# ATPL-2812: SPECIAL TOPICS: ELECTRICITY FOR MECHANICAL

## Cuyahoga Community College

### Viewing: ATPL-2812 : Special Topics: Electricity for Mechanical

**Academic Term:**
Fall 2026

**Subject Code**
ATPL - Applied Ind Tech - Plumbers

**Course Number:**
2812

**Title:**
Special Topics: Electricity for Mechanical

**Catalog Description:**
Basic course on fundmentals of electricity for the plumbing trade. The course covers safety, transformers, direct and alternating current, and basic controls. Course also includes discussion of motors and troubleshooting exercises.

**Credit Hour(s):**
2

**Lecture Hour(s):**
2

### Requisites

**Prerequisite and Corequisite**
Departmental approval: admission to Plumbers' apprenticeship program.

### Outcomes

**Course Outcome(s):**
Explain the safety precautions related to electrical safety and discuss how they relate to mechanical service.

**Objective(s):**
1. Explain the effects of electric current on the human body.
2. Identify injuries resulting from electrical shock.
3. Define grounding and the importance of grounding tools and electrical appliances.
4. Follow the principles of safety when installing and servicing mechanical equipment.

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**Course Outcome(s):**
Explain the fundamentals of electrical circuits including basic principles, types and different currents.

**Objective(s):**
1. Explain atomic theory and its relationship to electrical flow.
2. Discuss electrical potential, current flow, and resistance.
3. Explain Ohm's Law.
4. Discuss the procedures for conducting and wiring methods.

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**Course Outcome(s):**
Explain the different types of transformers, their function, and applications, and explain the purpose of different transformer coils that are used.

**Objective(s):**

1. List the different kinds of transformers that are used in the mechanical industry and explain the various applications.
2. Identify the components of any transformer and explain how they interact.
3. Demonstrate how transformers are used to either step up or step down voltage.
4. Explain the principles of mutual induction as applied to transformers.
5. Describe how the core of a transformer can result in high efficiency performance and minimal power loss in mechanical equipment.

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**Course Outcome(s):**

Describe the different currents as either alternating or direct and discuss why.

**Objective(s):**

1. Identify the different types of current phases and explain the respective applications.
2. Determine the voltages used in the operation of appliances and equipment and identify the efficiency of each.
3. Discuss and apply Sine Wave Theory.
4. Explain the physics of magnetic fields and their relative importance to the motors and electrical equipment.

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**Course Outcome(s):**

Describe different motors, their uses, operating principles, and various controls.

**Objective(s):**

1. List the motors that are used in the mechanical industry and explain how each is used.
2. Describe the components of a motor and explain how magnetism and phasing result.
3. Review the different motor controls, discuss respective functions, and demonstrate each operation.
4. Identify and explain the operation of motor starting relays and other starting components that are used in single-phase operation.
5. Troubleshoot malfunctions in motors, diagnose problems, and identify solutions.
6. Install motor starting relays, including start and run capacitors.

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**Methods of Evaluation:**

1. Attendance
2. Participation
3. Assignments
4. Exams

**Course Content Outline:**

1. Safety
1. Occupational Safety and Health Administration (OSHA)
1. Personal protective equipment
2. Substandard 70-E
3. National Fire Protection Agency
1. Injuries
1. Burns
2. Electrical shock
1. Grounding
1. Definition
2. Purpose
3. Tools
4. Equipment
1. Service
1. Electrical circuits
1. Atomic theory

1. Atom structure
2. Electron
1. Potential, current and resistance
1. Voltage
2. Amperage
3. Loads
1. Ohm’s Law
1. Mathematical calculations
2. Circuit solving
3. Probability versus actual
1. Conduction and wiring methods
1. Transformers
1. Types
1. Oil
2. Dry
1. Function
1. Voltage
1. Step down
2. Step up
1. Isolation
1. Operation and use
1. Residential
1. Circuit controls
2. Safety circuits
1. Commercial
1. Power supply
2. Safety and controls
1. Industrial
1. Operation
1. Windings
2. Wire size
1. Mutual induction
2. High efficiency
1. Currents
1. Alternating
1. Sine wave theory
2. Field application
1. Direct
2. Phases
1. Single
1. Residential
2. Commercial
1. Three phase
1. Sine wave theory
1. Peak voltage
2. Applicable voltage
3. Change per second
1. Magnetic fields
1. Lines of flux
2. Inductance
3. Inductive reactance
4. Lenz Law
1. Motors
1. Types

1. Single phase 110 volts
2. Single phase 220 volts
3. Three phase 220 volts

1. Components

1. Stator
2. Commutator
3. Brushes
4. Windings

1. Motor controls

1. Switches
2. Starters
3. Relays

1. Trouble shooting

1. Open circuit
2. Grounded circuit
3. High voltage draw

**Religious Accommodation**

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

**Religious Accommodation:**

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: https://portal2.tri-c.edu/ReligiousAccommodation/ Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

**Other Required Instructional Policies:**

https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf

**Weekly Schedule**

| | Topics |
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| Week 1 | Electrical Safety, OSHA, PPE, and NFPA Standards |
| Week 2 | Electrical Injuries, Shock, Burns, and Grounding Principles |
| Week 3 | Atomic Theory and Fundamentals of Electricity |
| Week 4 | Voltage, Current, Resistance, and Loads |
| Week 5 | Ohm’s Law and Basic Electrical Calculations |
| Week 6 | Electrical Circuits: Series, Parallel, and Compound |
| Week 7 | Conduction, Wiring Methods, and Wire Sizing |
| Week 8 | Transformers: Types, Functions, and Applications |
| Week 9 | Transformer Operation, Mutual Induction, and Efficiency |
| Week 10 | Alternating Current (AC) vs. Direct Current (DC) |
| Week 11 | Sine Wave Theory, Voltage Characteristics, and Phases |
| Week 12 | Magnetic Fields, Inductance, and Lenz’s Law |
| Week 13 | Motors: Types, Components, and Operating Principles |
| Week 14 | Motor Controls: Starters, Relays, and Safety Circuits |
| Week 15 | Single-Phase and Three-Phase Motor Applications |
| Week 16 | Motor Troubleshooting and Final Review |

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

**Required/Recommended Readings**
Instructor-provided materials

## Resources for the Instructor

United Association Training Department. *Basic Electricity*. Annapolis, MD: United Association, www.ua.org/training

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**Additional Resources for the Instructor**
www.ua.org (https://catalog.tri-c.eduwww.ua.org)
www.ua.org/training (https://catalog.tri-c.eduwww.ua.org/training/)
www.osha.gov (https://catalog.tri-c.eduwww.osha.gov) (CFR OSHA Regulations)

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