



Western Technical College

10601116 HVACR Electric Motors & Controls

Course Outcome Summary

Course Information

Description	This course covers basic electrical theory, parallel and series circuits, voltage, current, and resistance. Transformers, contactors, relays and solid state devices are studied. The types and characteristics of electric motors and controls commonly found in air conditioning and refrigeration applications are studied. This course covers the basic fundamentals of electricity including magnetism, resistance, inductance and capacitance. Learners will read electrical diagrams, interpret symbols , use test instruments and perform troubleshooting tasks. HVACR is a common reference to Heating, Ventilation, Air Conditioning and Refrigeration.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	4
Total Hours	108

Textbooks

Refrigeration and Air Conditioning Technology. 9th Edition. Copyright 2021. Whitman, Bill, Bill Johnson, John Timczyk, and Eugene Silberstein. Publisher: Cengage Learning. **ISBN-13**:978-0-357-12227-3. Required.

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor**: Campus Shop. Required.

Success Abilities

1. Cultivate Passion: Enhance Personal Connections

2. Cultivate Passion: Increase Self-Awareness

Experiential Learning

1. Community Based Learning Project: a key learning outcome of this course is to connect academic learning and civic development while simultaneously addressing a community partner's needs, interests, or problems.

Program Outcomes

1. Install HVACR systems
2. Service HVACR systems
3. Troubleshoot HVACR systems
4. Repair HVACR equipment
5. Analyze HVACR systems

Course Competencies

1. Practice electrical safety.

Criteria

You will know you are successful when

- 1.1. you use basic electrical safety procedures.

Learning Objectives

- 1.a. Use the NEC for reference to codes and regulations
- 1.b. Practice and discuss basic electrical safety

2. Apply basic electricity fundamentals.

Criteria

You will know you are successful when

- 2.1. you describe the relationships that exist in electrical circuits
- 2.2. you calculate the relationships that exist in electrical circuits.

Learning Objectives

- 2.a. Explain basic concepts of electricity
- 2.b. Explain electrical potential, current flow, resistance and power and how it is measured
- 2.c. Explain Ohm's Law
- 2.d. Calculate the mathematical relationships that exist in electrical circuits

3. Analyze fundamental circuits.

Criteria

You will know you are successful when

- 3.1. you explain the types and components of basic electrical circuits.
- 3.2. you compare the electrical characteristics of series and parallel circuits.
- 3.3. you calculate the electrical characteristics of series circuits.
- 3.4. you calculate the electrical characteristics of parallel circuits.

Learning Objectives

- 3.a. Explain the concepts of a basic electric circuit
- 3.b. Explain the characteristics of series, parallel and series/parallel circuits
- 3.c. Describe how series circuits are used as control circuits
- 3.d. Describe why parallel circuits are used for power circuits
- 3.e. Calculate the electrical characteristics of series and parallel circuits

4. Obtain data using electrical test meters.

Criteria

You will know you are successful when

- 4.1. you apply safety practices.
- 4.2. you obtain accurate data using electrical test instruments.

Learning Objectives

- 4.a. Describe the use of electric meters
- 4.b. Practice electrical safety procedures
- 4.c. Explain the basic operation of test meters
- 4.d. Define terms used when discussing electrical measurements
- 4.e. Measure electrical characteristics of components and circuits

5. Use components and symbols used in HVAC/R systems.

Criteria

You will know you are successful when

- 5.1. you identify components and symbols used in HVAC systems.

Learning Objectives

- 5.a. Explain what electrical loads and switches are
- 5.b. List examples of electrical loads and switches
- 5.c. Identify the symbols of common loads and switches
- 5.d. Identify common electrical devices used in HVAC systems

6. Interpret HVAC/R electrical diagrams.

Criteria

You will know you are successful when

- 6.1. you analyze electrical diagrams.

Learning Objectives

- 6.a. Identify the types of electrical diagrams used in HVAC systems
- 6.b. Complete a pictorial diagram
- 6.c. Complete a schematic diagram
- 6.d. Write a sequence of operation
- 6.e. Analyze electrical diagrams

7. Explain alternating current, power distribution and voltage systems.

Criteria

You will know you are successful when

- 7.1. you explain and identify common voltage systems.

Learning Objectives

- 7.a. Explain the basic difference between direct and alternating current
- 7.b. Briefly explain how alternating current is produced and distributed
- 7.c. Explain the difference between single-phase and three-phase power systems
- 7.d. Explain and identify common voltage systems
- 7.e. Explain the factors that are considered when sizing electrical circuit conductors
- 7.f. Size electrical conductors

8. Diagnose basic electric motors.

Criteria

You will know you are successful when

- 8.1. you troubleshoot common HVAC motors.

Learning Objectives

- 8.a. Summarize electric motor terms

- 8.b. Explain the operation of a basic electric motor
- 8.c. Determine the common, start and run terminals of a single-phase motor
- 8.d. Troubleshoot single and three-phase motors

9. Troubleshoot components for electric motors.

Criteria

Criteria - Performance will be satisfactory when:

- 9.1. you troubleshoot components for electric motors.

Learning Objectives

- 9.a. Summarize the purpose of capacitors in the operation of single-phase motors
- 9.b. Summarize the purpose of starting relays in the operation of single-phase motors
- 9.c. Identify the basic components of single-phase motors
- 9.d. Wire single-phase motors
- 9.e. Describe how to diagnose components
- 9.f. Troubleshoot motor components

10. Troubleshoot contactors, relays and overloads.

Criteria

You will know you are successful when

- 10.1. you troubleshoot contactors, relays and overloads.

Learning Objectives

- 10.a. Explain the parts and operation of contactors, relays and overloads
- 10.b. Explain the application of contactors, relays and overloads
- 10.c. Install contactors, relays and overloads
- 10.d. Draw diagrams using contactors, relays and overloads
- 10.e. Troubleshoot contactors, relays and overloads

11. Troubleshoot electric control devices.

Criteria

You will know you are successful when

- 11.1. you troubleshoot electric control devices.

Learning Objectives

- 11.a. Explain the purpose of transformers, thermostats, pressure switches and other electric control devices
- 11.b. Identify electric control devices
- 11.c. Draw basic diagrams using electric control devices
- 11.d. Install electric control devices
- 11.e. Troubleshoot electric control devices

12. Construct electrical diagrams of air conditioning systems.

Criteria

You will know you are successful when

- 12.1. you draw a schematic diagram and identify system components.

Learning Objectives

- 12.a. Summarize motor and control circuits
- 12.b. List System Components
- 12.c. Identify system components
- 12.d. Draw a simple schematic diagram

13. Troubleshoot residential HVACR systems.

Learning Objectives

- 13.a. Articulate a diagnostic procedure
- 13.b. Evaluate and test heating and air conditioning systems
- 13.c. Identify electrical and electronic defective components

