

Module Overview

This module provides an introduction to the theory of alternating current, along with AC circuits, inductors, capacitors, transformers, and three-phase systems.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe how single-phase and three-phase alternating current is developed.
2. Calculate the peak and effective voltage or current values for an AC waveform.
3. Describe phase relationships in AC circuits.
4. Describe impedance and explain how it affects AC circuits.
5. Describe the operating principles and functions of inductors.
6. Describe the operating principles and functions of capacitors.
7. Explain the principles and functions of transformers.
8. Explain the following terms as they relate to AC circuits:
 - True power
 - Apparent power
 - Reactive power
 - Power factor

Performance Tasks

This is a knowledge-based module; there are no performance tasks.

Materials and Equipment

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Power Line Worker Level Two: Distribution

PowerPoint® Presentation Slides
(ISBN 978-0-13-274329-7)

Multimedia projector and screen

Computer

Appropriate personal protective equipment

Calculator

Common capacitors

Inductors, resistors, capacitors, power sources,
and wiring to build RL, RC, RLC, and LC
circuits

Voltmeter

Transformers

Copies of the Quick Quiz*

Module Examinations**

* Located at the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Ensure that trainees are briefed on basic electrical safety and shop safety policies.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Principles of Electric Circuits: Conventional Current Version, 2009. Thomas L. Floyd. New York: Prentice Hall.

Teaching Time For This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 17½ hours are suggested to cover *Alternating Current and Three-Phase Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	Planned Time
Session I. Introduction; Sine Wave Generation and Terminology	
A. Introduction	_____
B. Sine Wave Generation	_____
C. Sine Wave Terminology	_____
Session II. AC Phase Relationships; Resistance; Inductance and Capacitance; Types of AC Circuits	
A. AC Phase Relationships	_____
B. Resistance in AC Circuits	_____
C. Inductance in AC Circuits	_____
D. Capacitance	_____
E. RL, RC, LC, and RLC Circuits	_____
Session III. Power in AC Circuits	
A. Power in AC Circuits	_____
1. True Power	_____
2. Apparent Power	_____
3. Reactive Power	_____
4. Power Factor	_____
5. Power Triangle	_____
Sessions IV and V. Transformers	
A. Transformers	_____
1. Transformer Construction	_____
2. Operating Characteristics	_____
3. Turns and Voltage Ratios	_____
4. Types of Transformers	_____
5. Transformer Selection	_____
Session VI. Three-Phase Power Distribution Systems	
A. Three-Phase Power Distribution Systems	_____
1. Voltage and Current Imbalance in a Three-Phase System	_____

Session VII. Review and Testing

A. Module Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.



Module Overview

This module introduces the trainee to aerial distribution equipment and the role of transformers in a power distribution system.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the types of transformers and how they are used in aerial distribution systems.
2. Explain the construction of an aerial distribution transformer.
3. Describe the functions of aerial load management devices including:
 - Regulators
 - Reclosers
 - Capacitors
 - Fault indicators
 - Fuses and cutouts
 - Switches
4. Assemble overhead street lights.
5. Energize or de-energize a single-phase transformer using the proper hot stick.
6. Open a disconnect switch using a load break tool.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Energize or de-energize a single-phase transformer using a hot stick.
2. Open a disconnect switch using a load break tool.
3. Assemble overhead street lights.
4. Hook up a three-phase transformer per diagrams and instructions provided by the instructor.

Materials and Equipment

Multimedia projector and screen
Power Line Worker Level Two: Distribution
PowerPoint® Presentation Slides
(ISBN 978-0-13-274329-7)

Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Access to a location with a number of transform-
ers, including pole- and pad-mounted
Three-phase transformers and conductors
required for hookup

Access to a substation with a see-through fence
and binoculars if necessary to see components
Access to a location with open transformers for
inspection
Access to sufficient street lights for assembly
Hot sticks, shotgun sticks, and extendo sticks
Load break tools
Tools for street light assembly
Copies of Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located at the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or near power lines and power distribution equipment. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

The Lineman's and Cableman's Handbook, 11th Edition. New York, NY: McGraw-Hill.

National Electrical Safety Code C2-2007. New York, NY: Institute of Electrical and Electronics Engineers.

Electrical Power Distribution and Transmission. Upper Saddle River, NJ: Prentice Hall.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover *Aerial Distribution Equipment*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety; Aerial Distribution Transformers	
A. Introduction	_____
B. Safety	_____
C. Aerial Distribution Transformers	_____
1. Aerial Transformer Characteristics	_____
2. Aerial Distribution Transformer Types	_____
3. Other Distribution Transformers	_____
Sessions II and III. Transformer Construction	
A. Transformer Construction	_____
1. Transformer Terminals	_____
2. Common Transformer Connections	_____
3. Single-Phase Light and Power Systems	_____
4. Three-Phase Power Systems	_____
5. Connecting Transformers	_____
B. PT/Laboratory	_____
Have trainees practice connecting three-phase transformers.	
This task corresponds to Performance Task 4.	
Sessions IV and V. Load Management and Protective Devices	
A. Load Management and Protective Devices	_____
1. Current Surge Protection Devices	_____
2. Voltage Regulators	_____
3. Isolating Devices	_____

Sessions VI and VII. Insulated Tools

A. Insulated Tools

- 1. Hot Sticks
- 2. Clamp Stick
- 3. Extendo Stick
- 4. Load Break Tool

B. PT/Laboratory

- 1. Have trainees use a hot stick to energize and de-energize a single-phase transformer. This laboratory corresponds to Performance Task 1.
- 2. Have trainees use a load break tool to open a disconnect switch. This laboratory corresponds to Performance Task 2.

Sessions VIII–IX. Overhead Street Lights

A. Overhead Street Lights

- 1. Street Light Power Supply
- 2. Pole Requirements
- 3. Luminaire Installation
- 4. Luminaire Control

B. PT/Laboratory

- 1. Have trainees assemble a street light. This laboratory corresponds to Performance Task 3.

Session X. Review and Testing

A. Review

B. Module Examination

- 1. Trainees must score 70% or higher to receive recognition from NCCER.
- 2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

C. Performance Testing

- 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
- 2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

Module Overview

This module introduces the trainee to the installation, removal, and repair of the cables and conductors that tie the components of aerial distribution systems together.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Install cables and conductors.
2. Describe how to remove cables and conductors.
3. Splice and terminate cables and conductors.
4. Explain how to select and size a conductor for a given application.
5. Operate cable-pulling equipment.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install cables and conductors.
2. Splice and terminate cables and conductors.
3. Operate cable-pulling equipment.

Materials and Equipment

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Power Line Worker Level Two: Distribution

PowerPoint® Presentation Slides
(ISBN 978-0-13-274329-7)

Multimedia projector and screen

Computer

Appropriate personal protective equipment

Short sections of cables and conductors for comparison

Several types of aluminum conductors

Examples of several sizes of conductors

Ties and tie kits

Appropriate cables for splicing

Tools for splicing, installing, pulling, removing, and repairing cable and conductor

Access to an area where trainees can install, pull, remove, and repair cable and conductor

Appropriate cables and conductors for installing and removing

Appropriate cables for pulling

Copies of Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located at the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on cables and conductors for aerial power distribution. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Power Distribution Engineering. New York, NY: Marcel Dekker.

Guide to Electrical Power Distribution Systems, 5th Edition. Tulsa, OK: PennWell Books.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Cable and Conductor Installation and Removal*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety; Cables and Conductors; Selecting Conductors	
A. Introduction	_____
B. Safety	_____
C. Cables and Conductors	_____
1. Characteristics of Conductors	_____
D. Selecting Conductors	_____
1. Line Current and Voltage	_____
2. Snow and Ice Loads	_____
3. Wind Loads	_____
4. Ambient Temperature	_____
5. Material Cost	_____
Sessions II through IV. Installing Cables and Conductors	
A. Installing Cables and Conductors	_____
1. Stringing Conductors	_____
2. Dead-End Conductors	_____
3. Tensioning and Sagging Conductors	_____
4. Tie Conductors to Insulators	_____
5. Installing Overhead Cables	_____
B. P/T Laboratory	_____
Have trainees practice installing cables and conductors. This laboratory corresponds to Performance Task 1.	
C. Laboratory	_____
Have trainees practice tying conductors to insulators.	

Sessions V and VI. Repair and Replace Cables and Conductors

A. Repair and Replace Cables and Conductors

- 1. Full-Tension Splice
- 2. Full-Tension Crimp-On Splice
- 3. Conductor Crimp-On Splice
- 4. Splice Shunt
- 5. Repair Sleeve
- 6. Automatic Splice

B. P/T Laboratory

Have trainees splice and terminate cables and conductors. This laboratory corresponds to Performance Task 2.

Session VII. Cable-Pulling Equipment

A. Cable-Pulling Equipment

B. P/T Laboratory

Have trainees operate cable-pulling equipment. This laboratory corresponds to Performance Task 3.

Session VIII. Review and Testing

A. Review

B. Module Examination

- 1. Trainees must score 70% or higher to receive recognition from NCCER.
- 2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

C. Performance Testing

- 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
- 2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

Module Overview

This module introduces trainees to URD systems, including switchgear, transformers, and conductors. The trainees will become familiar with connection and termination methods and will learn how to install lightning protection and fault-indicating devices.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the history and applications of URD systems.
2. Describe trenching and backfill methods used for URD systems, including common-trench applications.
3. Identify and describe common types of cable conductors and termination methods used in URD installations.
4. Describe common types of lightning protection and fault indicating devices used in URD systems.
5. Install lightning protection and fault indicating devices in URD systems.
6. Identify and describe pad-mounted switchgear and transformers used in URD systems.
7. Select the proper types of conductors and termination methods for specific URD applications.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install lightning protection and fault indicating devices in URD systems.
2. Identify and describe pad-mounted switchgear and transformers used in URD systems.
3. Select the proper types of conductors and termination methods for specific URD applications.

Materials and Equipment

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Power Line Worker Level Two: Distribution

PowerPoint® Presentation Slides
(ISBN 978-0-13-274329-7)

Multimedia projector and screen

Computer

Appropriate personal protective equipment

Sample pieces of primary and secondary URD cables

Sufficient vises, manual and battery-powered cable cutters, and cable-stripping tools

Sufficient pieces of cable for cutting and stripping

Sufficient sections of aluminum and copper conductors, compression connectors, and a compression tools and die

Split-bolt connector, splice kit, and pieces of primary URD cable

Mechanical crimping tool

Hand-operated hydraulic tool

Lightning protection devices

Fault-indicating devices

Access to an area with pad-mounted URD switchgear and transformers or, if not available, a selection of photographs

Selection of URD conductors and termination methods

Module Examinations*

Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with all appropriate PPE and know how to use it properly. This module includes optional activities that may require safety glasses and/or other PPE. Ensure that trainees are familiar with and use the proper PPE.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Electric Power Distribution Handbook. T. A. Short. Boca Raton, FL: CRC Press LLC.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover *Underground Residential Distribution (URD) Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; URD System Overview	
A. Introduction	_____
B. URD System Overview	_____
1. History and Significance of URD Systems	_____
2. Types of URD Systems	_____
3. URD Trenching and Backfilling Methods	_____
Sessions II and III. Cable Types and Termination Methods, Part One	
A. Cable Types and Termination Methods	_____
1. Conductors	_____
2. Termination Methods	_____
B. Laboratory	_____
Have the trainees cut and strip pieces of cable.	_____
Sessions III and IV. Cable Types and Termination Methods, Part Two	
A. Cable Types and Termination Methods	_____
1. Termination Methods	_____
B. Laboratory	_____
1. Have the trainees join conductors.	_____
2. Have the trainees splice conductors.	_____
3. Have the trainees crimp compression terminals and connectors.	_____
Sessions V through VII. Lightning Protection and Fault-Indicating Devices	
A. Lightning Protection and Fault-Indicating Devices	_____
1. Lightning Protection Devices	_____
2. Fault-Indicating Devices	_____
3. Lightning Protection and Fault-Indicating Device Installation	_____
B. PT/Laboratory	_____
Have the trainees install lightning protection and fault-indicating devices in URD systems. This laboratory corresponds to Performance Task 1.	

Module Overview

This module introduces trainees to overhead and URD service installation. Trainees will learn to install single- and three-phase loops and to install risers on poles. Trainees will also learn to terminate single- and three-phase underground secondary services.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the methods and equipment used in the installation of residential and commercial electrical services.
2. Install single- and three-phase overhead loops.
3. Install risers on poles (conduit or U-guard).
4. Terminate single- and three-phase underground secondary services.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install single- and three-phase overhead loops.
2. Install risers on poles (conduit or U-guard).
3. Terminate a single- and/or three-phase underground secondary service.

Materials and Equipment

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Power Line Worker Level Two: Distribution

PowerPoint® Presentation Slides

(ISBN 978-0-13-274329-7)

Multimedia projector and screen

Computer

Appropriate personal protective equipment

Sufficient poles, risers, U-guard, conduit, and other necessary equipment/materials for installing risers

Watt-hour meters and meter bases

Meter mounts, conduit, and a selection of connectors

Lengths of direct burial and overhead triplex

Sufficient pad-mounted single- and three-phase transformers

Spade terminals and ring terminals

Appropriate tools for terminating single- and three-phase secondary services

Module Examinations*

Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or near electrical distribution systems, especially conductors and transformers. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Underground Power Cables. New York, NY: Longman Group.

Underground Transmission Systems Reference Book. Palo Alto, CA: Electric Power Research Institute (EPRI).

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Overhead and URD Service Installations*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety; Types of Distribution Systems	
A. Introduction	_____
B. Safety	_____
C. Types of Distribution Systems	_____
1. Overhead Distribution Systems	_____
2. Underground Distribution Systems	_____
Session II. Installing Overhead Services	
A. Types of Overhead Meter Loops	_____
B. Installing an Overhead Service Drop	_____
C. Commercial Overhead Service Installation	_____
D. Watt-Hour Meters	_____
Session III. Laboratory	
A. PT/Laboratory	_____
Have the trainees install single- and three-phase overhead loops. This laboratory corresponds to Performance Task 1.	
Session IV. Installing and Terminating Underground Secondary Services	
A. Installing and Terminating Underground Secondary Services	_____
1. Underground Conductors	_____
2. Pad-Mounted Conductors	_____
3. Underground Secondary Distribution Systems	_____
4. Installing Underground Meter Loops	_____
5. Street Lighting	_____
6. Commercial Underground Service	_____
Session V. Laboratory	
A. PT/Laboratory	_____
1. Have the trainees install risers on poles, including conduit or U-guard. This laboratory corresponds to Performance Task 2.	
2. Have the trainees terminate a single- and three-phase underground secondary service. This laboratory corresponds to Performance Task 3.	

Session VI. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

Module Overview

This module introduces the trainee to maintenance of distribution lines, including inspection and replacement of equipment. The trainee will learn to recognize damage and other problems in aerial and URD distribution systems.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. State the safety precautions associated with power line maintenance.
2. Describe the requirements for pole and distribution line inspections.
3. Describe the maintenance requirements for pole-mounted equipment and conductors.
4. Describe methods used to achieve load management and fuse coordination.
5. Re-conductor overhead lines.
6. Replace cross-arms, arresters, switches, insulators, and associated hardware.
7. Replace an aerial transformer.
8. Describe the methods used to locate and correct faults in URD cabling systems.
9. Perform testing and inspection of aerial transformers.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Re-conductor overhead lines.
2. Replace cross-arms, arresters, switches, insulators, and associated hardware.
3. Replace an aerial transformer.
4. Perform testing and inspection of aerial transformers.

Materials and Equipment

Markers/chalk	Appropriate tools for replacing pole-mounted equipment
Pencils and scratch paper	Lengths of conductors, cross-arm insulator, and cross-arm extender
Whiteboard/chalkboard	Appropriate tools for replacing conductors
<i>Power Line Worker Level Two: Distribution</i>	Conductor splices with manufacturer's instruction
PowerPoint® Presentation Slides (ISBN 978-0-13-274329-7)	Lengths of conductor, filler rods, and tape
Multimedia projector and screen	Appropriate tools for installing a full-tension splice
Computer	Dynamometer and sag scope
Appropriate personal protective equipment	Access to aerial conductors
Screwdriver and hammer	New conductors and tools for replacing overhead conductors
Access to a wood pole with rotted sections	Manufacturer's instructions for installation, operation, and maintenance of pole-mounted equipment
Access to wood poles with cross-arms, arresters, switches, insulators, and associated hardware	Access to pole-mounted equipment
Guy wire grip	Service literature for a recloser
Come-along	
Pulling eye	
Guy wrap	
Replacement cross-arms, arresters, switches, insulators, and associated hardware	

continued

If possible, access to a damaged transformer
 Access to aerial transformers
 Replacement aerial transformers
 Tools required for replacing aerial transformers

Voltmeters
 Module Examinations*
 Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or performing maintenance on or near power distribution lines, including fall protection. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Electric Power System Basics for the Non-Electrical Professional. Steven W. Blume. Hoboken, NJ: Wiley IEEE Press.

Electrical Machines, Drives and Power Systems, 6th Edition. Theodore Wildi. Upper Saddle River, NJ: Prentice Hall.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 50 hours are suggested to cover *Distribution Line Maintenance*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety	
A. Introduction	_____
B. Safety	_____
1. Personal Protective Equipment (PPE)	_____
2. Protective Grounds	_____
3. Insulating Line Covers	_____
4. Effects of Fatigue	_____
5. Working Near Traffic	_____
Sessions II and III. Pole Inspection	
A. Pole Inspection	_____
1. Wood Pole Problems	_____
2. Inspecting Pole Guys	_____
B. Laboratory	_____
Have trainees practice tensioning pole guys, using a guy grip, come-along, pulling eye, and guy wrap.	

Sessions IV and V. Inspection and Maintenance of Conductors

A. Inspection and Maintenance of Conductors

- 1. Conductor Inspection
- 2. Abrasion
- 3. Trees and Brush
- 4. Repairing and Replacing Conductors
- 5. Laboratory
Have the trainees practice installing splices.
- 6. Conductor Sag
- 7. Conductor Ties
- 8. Vibration Dampers

Sessions VI through VIII. Laboratory

A. PT/Laboratory

Have trainees remove and replace existing conductors. This laboratory corresponds to Performance Task 1.

Sessions IX and X. Inspection and Maintenance of Pole-Mounted Equipment

A. General Inspection Requirements

- 1. Thermal Testing
- 2. Oil-Filled Equipment

B. Field Maintenance

- 1. Reclosers
- 2. Sectionalizers
- 3. Capacitors
- 4. Pole-mounted Switches
- 5. Distribution Transformers
- 6. Voltage Regulators
- 7. Insulators

Sessions XI through XIV. Laboratory

A. PT/Laboratory

Have trainees replace cross-arms, arresters, switches, insulators, and associated hardware. This laboratory corresponds to Performance Task 2.

Session XV. Transformer Testing and Diagnostics

- A. Visual Inspection
- B. Operation of Switches or Breakers
- C. Secondary Voltage Test

Sessions XVI and XVII. Laboratory

A. PT/Laboratory

- 1. Have trainees replace an aerial transformer. This laboratory corresponds to Performance Task 3.
- 2. Have trainees inspect and test an aerial transformer. This laboratory corresponds to Performance Task 4.
