase circuits
        - operating single phase transformers in parallel
    - three-phase circuits
        - transformer bank with a delta primary
        - transformer bank with an open-delta primary
        - transformers paralleled for single-phase service
        - single-phase transformers on a delta system
        - transformers connected star-delta, isolated neutral
        - transformers connected star-delta, grounded neutral
        - transformers connected star-star
        - single-phase transformers on a star primary

4. Transformer fusing.
    - selecting the proper fuse rating
    - fusing three phase banks
    - open banks - transformer capacity
    - fusing transformers in open banks

5. Identify uses and safe practices for single-phase voltage booster transformers.
   - raise voltage
   - lower voltage
   - precautions

6. Identify potential hazards of alternate sources of energy.
   - accidental energization
   - electromagnetic coupling
   - electrostatic charge

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

LEVEL 4

MENT-1802 Workplace Mentoring II
(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for teaching workplace skills.
- Demonstrate strategies to assist in teaching skills in the workplace

Objectives and Content:

1. Describe the impact of your own experiences in teaching skills.
2. Identify the different roles played by a workplace mentor.
3. Describe the six-step approach to teaching skills.
4. Explain the importance of identifying the point of the lesson.
5. Identify how to choose a good time to present a lesson.
6. Explain the importance of linking the lessons.
7. Identify the components of the skill (the context).
8. Describe considerations for demonstrating a skill.
9. Identify types of skill practice.
10. Describe considerations in setting up opportunities for skill practice.
11. Explain the importance of providing feedback.
12. Identify techniques for giving effective feedback.
13. Describe a skill assessment.
14. Identify methods of assessing progress.
15. Explain how to adjust a lesson to different situations.

Resource:

- Recommended resource to use in the delivery of this unit:
  www.apprenticeship.nscc.ca/mentoring/apprentice.htm

PLT-4011 Line Capacitors

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the various arrangements of capacitor banks, their basic operating principles and switching and protection requirements.

Theory:

1. Explain capacitor construction, ratings and standards.
    - capacitor construction
    - ratings and standards

2. Discuss capacitors installed on distribution circuits.
    - shunt connection
        - effects
        - protection
            - bank fusing
            - individual fusing
        - automatic control
        - operating
    - series connection
        - effects
        - protection
        - operating

3. Discuss capacitors installed on transmission circuits.
    - connections
    - switching and protection requirements
    - operating
        - procedures for grounding
        - placing back in service

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4021 Power Transformers

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe stationary power transformers and mobile substations in sufficient detail as to be familiar with their capabilities and limitations.

Theory:

1. Discuss the construction, operation, inspection and energizing procedure for stationary transformers.
    - definition
    - construction and operation
        - windings
        - insulation
        - cooling
        - auxiliary devices
            - protective devices
            - voltage control apparatus
                - off-circuit tap changer
                - load-tap changer
            - external cooling equipment
        - effects of impedance
        - effects of load
        - exciting current
        - in-rush current
        - connection
    - inspection
    - energizing procedure

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4031 Paralleling Three-Phase Circuits

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- describe the terms used with respect to the relationship between phases of a three-phase system.
- possess a knowledge base for the safe operation of those systems.

Theory:

1. Describe phase rotation.
   - phase sequence
   - testing rotation

2. Describe phase shift.
   - in transformers
   - in lines

3. Explain phasing.
   - phasing tester

4. Explain paralleling of three-phase circuits.
   - transmission system
   - distribution system
   - summary

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4041 Electronic Oil Reclosers And Vbm Fault Interrupter

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate knowledge of the “electronic oil recloser” and the “V.B.M” Fault Interrupter.

Theory:

1. Provide a complete overview of the “Electronic Oil Recloser”.
    - use of oil reclosers of all types and sectionanalizers
    - purpose and theory of EOR operation
    - application of reclosers
    - physical features of electronic oil reclosers
    - the control panel and function of controls
        - form 3A control
        - form 4C control
    - operating procedures
        - placing an EOR “in” service
        - removing an EOR “from” service
        - placing an EOR in “non-reclose” for a “hold-off”
        - picking up “cold load” with an EOR
        - closing the EOR manually with the manual closing tool
    - trouble shooting checks
    - reference standard Operating Practice III-017-1.3
    - reference standard Operating Practice III-017-1.4

Practical:

Suggested learning activities are assigned to enhance the apprentice’s ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4081 Distribution Circuits Load Characteristics

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the design of a distribution transformer and secondary layout in order to determine the adequacy of facilities.

Theory:

1. Identify and explain factors which affect transformer / secondary design.
    - introduction
    - load characteristics
        - power factor
        - connected load and demand
            - demand
            - demand factor
        - load factor
            - monthly load factors
            - yearly load factors
        - diversity and coincidence factors
        - load growth
            - transformer loading
            - transformer sizing

2. Examine requirement demands that affect transformer / secondary layout.
    - determining transformer size
    - determining secondary size

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-1410 Substations, Switching Stations And Terminals

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe substations, switching stations and terminals in terms of the powerline technician's involvement with both their operation and their inspection.

Theory:

1. Explain the operation and inspection of substations as they pertain to the powerline technician.
    - types of substations
    - functions of substations
        - switching
        - transformation
        - control of system voltage
    - location of substations
    - line diagrams
        - symbols
    - substation inspections
    - substation trouble shooting

2. Explain the operation and inspection of switching stations as they pertain to the powerline technician.
    - function of switching stations
    - location of switching stations
    - line diagrams
    - switching station inspections
    - switching station trouble shooting

3. Explain the operation and inspection of terminals as they pertain to the powerline technician.
    - functions of terminals
        - switching
        - transformation
        - control of system voltage
    - location of terminals
    - bus design considerations
    - line diagrams
    - terminal inspections
    - terminal trouble shooting

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4121 Line Protection (Metal Clad Switch Gear)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe the fundamentals of line protection as they relate to metal-clad switchgear and its associated protective devices.

Theory:

1. Introduce metal-clad switchgear.
    - main features
    - air breaker operation
        - normal operation
        - opening
        - closing

2. Describe relays, instruments and switches
    - current transformers
    - potential transformers
    - thermal demand ammeters
    - time-over current relays
    - breaker position indicating lights
    - breaker operating switch
    - permissive trip button
    - reclosing relay
    - reclose blocking switch
    - underfrequency relay
    - underfrequency timer
    - underfrequency relay blocking switch
    - metering
        - demand energy meter
        - test socket
        - recording voltmeter
    - differential relays
    - miscellaneous relays
        - synchronism check device
        - under voltage relay
        - annunciator relay
        - manual selector transformer switch
        - transformer thermal relay
        - transformer gas pressure relay

- alarm relay
- locking out relay
- tripping relay

3. Discuss protective device co-ordination involving metal-clad switchgear.
   - considerations for protective device co-ordination
   - operation of protective devices
     - under frequency
     - differential current
     - over current
     - other conditions

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4051 Circuit Switchers

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate knowledge of circuit switchers.

Theory:

1. Provide an overview of the “circuit switcher”.
    - circuit switches and fault interrupters
    - the use of the circuit switcher
    - parts of the circuit switcher
        - support structure
        - support insulators
        - the interphase coupling
        - the shunt trip solenoid housing
        - the shunt trip insulating operating shaft
        - the interrupting section
        - the gas pressure indicator
        - a pressure relief device
        - the contact position indicator
        - the disconnect blade and striking contacts
        - a ground switch
        - the switch operator
        - the dc motor
        - the position indicating pumps
        - the control switch
        - the control fuses
        - the position indexing drums
        - the selector handle
        - the manual operating handle
        - the kirk interlock
    - electrical operation of circuit switcher
        - to close the circuit switcher
        - to open the circuit switcher
    - manual operation of circuit switcher
      operational checks and trouble shooting
      reference standard operating practice

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLTA-1002 Canadian Electrical Code
(Nova Scotia Unit of Instruction)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
-

Theory:

(Pending)

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4071 Single-Phase And Three-Phase Revenue Metering

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- explain how instrument transformers are used in both single and three-phase metering installations
- to explain the procedures for application and operation of these installations.

Theory:

1. Explain the two main types and uses of instrument transformers.
    - voltage transformers
    - current transformers
    - metering outfit
    - multipliers
    - polarity marks
    - records

2. Explain the application of meters and instrument transformers.
    - electro-mechanical meters
    - digital meters
    - single-phase, three-wire circuit
    - three-phase, four-wire circuit
        - with a self-contained meter
        - with a transformer-rated meter

3. Explain installation and servicing procedures.
    - meter test switch
    - wire color codes
    - test methods
    - mounting of instrument transformers
    - clearance
    - connections

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities.

Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLT-4091 Radio And Television Interference

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for the Powerline Technician occupation.

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- be familiar with common causes of radio and television interference
- be able to consider some corrective and preventive measures.

Theory:

1. Define radio and television interference and identify its causes.
   - types
   - sources
   - myths

2. Examine some corrective and preventive measures for radio and television interference.
   - locating
   - work practices
   - complaints

Practical:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

1. Classroom exercises as determined by the instructor.

PLTA-1006 Program Review

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Upon successful completion of this unit, the apprentice will complete a study plan based on the National Occupational Analysis.

Objectives and Content:

1. Identify areas of the program where knowledge of theory is weakest.

2. Identify areas where workplace experience is lacking or weak.

3. Identify resources necessary to address areas of shortfall.

4. Identify timelines to address areas of weakness.

Suggested Learning Activities:

1. Conduct a mock certification exam to be used for diagnostic purposes.
2. Review the National Occupational Analysis.
3. Review the Apprentice Logbook.
4. Review the Exam Preparation information found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
5. Conduct a final mock certification exam.

Resources:

These are the recommended resources to use in the delivery of this unit:

- Exam Preparation information, including videos, occupational analyses, exam counseling sheets, practice exams and sample questions, and other study materials and resources, can be found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
- Apprentice's personal logbook
- Applicable codes and regulations
- Program texts

Evaluation: pass/fail

Nova Scotia Document Evaluation Form

Thank you for your interest in the development and revision of this document. Upon review of the document, please record your feedback in relation to the following items:

- course division and organization
- relevancy of the content
- errors or omissions
- other suggestions for improvement and consideration

Overall comments are to be entered on this evaluation form and specific changes are to be entered directly on the document in the relevant area(s). When making proposed corrections(s) in the document, please use red ink. When all feedback has been recorded, return this evaluation form along with the document to the Apprenticeship Office noted at the bottom of the page.

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