Load Calculations – Feeders and Services

Course Planning Tools

Module 26401-20
Overview
Using load calculations to accurately size protection devices and circuit conductors ensures that loads are safely supported in an electrical system. These calculations must be made in accordance with NEC® requirements, which establish the minimum standards for electrical calculations. This module covers basic calculations for commercial and residential applications, including raceway fill, conductor derating, and voltage drop.

Learning Objective 1
Successful completion of this module prepares trainees to:
Perform basic load calculations in accordance with National Electrical Code® (NEC®) requirements.

a. Make adjustments in conductor size for various installations.
b. Calculate feeder ampacity.
c. Apply tap rules.
d. Apply demand factors.

Learning Objective 2
Successful completion of this module prepares trainees to:
Make service calculations for residential installations.

a. Calculate the minimum service size for simple electrical installations.
b. Make service calculations for single-family dwellings.
c. Make service calculations for multi-family dwellings.

Learning Objective 3
Successful completion of this module prepares trainees to:
Make service calculations for commercial installations.
a. Size commercial and industrial lighting loads.
b. Calculate loads for retail stores.
c. Calculate loads for office buildings.
d. Calculate loads for restaurants.
e. Calculate loads for hotels and motels.
f. Perform optional calculations for schools.
g. Size shore power circuits for marinas and boatyards.
h. Make farm load calculations.
i. Size motor circuits.

**Performance Tasks**

This is a knowledge-based module. There are no Performance Tasks.
Recommended Teaching Time: 20 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26401-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®
Health Care Facilities

Course Planning Tools

Module 26402-20
Overview

In health care facilities, reliable electrical systems and adequate backup power are vital for the safety of patients. For this reason, these systems are strictly regulated in the NEC®, as well as in state and local codes. This module covers the installation, alarm system, and backup system requirements of electrical systems in health care facilities, including the requirements for life safety and critical circuits.

Learning Objective 1

Successful completion of this module prepares trainees to:

List the types of health care facilities and their power requirements.

   a. Identify types of essential electrical systems used in health care facilities.
   b. Identify types of distribution systems used in health care facilities.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the categories and branch portions of the distribution circuits.

   a. Describe the operation and applications of hospital-grade receptacles.
   b. Identify the receptacle requirements for general care (Category 2) spaces.
   c. Identify the receptacle requirements for critical care (Category 1) spaces.
   d. Identify the grounding requirements for receptacles and fixed electrical equipment.

Learning Objective 3

Successful completion of this module prepares trainees to:

List the required wiring methods in health care facilities.

   a. Identify the wiring requirements for inhalation anesthetizing locations.
b. Identify the wiring requirements for low-voltage equipment and instruments.

c. Identify the wiring requirements for X-ray installations.

d. Identify the requirements for communication, signaling, data, and fire alarm systems installed in patient care areas.

e. Identify the requirements for isolated power systems.

Performance Tasks

This is a knowledge-based module. There are no Performance Tasks.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26402-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®
Overview

In places of assembly, power systems provide important functions such as lighting, evacuation routes and others during emergency situations. This module explains the NEC® installation requirements for electric generators and storage batteries used during such emergency situations.

Learning Objective 1

Successful completion of this module prepares trainees to:

Differentiate between emergency and standby systems and identify their primary components.

- a. Identify emergency and standby power system components.
- b. Explain the principles of transfer switch operation and their configuration/sizing considerations.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe battery and UPS system types and explain their maintenance requirements.

- a. Describe the different types of batteries used.
- b. Explain the maintenance requirements of batteries and their charging considerations.
- c. Identify single- and double-conversion UPS systems.

Learning Objective 3

Successful completion of this module prepares trainees to:

Describe the NEC® requirements for emergency/standby power and lighting systems.

- a. Describe legally required standby systems.
- b. Describe the alternate power requirements for health care facilities.
- c. Describe the alternate power requirements for places of assembly.
d. Describe emergency lighting requirements and devices for public buildings.

**Performance Tasks**

This is a knowledge-based module. There are no Performance Tasks.

Recommended Teaching Time: 10 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26403-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the *National Electrical Code*®
Overview
Electronics is a science that deals with the behavior and effect of electron flow in specific substances (which are used to create electronic devices), such as semiconductors. Electronics can be distinguished from electricity in terms of the voltages and currents used. This module explains the function and operation of basic electronic devices, including semiconductors, diodes, rectifiers, and transistors.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe electronic fundamentals.

a. Explain basic electronic theory.
b. Explain semiconductor fundamentals.

Learning Objective 2
Successful completion of this module prepares trainees to:
Identify and describe semiconductor devices.

a. Describe the operation and uses of diodes.
b. Describe the operation and uses of transistors.
c. Describe the operation and uses of semiconductor switching devices.

Performance Tasks
1. Test a transistor to determine whether it is an NPN or PNP.
2. Identify the cathode on three different styles of SCRs, using the shape or markings for identification.
Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26404-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®

Performance Task 1

- Transistors
- Silicon-controlled rectifiers (SCRs)
- Multimeter
- Performance Profile Sheets

Performance Task 2

- Transistors
- Silicon-controlled rectifiers (SCRs)
- Multimeter
- Performance Profile Sheets
Overview

Fire alarms provide an essential service that protects both human life and property from the effects of fire. Fire alarms can be complex systems made up of many different technologies. Numerous codes govern fire alarms to ensure that they operate in useful and predictable ways. This module explores the technologies, codes, and wiring approaches used to assemble a fire alarm system. Installation and troubleshooting techniques are also examined.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe the various codes and standards that relate to fire alarm systems.

a. Explain how codes and standards are implemented and list organizations responsible for their creation and maintenance.
b. List the various NFPA codes and standards that apply to fire alarm systems.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the basic types of fire alarm systems and their primary components.

a. Describe the basic types of fire alarm communication systems.
b. Describe the primary components of fire alarm systems.

Learning Objective 3

Successful completion of this module prepares trainees to:

Describe fire alarm control panels and their primary features.

a. Describe fire alarm control panels and their power source requirements.
b. Explain how users interface with the control panel.
c. Define and describe initiating circuits and panel outputs.

Learning Objective 4

Successful completion of this module prepares trainees to:
Identify and describe approaches to fire alarm notification and communication/monitoring.

a. Describe visual and audible notification devices and systems.
b. Describe important considerations in the use of fire alarm notification signals.
c. Describe communication and monitoring options for fire alarm systems.

Learning Objective 5

Successful completion of this module prepares trainees to:
Describe fire alarm system installation guidelines and requirements.

a. Describe the general wiring requirements.
b. Describe the general installation requirements for wiring and various components.
c. Describe the installation guidelines for totally protected premises.
d. Describe the installation guidelines for fire alarm-related systems and devices.
e. Describe how to troubleshoot fire alarm systems.

Performance Task

1. Connect selected fire alarm system(s).

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26405-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the *National Electrical Code®*

**Performance Task 1**

- Module Review Answer
- Key Module Examination
- Performance Profile Sheets
Specialty Transformers

Course Planning Tools

Module 26406-20
Specialty Transformers

Overview
Transformers are used to increase or decrease voltage coming from a power source. They can be constructed in a variety of configurations for different applications. This module covers various types of transformers, and provides information on selecting, sizing, and installing them.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify and describe various types of transformers.

a. Identify common transformer types.
b. Explain how three-phase transformers can be wired internally.
c. Identify types of specialty transformers.

Learning Objective 2
Successful completion of this module prepares trainees to:
Identify instrument transformers.

a. Identify and describe the use of current transformers.
b. Identify and describe the use of potential transformers.

Learning Objective 3
Successful completion of this module prepares trainees to:
Define harmonics and explain how harmonic issues are identified and resolved.

a. Describe the common sources of harmonics in office buildings and industrial plants.
b. Explain how to survey a system to identify the source of harmonics.
c. Explain how to resolve harmonics.

### Performance Tasks

1. Identify various specialty transformers.
2. Connect a buck-and-boost transformer to a single-phase circuit so that it will first be in the boost mode and then in the buck mode. Record the voltage increase and decrease for each configuration.
3. Using a clamp-on ammeter, demonstrate the principles of a current transformer; identify the primary winding, and then calculate and measure the effects of increasing the number of turns (loops) in the primary winding.

Recommended Teaching Time: 10 hours

### Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26406-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®

**Performance Tasks 1 and 2**

- Various specialty transformers, including one or more buck-and-boost transformers
- Multimeter
- Single-phase circuit
- Performance Profile Sheets

**Performance Task 3**

- Current transformers
- Clamp-on ammeter
• Single-phase circuit
• Performance Profile Sheets
Overview
Control systems are what regulate and direct the behavior of devices within an electrical system. They vary in complexity and consist of a variety of components, which provide different types of control. This module discusses applications and operating principles of various control system components, such as solid-state relays, reduced-voltage starters, and adjustable-frequency drives. It also covers basic troubleshooting procedures.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe the various types of relays used in motor control circuits.

a. Identify and describe solid-state relays and their uses.
b. Identify timing relays and explain their uses.

Learning Objective 2
Successful completion of this module prepares trainees to:
Explain how reduced-voltage starting is accomplished.

a. Describe the use and selection of conventional reduced-voltage motor starting methods.
b. Describe solid-state reduced-voltage motor starting methods.

Learning Objective 3
Successful completion of this module prepares trainees to:
Specify an adjustable frequency drive (AFD) for a given application.

a. Describe the types of AFDs, along with their operation and components.
b. Compare the uses, benefits, and problems when selecting an AFD.
**Learning Objective 4**

*Successful completion of this module prepares trainees to:*

Compare motor braking methods.

a. Describe DC injection braking.
b. Identify dynamic and regenerative braking methods.
c. Describe friction braking.

**Learning Objective 5**

*Successful completion of this module prepares trainees to:*

Describe how to maintain motor controls for peak operation.

a. Apply the precautions associated with solid-state controls.
b. Implement the preventive maintenance procedures associated with solid-state controls.

**Learning Objective 6**

*Successful completion of this module prepares trainees to:*

Describe how to troubleshoot motor controls.

a. Explain basic troubleshooting methods.
b. Describe the electrical troubleshooting methods used to check control circuits and devices.

**Performance Task**

1. Identify and connect various control devices.

**Recommended Teaching Time:** 20 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26407-20
- A variety of standard marker sizes
- Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations
• A copy of the National Electrical Code®

Performance Task 1
• Selected controls for connection into a three-phase motor circuit
• Multimeter
• Copies of Performance Profile Sheets
Overview
Heating, ventilation, and air conditioning (HVAC) systems are among the electrically powered and controlled systems that electricians will encounter, especially in residential and commercial construction. During installation, electricians will be called upon to provide power and control connections to the various components of these systems. For that reason, it is important that electricians develop a basic understanding of HVAC systems and their components.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe the operating principles and major components of HVAC systems.

a. Describe the basic principles of heating and ventilation.
b. Describe the basic principles and components of comfort air conditioning systems.

Learning Objective 2
Successful completion of this module prepares trainees to:
Identify the types of thermostats and their uses.

a. State the operating principles of thermostats.
b. Install different types of thermostats.

Learning Objective 3
Successful completion of this module prepares trainees to:
Identify and describe HVAC control systems and devices.

a. Identify and describe controls used in comfort cooling systems.
b. Identify and describe furnace controls.
c. Identify and describe heat pump defrost controls.
d. Describe digital controls used in HVAC systems.

e. Analyze the operating sequences of various HVAC control systems.

f. Describe troubleshooting methods used for HVAC systems.

Learning Objective 4

Successful completion of this module prepares trainees to:
Identify the NEC® requirements that apply to HVAC systems.

- a. Identify the NEC® requirements that apply to HVAC controls.
- b. Identify the NEC® requirements that apply to HVAC equipment.

Performance Tasks

1. Identify various types of thermostats and describe their operation and uses.
2. Install a thermostat and hook it up using the standard coding system for thermostat wiring.
3. Check and adjust a thermostat, including the heat anticipator setting and indicator adjustment.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26408-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®

Performance Task 1

- Different types of thermostats
• Performance Profile Sheets

**Performance Task 2**
• Tools needed to install a conventional 24V bimetal thermostat
• Performance Profile Sheets

**Performance Task 3**
• Tools needed to check and adjust a thermostat
• Performance Profile Sheets
Heat Tracing and Freeze Protection

Overview

Electrical heat-tracing systems keep piping systems at or above a given temperature for the purposes of freeze protection and temperature maintenance. In cold climates, freeze protection is needed because the thermal insulation installed around pipes is not enough to prevent the process fluids from freezing. This module presents heat-tracing and freeze-protection systems along with various applications and installation requirements.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe heat-tracing applications, components, controls, and selection/installation considerations related to piping.

a. Describe common pipeline heat-tracing applications, cables, and power distribution considerations.
b. Describe methods of controlling and monitoring heat-tracing systems.
c. Explain how typical heat-tracing systems operate.
d. Explain how to select the equipment and components for a typical heat-tracing system.
e. Explain how heat-tracing system components are installed and the related NEC® requirements.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe roof, gutter, and downspout de-icing systems and the relevant selection/installation considerations.

a. Describe roof, gutter, and downspout de-icing systems.
b. Explain how roof, gutter, and downspout de-icing system components are selected and installed.
Learning Objective 3

Successful completion of this module prepares trainees to:
Describe snow-melting and anti-icing systems and the relevant selection/installation considerations.

a. Describe snow-melting and anti-icing system components.
b. Explain how snow-melting and anti-icing system components are selected and installed.

Learning Objective 4

Successful completion of this module prepares trainees to:
Describe other electric heat-tracing and warming systems and the relevant selection/installation considerations.

a. Describe domestic hot-water temperature maintenance systems and the relevant selection/installation considerations.
b. Describe electric floor heating systems and the relevant selection/installation considerations.

Performance Task

1. Prepare and connect heat-tracing cable in a power connection box or splice box.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26409-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®
Performance Task 1

- Self-regulating cables, power-limiting cables, and mineral-insulated cables
- Manufacturer's application/design guides
- Components used in pipeline heat-tracing systems
- Performance Profile Sheets
Overview
For motors to operate at optimum levels over a long span of time, proper care and maintenance is required. This module covers motor care procedures, including cleaning, testing, and preventive maintenance. Basic troubleshooting procedures are also presented.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify the factors that affect motor reliability and lifespan.

a. Identify the common causes of motor failure.
b. Identify motor characteristics.

Learning Objective 2
Successful completion of this module prepares trainees to:
Describe maintenance and troubleshooting requirements for electric motors.

a. Identify the tools and basic care and maintenance requirements for electric motors.
b. Explain the requirements for maintaining motor bearings.
c. Explain how to perform motor insulation testing.
d. Explain how to troubleshoot an electric motor.

Learning Objective 3
Successful completion of this module prepares trainees to:
Describe the guidelines for installing and commissioning electric motors.

a. Explain alignment and adjustment requirements.
b. Describe startup procedures.

**Performance Tasks**

This is a knowledge-based module. There are no Performance Tasks.

Recommended Teaching Time: 10 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26410-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the *National Electrical Code®*
Medium-Voltage Terminations/Splices

Electrical Level Four

Overview
Both taping systems and manufactured slip-on kits are used to make splices and terminations. This module identifies types of medium-voltage cable and describes how to make various splices and terminations. It also covers hi-pot testing.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe how to splice medium-voltage cable.

a. Identify medium-voltage power cable configurations and components.
b. Describe a typical procedure for making a straight splice.
c. Describe a typical procedure for making an inline tape splice.
d. Identify various manufactured termination and splice kits.

Learning Objective 2
Successful completion of this module prepares trainees to:
Describe termination classes and important considerations when creating terminations.

a. Identify termination classes.
b. Identify stress control methods.

Learning Objective 3
Successful completion of this module prepares trainees to:
Define high-potential testing and explain how such testing is conducted.

a. Identify types of hi-pot tests.
b. Explain how to make various test connections.
c. Describe typical procedures for conducting high-potential tests.

**Performance Task**

1. Prepare a cable and complete a splice or stress cone.

Recommended Teaching Time: 10 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26411-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the *National Electrical Code®*

**Performance Task 1**

- Common types of medium-voltage cable Inline tape splicing kits
- Cable stripping tool
- Appropriate solvent for cleaning cable
- Clean rags
- Soldering gun and solder
- Nonconductive abrasive cloth
- Various types of tape applied for primary insulation
- Manufactured termination and splice kits
- Quick inline splicing kit
- Photos of terminations/cables that have been damaged by flashover and/or tracking
- Insulators used with medium-voltage terminations
- Performance Profile Sheets
Overview
As an electrician, it is your responsibility to familiarize yourself with all of the NEC® requirements for any electrical installation you undertake, as well as any local or regional codes that may also apply. This module describes the NEC® requirements for selecting and installing equipment, enclosures, and devices for special locations that require unique attention. These locations include places of public assembly, theaters, carnivals, agricultural and livestock facilities, marinas, swimming pools, and temporary facilities.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify and select equipment, components, and wiring methods for various special locations and applications.

a. Identify and select equipment, components, and wiring methods for places of assembly.
b. Identify and select equipment, components, and wiring methods for theaters and similar locations.
c. Identify and select equipment, components, and wiring methods for carnivals, circuses, and fairs.
d. Identify and select equipment, components, and wiring methods for agricultural buildings.
e. Identify and select equipment, components, and wiring methods for temporary installations.
f. Identify and select equipment, components, and wiring methods for wired office partitions.

Learning Objective 2
Successful completion of this module prepares trainees to:
Identify and select equipment, components, and wiring methods for marinas, boatyards, and bodies of water.

a. Identify and select equipment, components, and wiring methods for marinas and boatyards.
b. Identify and select equipment, components, and wiring methods for natural and man-made bodies of water.
Learning Objective 3

Successful completion of this module prepares trainees to:
Identify and select equipment, components, and wiring methods for pools, spas, tubs, and fountains.

a. Identify general wiring requirements for pools, spas, tubs, and fountains.
b. Identify and select equipment, components, and wiring methods for permanently installed pools.
c. Identify and select equipment, components, and wiring methods for storable pools.
d. Identify and select equipment, components, and wiring methods for spas, hot tubs, and therapeutic tubs.
e. Identify and select equipment, components, and wiring methods for fountains.

Performance Tasks

This is a knowledge-based module. There are no Performance Tasks.
Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 26412-20
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- A copy of the National Electrical Code®
Module 46101 teaches skills needed to become an effective crew leader, as well as knowledge and abilities required to transition from craftworker to crew leader. The module also covers workforce diversity and organization, basic leadership skills, safety, and project control.

### Objectives

**Learning Objective 1**
- Describe current issues and organizational structures in industry today.
  - a. Describe the leadership issues facing the construction industry.
  - b. Explain how gender and cultural issues affect the construction industry.
  - c. Explain the organization of construction businesses and the need for policies and procedures.

**Learning Objective 2**
- Explain how to incorporate leadership skills into work habits, including communications, motivation, team-building, problem-solving, and decision-making skills.
  - a. Describe the role of a leader on a construction crew.
  - b. Explain the importance of written and oral communication skills.
  - c. Describe methods for motivating team members.
  - d. Explain the importance of teamwork to a construction project.
  - e. Identify effective problem-solving and decision-making methods.

**Learning Objective 3**
- Identify a crew leader’s typical safety responsibilities with respect to common safety issues, including awareness of safety regulations and the cost of accidents.
  - a. Explain how a strong safety program can enhance a company’s success.
  - b. Explain the purpose of OSHA and describe the role of OSHA in administering worker safety.
  - c. Describe the role of employers in establishing and administering safety programs.
  - d. Explain how crew leaders are involved in administering safety policies and procedures.

**Learning Objective 4**
- Demonstrate a basic understanding of the planning process, scheduling, and cost and resource control.
  - a. Describe how construction contracts are structured.
  - b. Describe the project planning and scheduling processes.
  - c. Explain how to implement cost controls on a construction project.
  - d. Explain the crew leader’s role in controlling project resources and productivity.

### Performance Tasks

**Performance Task 1 (Learning Objective 4)**
- Develop and present a look-ahead schedule.

**Performance Task 2 (Learning Objective 4)**
- Develop an estimate for a given work activity.

### Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids, including the PowerPoint® presentation, and these lesson plans, and to gather the required equipment and materials. Consider the time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). For information about accessing the Module Examinations, visit [www.nccer.org/testing](http://www.nccer.org/testing). The passing score for submission into NCCER's Registry is 70% or above for the module exam; performance testing is graded pass or fail.
Recommended Teaching Time: 22.5 hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Sheets for this module from NCCER’s Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review and the written module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the written exam. Record the testing results for each trainee on the Registration of Training Modules form and submit the form to the Training Program Sponsor.

Classroom Equipment and Materials

- Whiteboard
- Markers
- Pencils and paper
- Fundamentals of Crew Leadership PowerPoint® Presentation
- LCD projector and screen
- Computer with Internet access during class (optional)
- Blank copies of a look-ahead schedule
- Blank copies of takeoff and summary worksheets
- Module Review answer key
- Module examinations
- Performance Profile Sheets
Additional Resources
This module presents thorough resources for task training. The following reference material is recommended for further study.


The following websites offer resources for products and training:

- Aging Workforce News, [www.agingworkforcenews.com](http://www.agingworkforcenews.com)
- American Society for Training and Development (ASTD), [www.astd.org](http://www.astd.org)
- Architecture, Engineering, and Construction Industry (AEC), [www.aecinfo.com](http://www.aecinfo.com)
- Equal Employment Opportunity Commission (EEOC), [www.eeoc.gov](http://www.eeoc.gov)
- National Association of Women in Construction (NAWIC), [www.nawic.org](http://www.nawic.org)
- National Census of Fatal Occupational Injuries (NCF0I), [www.bls.gov](http://www.bls.gov)
- National Institute of Occupational Safety and Health (NIOSH), [www.cdc.gov/niosh](http://www.cdc.gov/niosh)
- National Safety Council, [www.nsc.org](http://www.nsc.org)
- Occupational Safety and Health Administration (OSHA), [www.osha.gov](http://www.osha.gov)
- Society for Human Resources Management (SHRM), [www.shrm.org](http://www.shrm.org)
- United States Census Bureau, [www.census.gov](http://www.census.gov)
- United States Department of Labor, [www.dol.gov](http://www.dol.gov)
- US Green Building Council (USGBC), [www.usgbc.org/leed](http://www.usgbc.org/leed)
- Wi-Fi® is a registered trademark of the Wi-Fi Alliance, [www.wi-fi.org](http://www.wi-fi.org)

There are a number of online resources available for trainees who would like more information on effective leadership skills and professionalism in the construction industry. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide examples of both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.