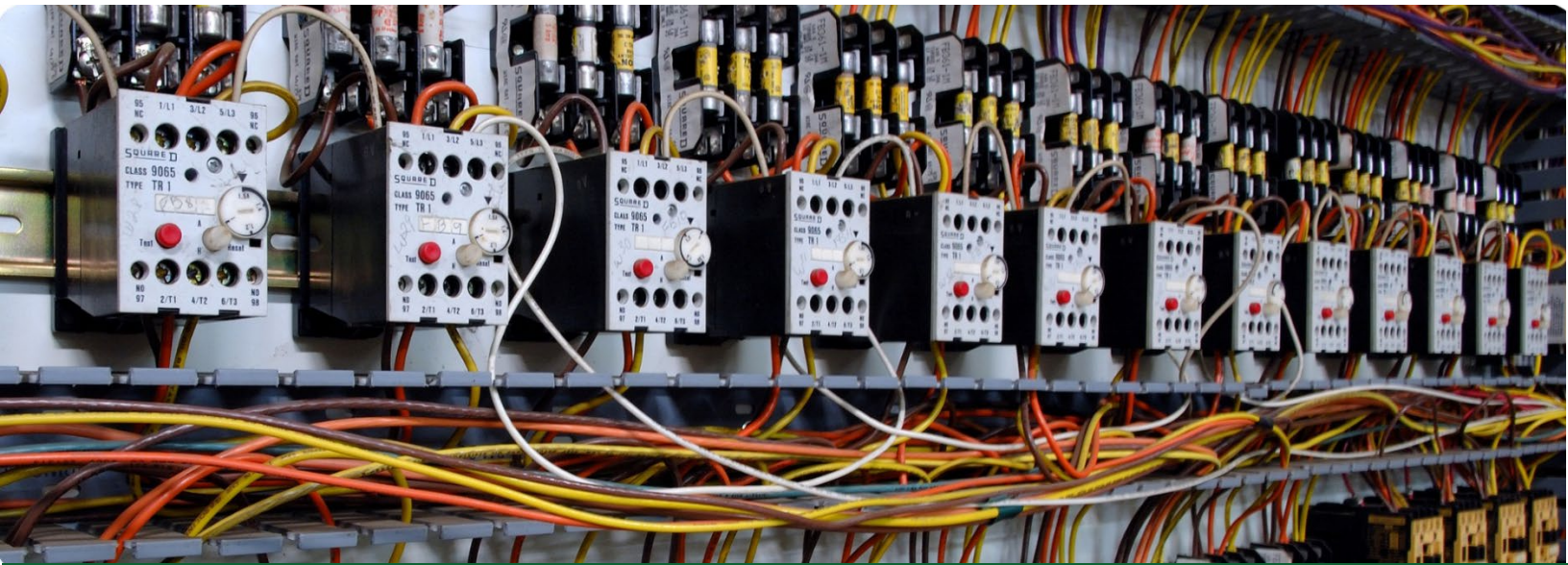


INSTRUCTOR GUIDE

Electrical Foundations

May 2026



Course Outline

- Module 1: Introduction to Electricity
- Module 2: Basic Electrical Principles
- Module 3: AC and DC Electricity
- Module 4: Circuit Components & Architecture
- Module 5: Magnetism and Electromagnetism
- Module 6: Electrical Tools
- Module 7: Safety and PPE



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Federal Transit Administration

Course: Electrical Foundations

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Course Description

This section outlines the course duration, provides an overview of the classroom instruction format, and details the module structure to ensure a clear understanding of the training layout.

Foundational Skills Course: Electrical Foundations

Electrical Foundations is a series of modular courses designed to provide participants with a basic overview and practical experience with the fundamentals of electricity. The overall course is approximately **34.5 hours** in length and includes hands-on, participant-led activities to support engagement with the material.

The Electrical Foundations modules cover topics such as basic electrical characteristics and principles, basic electrical laws, the differences between AC and DC electricity, circuitry and electrical architecture, and the fundamentals of magnetism and electromagnetism.

Learners will also gain knowledge of electrical tools and their use, as well as the safety practices and personal protective equipment (PPE) necessary when working with electricity.

Module 1 – Introduction to Electricity

This module introduces the fundamentals of electricity and its role in everyday work and transit systems. Participants will explore how electricity was discovered, examine its key characteristics, understand how electricity operates at the atomic level, as well as how it is generated and used.

Objectives:

- Explain what electricity is and how it is used in everyday work.
- Explain the difference between static electricity and current electricity.
- Explain how electricity is made and why it is important in transit systems.
- Identify key people who helped develop electricity and how their work affects modern systems.
- Describe the basic parts of an atom and explain how electrons create electrical flow.
- Recognize the difference between Direct Current (DC) and Alternating Current (AC).
- Identify conductors and insulators and explain why both are needed for safety.

Module 2 – Basic Electrical Law

This module introduces the principles of voltage, current, and resistance, and how they interact in basic electrical circuits. By the end, participants will be able to evaluate how changes in voltage or resistance impact current, and apply Ohm's Law to solve basic circuit calculations.

Objectives:

- Define and explain voltage, current, and resistance.
 - Describe how voltage, current, and resistance are related in a simple circuit.
 - Predict how changes in voltage or resistance affect current before measuring.
 - Use Ohm's Law to calculate a missing value in a basic circuit.
-

Module 3 – AC and DC Electricity

This module introduces the key differences between AC and DC electricity and their common applications in transit systems. Participants will recognize the advantages and limitations of each, examine the role of frequency and phase in equipment operation, and gain a foundational understanding of power conversion between AC and DC.

Objectives:

- Explain the difference between AC and DC electricity.
 - Identify common uses of AC and DC in transit systems.
 - Explain the basic advantages and disadvantages of AC and DC.
 - Describe frequency and phase and why they matter for equipment.
 - Explain how power is converted between AC and DC.
-

Module 4 – Circuit Components & Architecture

This module introduces the design and function of basic electrical circuits, including key differences between circuit types. Participants will strengthen their ability to analyze electrical behavior using Kirchhoff's Current and Voltage Laws through practical application. The module also covers key circuit components and their functions, while building skills in interpreting standard electrical diagrams and symbols used in the field. By the end of the module, participants will be able to recognize, draw, and analyze fundamental circuit components and circuit architecture.

Objectives:

- Define basic types of circuits and differences between them.
- Draw and label a simple electrical circuit.
- Define the major components of an electrical circuit and describe their functionality.
- Apply Kirchhoff's Current and Voltage Laws to analyze circuits and solve for unknown electrical values.
- Identify the major symbols for circuit components.
- Recognize basic electrical diagrams.

Module 5 – Magnetism and Electromagnetism

This module introduces the foundational principles of magnetism and electromagnetism, including magnetic fields, strengths, sources, and magnetic materials. Participants will explore the relationship between electricity and magnetism, examine how electromagnets function and what influences their strength, and see how these principles are applied in transit systems. By the end of the module, participants will understand how changing magnetic fields generate electricity, as described by Faraday's Law of Induction.

Objectives:

- Explain basic magnetism, including magnetic fields, poles, and magnetic materials.
- Explain how electromagnetism works and describe how electricity and magnetism are related.
- Describe how an electromagnet works and what affects its strength.
- Explain how electromagnetism is used in transit systems such as relays, motors, and generators.
- Explain Faraday's Law of induction and how changing magnetic fields are used to generate electricity in real-world systems.

Module 6 – Electrical Tools

This module introduces common electrical and testing tools, including their functions, designs, and limitations. Participants will learn how to select the appropriate tool for specific tasks and use them correctly. They will also gain hands-on experience performing basic electrical tests while ensuring safety and reliability.

Objectives:

- Identify common electrical and testing tools.
- Describe the purpose and limitations of common electrical testing tools.
- Make a proper wire connection using the correct tools.
- Inspect wire connections to ensure they are safe.
- Select the right tool to test an electrical circuit.
- Perform basic electrical tests safely.

Module 7 – Safety and PPE

This module focuses on identifying electrical hazards and working safely. Participants will assess risks, choose appropriate PPE for various voltage and arc flash conditions, and follow procedures to prevent electrical incidents.

Objectives:

- Identify and assess electrical hazards in the workplace.
 - Select and utilize appropriate PPE for high voltage, low voltage, and arc flash environments.
 - Apply workplace safety policies and procedures to mitigate electrical hazards.
-

Assessments

This course provides a **Pre-Assessment** to be given *before* instruction and a **Post-Test** to be given *after* instruction. These assessments align with the learning objectives and can be used to measure learning gains and instructional effectiveness. A **Question Bank** of ready-to-use questions that instructors can select from to support teaching, review, and assessment has also been provided.

Course Preparation

This section outlines the steps instructors should take to prepare for the course, such as gathering required materials and checking that all audio-visual equipment is set up and functioning.

Checklist of Instruction

✓	Confirm the training dates, location, and number of participants.
	Gain access to the courseware through the Transit Workforce Center website. Make sure you can access and download the materials in advance.
	Follow your agency's requirements for class sign-in. If required, print sign-in sheet for each day of class.
	For each module, read and study the Instructor Facilitation Toolkit, PowerPoint presentations, Participant Resource Guide, and any State or local documentation pertaining to your agency's location.
	Test all equipment placed in the training room prior to the start time on the first day of the course.

Supplies, Audio-Visual Equipment, Internet Access

The following is important for the adequate delivery of this course:

✓	LCD projector compatible with a notebook computer and cables for proper connection.
	Computer with software to run Microsoft PowerPoint.

	Projection screen (at least 6' x 6').
	Internet access
	Room audio
	<i>Optional</i> – Wireless remote to advance PowerPoint
	Office supplies such as pencils, note pads, markers, highlighters, flip chart with markers, dry-erase board, etc.

Course Materials (Instructor and Participant)

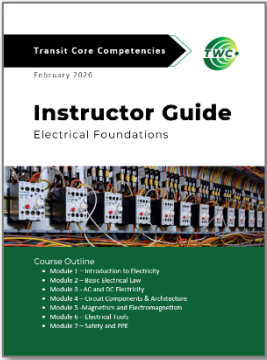

All materials are available on the Transit Workforce Center website. Check back regularly for updated materials and additional resources.

Best Practices for Delivering Training

This section provides strategies for effective training delivery to maintain a clear and organized flow of instruction while fostering an inclusive and supportive learning environment.

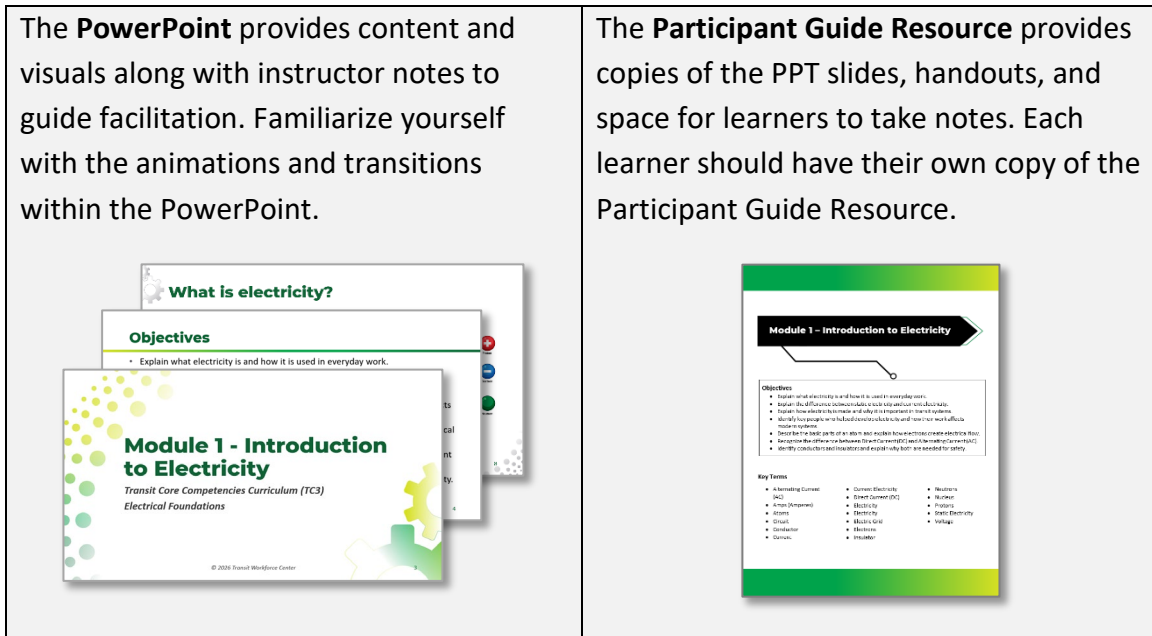
Before Instruction

1. Review the **Instructor Guide** (this document) and the **Instructor Facilitation Tool Kit** for each module.

<p>The Instructor Guide provides an overview of the <u>full</u> course along with course preparation and best practices for facilitation.</p> 	<p>An Instructor Facilitation Tool Kit is included with each module and provides <u>module specific</u> information such as materials, lesson progression, and answer keys.</p> 
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2. Review the **PowerPoint** and tailor the content to your specific agency and training needs.

3. Make sure you have a printed copy of the **Participant Guide Resource** for each learner. *All activity handouts are embedded in the Participant Resource Guide.*



During Instruction

1. Arrive at least an hour early on class day. Give yourself plenty of time to organize the training *before* the participants arrive.
2. Circulate an attendance sign-in sheet each day and make sure that all participants sign into the class to record their attendance.
3. Review the **learning objectives** at the beginning and end of each module to help learners understand what they are expected to learn and why it matters. It also sets clear expectations and helps learners focus their attention on the most important skills or knowledge in the lesson. The learning objectives are embedded in the PowerPoints.
4. Be available for questions during breaks, lab or hands-on learning activities, and after class.
5. Be mindful of time as you facilitate instruction. Use the “Pacing Guide” slide at the beginning of each PowerPoint to understand overall time requirements. Instructor notes included under each slide also suggest teaching times to help you stay on track. Remember that these are suggested times. It’s important to be responsive to your

learners and gauge when they are ready to move on or if they need more time.

6. Circulate among groups during class and lab activities to answer questions, offer guidance, and ensure participants stay on track. Provide constructive feedback during activities and participant presentations.
7. Check for understanding throughout the lesson by asking targeted recall and clarification questions aligned with the learning objectives. Use participant responses to gauge comprehension and adjust instruction or pacing as needed.

After Instruction

8. Reflect after each lesson and take a few moments to note what went well and what could be improved for next time. Use these reflections to refine your facilitation approach and make adjustments for future sessions.

Teaching Methods

A variety of teaching methods will be used throughout this course to support different learning styles and instructional needs. Each method is intentionally selected to help learners understand key concepts, practice skills, and stay engaged. Instructors are encouraged to use these methods flexibly and adjust their approach based on learner needs and course pacing.

Teaching Method	Definition	Best Practices
Lecture	A trainer-led method used to present information, concepts, or procedures efficiently to a group of learners.	Keep lectures short and focused to maintain attention. Use visuals like those provided in the PPT or examples to reinforce key points. Pause periodically to check understanding or invite questions.
Hands-On Learning	An active learning method where learners practice skills or tasks through real-world or simulated activities.	Clearly explain the task before learners begin. Provide demonstrations or models when possible. Allow time for practice and feedback.
Discussion-Based Learning	A learner-centered approach that encourages participants to share ideas,	Ask open-ended questions which cannot be answered with a simple yes or no to encourage learners to explain their thinking. Encourage

	ask questions, and think critically through group dialogue.	participation from all group members. Guide the discussion to stay on topics and aligned with learning objectives.
One-on-One Instruction	An individualized teaching approach that provides personalized guidance and support based on a learner's specific needs.	Identify the learner's goals or challenges early. Adjust pacing and instruction based on learner feedback. Use this time to reinforce confidence and clarify misunderstandings.
Self-Paced Learning <i>*May include eLearning</i>	A method that allows learners to progress through content independently at their own speed, often using written or digital materials.	Provide clear instructions and expectations. Break content into manageable sections. Include opportunities for self-checks or reflection to reinforce learning.