C-201 Electrical Systems 1
Course Credential

About this course

This SACA certified Electrical Systems 1 course prepares students for a career in an industrial automated 4.0 industry environment. Participants are taught to connect, adjust, operate, troubleshoot, and analyze electrical circuits using basic electrical components: resistors, capacitors, inductors, DC motors, solenoids, manual switches, relays, fuses, circuit breakers, transformers, and indicators.

Modules to be covered

1. **Standard 201.1 Apply electrical system safety**
   - Performance Indicators
     - Perform a lockout/tagout
     - Identify electrical hazards
   - Knowledge Indicators
     - Describe how to identify electrical hazards
     - Describe PPE/ safe dress for operating electrical systems
     - Describe how to determine if equipment is properly grounded
     - Describe the basic rules of electrical safety
     - Describe the basic elements of NFPA 70E Arc Flash and live cabinet safety rules

2. **Standard 201.2 Connect and operate basic electrical circuits**
   - Performance Indicators
     - Use an AC tester to check a wall outlet power
     - Connect and operate a power supply

- Connect and operate circuits that use knife, push button, and selector switches
- Connect and operate circuits that use resistors, buzzers, and lamps.
- Connect and operate basic series and parallel circuits

- Knowledge Indicators
  - Define electricity and give an application
  - Describe the two types of electrical current: AC and DC
  - Describe the operation of a circuit tester
  - Describe the basic operation of common input and output devices
  - Define series and parallel circuits
  - Describe the operation of two types of power supplies: AC and DC
  - Describe the operation of N.O. and N.C. switch contacts

3. **Standard 201.3 Interpret electrical schematics and diagrams**
   - Performance Indicators
     - Identify the schematic symbols for resistors, transistors, transformers, lamps, motors, solenoids, meters, fuses, and switches
     - Identify series and parallel circuits in a schematic
     - Interpret a basic electrical schematic
   - Knowledge Indicators
     - Describe resistor color codes
     - Describe the function of an electrical schematic
     - Explain the difference between a schematic and a wiring diagram

4. **Standard 201.4 Use a digital multi-meter (DMM) to make electrical measurements**
   - Performance Indicators
     - Use a DMM to measure voltage drops in series and parallel circuits
     - Use a DMM to measure current in series and parallel circuits
     - Use a DMM to measure the resistance of a component

- Measure the resistance in series and parallel circuits
- Use a DMM to test wire continuity

- Knowledge Indicators
  - Define voltage and give its units of measurement
  - Describe the basic operation of a digital multimeter
  - Describe the basic operation of a clamp-on ammeter
  - Describe the voltage characteristics of series and parallel circuits
  - Define current and give its units of measurement
  - Describe current characteristics of series and parallel circuits
  - Define resistance and give its units of measurement
  - Describe the resistance characteristics of series and parallel circuits
  - Describe two methods of measuring continuity

5. **Standard 201.5 Analyze basic load circuits**
   - Performance Indicators
     - Calculate voltage, current, and resistance in a series circuit
     - Calculate the total power used in a series circuit
     - Calculate the main line current in a parallel circuit
     - Calculate the total parallel resistance
     - Calculate the total power used in a parallel circuit
   - Knowledge Indicators
     - State Ohm's Law and explain its importance
     - State Kirchhoff's Voltage and Current Laws and explain their importance
     - Define power and give its units of measurement

6. **Standard 201.6 Test and replace/reset fuses and circuit breakers**
   - Performance Indicators
     - Test and replace a fuse
     - Test and reset a circuit breaker
   - Knowledge Indicators

- Describe the function and application of two types of circuit protection
- Describe the operation of a fuse
- Describe the operation of two types of circuit breakers
- Describe how fuses and circuit breakers are rated

7. **Standard 201.7 Connect and operate basic reactive components**
   - Performance Indicators
     - Connect and operate a circuit with an inductor
     - Connect and operate a circuit with a capacitor
     - Discharge a capacitor
     - Test a capacitor with a DMM
   - Knowledge Indicators
     - Define electromagnetism and give an application
     - Describe the operation of an inductor and give its schematic symbol
     - Describe the effect of an inductor in an AC and DC circuit and give an application
     - Describe the operation of a capacitor and its schematic symbol
     - Describe the effect of a capacitor in an AC and DC circuit and give an application
     - Describe the functions of 3 types of capacitors

8. **Standard 201.8 Analyze basic combination circuits**
   - Performance Indicators
     - Trace the current path in a combination circuit
     - Connect and operate a basic lighting circuit
     - Connect and operate a voltage divider network
     - Connect and operate a rheostat as a load dimmer
     - Design a voltage divider network given parameters
     - Solve a combination circuit
   - Knowledge Indicators
     - Define a series-parallel circuit

- Describe how to identify series and parallel circuit sections
- Describe the operation of 3 types of voltage dividers

9. **Standard 201.9 Troubleshoot basic series and parallel electrical circuits**
    - Performance Indicators
        - Locate a short circuit in a basic series or parallel circuit
        - Locate an open circuit in a basic series or parallel circuit
    - Knowledge Indicators
        - Explain the effects of short and open circuits
        - Describe how to troubleshoot short and open circuits
        - Describe the basic steps for troubleshooting an open circuit

10. **Standard 201.10 Connect and operate single-phase transformer circuits**
    - Performance Indicators
        - Connect and operate a transformer
        - Test a transformer
        - Size a transformer
        - Design a control transformer circuit to provide a given output voltage
    - Knowledge Indicators
        - Describe the operation of a transformer
        - Describe the function of a control transformer
        - Describe the function/ application of a secondary tap on a transformer

11. **Standard 201.11 Analyze Inductive Circuits**
    - Performance Indicators
        - Calculate the total load on an AC inductive circuit
        - Calculate the total inductance in series and parallel circuits
        - Calculate the current load on a transformer
        - Calculate the secondary coil voltage of a transformer
    - Knowledge Indicators

- Describe how to calculate total series inductance and inductive reactance
- Describe how to calculate total parallel inductance and inductive reactance

12. **Standard 201.12 Analyze Capacitive Circuits**
    - Performance Indicators
        - Calculate the total load on an AC capacitive circuit
        - Calculate the time to charge and discharge a capacitor
        - Calculate the total capacitance in series and parallel circuits
    - Knowledge Indicators
        - Describe how to calculate total series capacitance and capacitive reactance
        - Describe how to calculate total parallel capacitance and capacitive reactance