

Western Technical College

10620155 Industrial DC/AC 1

Course Outcome Summary

Course Information

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|----------------------------|--|
| Description | This course is a basic introduction to DC and AC electricity. AC and DC electrical theory and the quantities of voltage, current, resistance and power will be discussed. Ohm's Law, series circuits and multimeter usage are covered as well. Coverage will also include parallel and series-parallel circuits, batteries, electromagnetism, inductors/coils and capacitors. This course will cover the generation of alternating current and voltage. Properties of an AC waveform such as period, frequency, Peak, RMS, average and peak to peak will also be included. Three-phase voltage will also be introduced. Laboratory activities using the oscilloscope. scopemeter are performed to verify theory. AC transformer, reactive properties of series and parallel RC, RL and RLC circuits are discussed with emphasis on operation. Topics include reactance, phase angle and fundamental AC power concepts such as power triangle and power factor. |
| Career Cluster | Manufacturing |
| Instructional Level | Associate Degree Courses |
| Total Credits | 3.00 |
| Total Hours | 90.00 |

Types of Instruction

| Instruction Type | Credits/Hours |
|-------------------------|----------------------|
| Lecture | 1 CR / 18 HR |
| Lab | 2 CR / 72 HR |

Course History

Last Approval Date 11/28/2016

Pre/Corequisites

Pre/Corequisite 10834110 Elementary Algebra w Apps 1A (OR) 10804113 College Technical Math

Textbooks

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.
Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

Core Abilities

- 1. Apply mathematical concepts.**
Status Active
- 2. Demonstrate ability to think critically.**
Status Active
- 3. Transfer social and natural science theories into practical applications.**
Status Active
- 4. Use effective communication skills.**
Status Active
- 5. Use technology effectively.**
Status Active

Program Outcomes

- 1. Perform work safely**
Type TSA Status Active
Criteria
 - 1.1. Follow Lock-out Tag-out safety procedures and practices to ensure proper start-up and shutdown of equipment
 - 1.2. Follow Personal Protective Equipment requirement
 - 1.3. Follow established safety policies and practices (e.g. OSHA, site specific)
- 2. Troubleshoot electrical and mechanical systems and devices**
Type TSA Status Active
Criteria
 - 2.1. Verify proper operation or problem
 - 2.2. Identify the cause of the problem: mechanical, electrical
 - 2.3. Determine corrective action
 - 2.4. Utilize appropriate test equipment
- 3. Repair electrical and mechanical systems**
Type TSA Status Active
Criteria
 - 3.1. Utilize tools appropriate to the electromechanical field
 - 3.2. Select replacement components
 - 3.3. Configure replacement components
 - 3.4. Install replacement components
 - 3.5. Validate system performance
- 4. Communicate Technical Information**

Type *TSA* **Status** *Active*

Criteria

- 4.1. Interpret documentation of electro-mechanical devices and systems
- 4.2. Use field specific technical terminology in speaking and writing
- 4.3. Create electro-mechanical diagrams
- 4.4. Document problems and solutions
- 4.5. Interpret electro-mechanical diagrams

Course Competencies

1. Analyze how atomic theory applies to components and properties of basic DC and AC electrical circuits.

Domain *Cognitive* *Level* *Analyzing* *Status* *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

- 1.1. Written Objective Test
- 1.2. Demonstration

Criteria

You will know you are successful when

- 1.1. you describe the model of an atom.
- 1.2. you cite the theory of electrical charges.
- 1.3. you Identify the significance of the electron as it relates to voltage and current.
- 1.4. you describe the electrical characteristics of an insulator.
- 1.5. you describe the electrical characteristics of a conductor.
- 1.6. you describe the electrical characteristics of a semiconductor.

Learning Objectives

- 1.a. Describe the model of an atom.
- 1.b. Explore the theory of electrical charges.
- 1.c. Identify the significance of the electron as it relates to voltage and current.
- 1.d. Differentiate the electrical characteristics of an insulator, conductor, and a semiconductor.

2. Investigate the principles of magnetism and electromagnetism.

Domain *Cognitive* *Level* *Applying* *Status* *Active*

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

- 2.1. Written Objective Test
- 2.2. Demonstration

Criteria

You will know you are successful when

- 2.1. you memorize the principles of a magnetic field surrounding a current carrying conductor.
- 2.2. you memorize the principles of a magnetic field surrounding a permanent and electro-magnet.
- 2.3. you explain the effects of magnetic field interaction.
- 2.4. you demonstrate the operation of a relay and solenoid.
- 2.5. you explain the operation of a motor.
- 2.6. you differentiate the operation of the three most common electromagnetic devices.

Learning Objectives

- 2.a. Memorize the principles of a magnetic field surrounding a current carrying conductor.
- 2.b. Memorize the principles of a magnetic field surrounding a permanent and electro-magnet.
- 2.c. Explain the effects of magnetic field interaction.
- 2.d. Demonstrate the operation of a relay and solenoid.
- 2.e. Explain the operation of a motor.
- 2.f. Differentiate the operation of the three most common electromagnetic devices.

3. Demonstrate proper use of electronic symbols, standards, and terminology.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

- 3.1. Demonstration
- 3.2. Written Objective Test

Criteria

You will know you are successful when

- 3.1. you associate engineering notation powers of ten to the standard metric prefix and symbol for each.
- 3.2. you assign the name for electrical and magnetic quantities and units to the correct SI symbol.
- 3.3. you select the correct electrical component for circuit assembly from a schematic diagram.
- 3.4. you sketch common electrical schematic symbols and electrical paths on a circuit diagram using either conventional or electron flow.
- 3.5. you label correct polarities across components.
- 3.6. you contrast electron flow and conventional flow used in circuit analysis.

Learning Objectives

- 3.a. Associate engineering notation powers of ten to the standard metric prefix and symbol for each.
- 3.b. Assign the name for electrical and magnetic quantities and units to the correct SI symbol.
- 3.c. Select the correct electrical component for circuit assembly from a schematic diagram.
- 3.d. Sketch electrical paths on a circuit diagram using either conventional or electron flow.
- 3.e. Label correct polarities across components.
- 3.f. Contrast electron flow and conventional flow used in circuit analysis.

4. Explore the relationships between DC voltage, current, and resistance.

Domain Cognitive Level Analyzing Status Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.

Linked Program Outcomes

Perform work safely

Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information

Assessment Strategies

- 4.1. Demonstration
- 4.2. Written Objective Test

Criteria

You will know you are successful when

- 4.1. you define DC voltage in a circuit using Ohm's law.
- 4.2. you define DC current in a circuit using Ohm's law.
- 4.3. you define resistance in a DC circuit using Ohms' law.
- 4.4. you define power in a DC circuit using Watts law.
- 4.5. you define the relationship of voltage, current and resistance in a DC circuit.

Learning Objectives

- 4.a. Define DC voltage in a circuit using Ohm's law.
- 4.b. Define DC current in a circuit using Ohm's law.
- 4.c. Define resistance in a DC circuit using Ohms' law.
- 4.d. Define power in a DC circuit using Watts law.
- 4.e. Define the relationship of voltage, current, and resistance in a DC circuit.

5. Measure basic DC electrical quantities.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information

Assessment Strategies

- 5.1. Demonstration
- 5.2. Written Objective Test

Criteria

You will know you are successful when

- 5.1. you measure values in a DC circuit utilizing a digital multimeter (DMM).
- 5.2. you measure voltage in a DC circuit.
- 5.3. you measure current in a DC circuit.
- 5.4. you measure resistance in a DC circuit.
- 5.5. you measure power in a DC circuit.

Learning Objectives

- 5.a. Measure values in a DC circuit utilizing a digital multimeter (DMM).
- 5.b. Measure voltage in a DC circuit.
- 5.c. Measure current in a DC circuit.
- 5.d. Measure resistance in a DC circuit.
- 5.e. Measure power in a DC circuit.

6. Calculate the values of DC voltage, current, resistance, and power based on the relationships between their characteristics.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information

Assessment Strategies

- 6.1. Demonstration
- 6.2. Written Objective Test

Criteria

You will know you are successful when

- 6.1. you calculate the value of voltage in a DC circuit using Ohm's law.
- 6.2. you calculate the value of current in a DC circuit using Ohm's law.
- 6.3. you calculate the value of resistance in a DC circuit using Ohm's law.
- 6.4. you calculate the power in a DC circuit using Watt's law.

Learning Objectives

- 6.a. Calculate the value of voltage in a DC circuit using Ohm's law.
- 6.b. Calculate the value of current in a DC circuit using Ohm's law.
- 6.c. Calculate the value of resistance in a DC circuit using Ohm's law.
- 6.d. Calculate the power in a DC circuit using Watt's law.

7. Troubleshoot DC circuits.

| <i>Domain</i> | <i>Cognitive</i> | <i>Level</i> | <i>Analyzing</i> | <i>Status</i> | <i>Active</i> |
|---------------|------------------|--------------|------------------|---------------|---------------|
|---------------|------------------|--------------|------------------|---------------|---------------|

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information

Assessment Strategies

- 7.1. Demonstration
- 7.2. Written Objective Test

Criteria

You will know you are successful when

- 7.1. you use appropriate test equipment to determine circuit failure.
- 7.2. you determine if a short circuit condition exists.
- 7.3. you determine if an open circuit condition exists.
- 7.4. you determine the cause of DC circuit failures.
- 7.5. you repair failing DC circuits.

Learning Objectives

- 7.a. Use appropriate test equipment to determine circuit failure.
- 7.b. Determine if a short circuit condition exists.
- 7.c. Determine if an open circuit condition exists.
- 7.d. Determine the cause of DC circuit failures.

7.e. Repair failing DC circuits.

8. Explore the relationships between AC voltage, current, and resistance.

Domain Cognitive Level Analyzing Status Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

8.1. Demonstration
8.2. Written Objective Test

Criteria

You will know you are successful when

8.1. you define AC voltage in a circuit using Ohm's law.
8.2. you define AC current in a circuit using Ohm's law.
8.3. you define resistance in an AC circuit using Ohms' law.
8.4. you define power in an AC circuit using Watts law.
8.5. you define the relationship of voltage, current, and resistance in an AC circuit.

Learning Objectives

8.a. Define AC voltage in a circuit using Ohm's law.
8.b. Define AC current in a circuit using Ohm's law.
8.c. Define resistance in an AC circuit using Ohms' law.
8.d. Define power in an AC circuit using Watts law.
8.e. Define the relationship of voltage, current, and resistance in an AC circuit.

9. Measure basic AC electrical quantities.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information

Assessment Strategies

9.1. Demonstration
9.2. Written Objective Test

Criteria

You will know you are successful when

9.1. you calculate the value of voltage in an AC circuit using Ohm's law.
9.2. you calculate the value of current in an AC circuit using Ohm's law.
9.3. you calculate the value of resistance in an AC circuit using Ohms' law.
9.4. you calculate the power in an AC circuit using Watt's law.

Learning Objectives

- 9.a. Measure values in an AC circuit utilizing a digital multimeter (DMM).
- 9.b. Measure voltage in an AC circuit.
- 9.c. Measure current in an AC circuit.
- 9.d. Measure resistance in an AC circuit.
- 9.e. Measure power in an AC circuit.

10. Calculate the values of AC voltage, current, resistance, and power.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Apply mathematical concepts.
 Demonstrate ability to think critically.
 Use effective communication skills.

Linked Program Outcomes

Perform work safely
 Communicate Technical Information

Assessment Strategies

- 10.1. Demonstration
- 10.2. Written Objective Test

Criteria

You will know you are successful when

- 10.1. you calculate the value of voltage in an AC circuit using Ohm's law.
- 10.2. you calculate the value of current in an AC circuit using Ohm's law.
- 10.3. you calculate the value of resistance in an AC circuit using Ohm's law.
- 10.4. you calculate the power in an AC circuit using Watt's law.

Learning Objectives

- 10.a. Calculate the value of voltage in an AC circuit using Ohm's law.
- 10.b. Calculate the value of current in an AC circuit using Ohm's law.
- 10.c. Calculate the value of resistance in an AC circuit using Ohm's law.
- 10.d. Calculate the power in an AC circuit using Watt's law.

11. Troubleshoot AC circuits.

Domain Cognitive Level Analyzing Status Active

Linked Core Abilities

Apply mathematical concepts.
 Demonstrate ability to think critically.
 Transfer social and natural science theories into practical applications.
 Use effective communication skills.
 Use technology effectively.

Linked Program Outcomes

Perform work safely
 Troubleshoot electrical and mechanical systems and devices
 Repair electrical and mechanical systems
 Communicate Technical Information

Assessment Strategies

- 11.1. Demonstration
- 11.2. Written Objective Test

Criteria

You will know you are successful when

- 11.1. you use appropriate test equipment to determine circuit failure.
- 11.2. you determine if a short circuit condition exists.
- 11.3. you determine if an open circuit condition exists.
- 11.4. you determine the cause of AC circuit failures.
- 11.5. you repair failing AC circuits.

Learning Objectives

- 11.a. Use appropriate test equipment to determine circuit failure.
- 11.b. Determine if a short circuit condition exists.
- 11.c. Determine if an open circuit condition exists.
- 11.d. Determine the cause of AC circuit failures.
- 11.e. Repair failing AC circuits.

12. Investigate the operation of transformers.

Domain Cognitive Level Applying Status Active

Assessment Strategies

- 12.1. Demonstration
- 12.2. Written Objective Test

Criteria

You will know you are successful when

- 12.1. you calculate primary and secondary voltage of a transformer.
- 12.2. you calculate primary and secondary current of a transformer.
- 12.3. you calculate primary and secondary power of a transformer.

- 12.4. you measure voltage and current at the primary and secondary windings of a transformer.

Learning Objectives

- 12.a. Calculate primary and secondary voltage of a transformer.
- 12.b. Calculate primary and secondary current of a transformer.
- 12.c. Calculate primary and secondary power of a transformer.
- 12.d. Measure voltage and current at the primary and secondary windings of a transformer.

13. Investigate the operation of RC, RL, and RLC circuits.

Domain Cognitive Level Applying Status Active

Assessment Strategies

- 13.1. Demonstration
- 13.2. Written Objective Test

Criteria

You will know you are successful when

- 13.1. you calculate inductive reactance of a coil and capacitive reactance of a capacitor.
- 13.2. you compare phase shift in an inductor and capacitor.
- 13.3. you define and calculate RC and RL time constants.

- 13.4. you compare the real, reactive, and apparent power of an AC circuit.
- 13.5. you explain the factors that determine the impedance of an AC circuit.

Learning Objectives

- 13.a. Calculate inductive reactance of a coil and capacitive reactance of a capacitor.
- 13.b. Compare phase shift in an inductor and capacitor.
- 13.c. Compare the real, reactive, and apparent power of an AC circuit.
- 13.d. Define and calculate RC and RL time constants.
- 13.e. Explain the factors that determine the impedance of an AC circuit.

Course Learning Plans and Performance Assessment Tasks

| Type | Title | Source | Status |
|------|------------------|--------|--------|
| LP | Lab Assessment 1 | Course | Active |
| LP | Lab Assessment 2 | Course | Active |
| LP | Lab Assessment 4 | Course | Active |

| | | | |
|----|-------------------|--------|--------|
| LP | Lab Assessment 5 | Course | Active |
| LP | Lab Assessment 6 | Course | Active |
| LP | Lab Assessment 7 | Course | Active |
| LP | Lab Assessment 8 | Course | Active |
| LP | Lab Assessment 9 | Course | Active |
| LP | Lab Assessment 10 | Course | Active |
| LP | Lab Assessment 11 | Course | Active |
| LP | Lab Assessment 12 | Course | Active |
| LP | Lab Assessment 13 | Course | Active |
| LP | Lab Assessment 3 | Course | Active |
| LP | Lab Assessment 14 | Course | Active |
| LP | Day 1 | Course | Active |
| LP | Day 2 | Course | Active |
| LP | Day 3 | Course | Active |
| LP | Day 4 | Course | Active |
| LP | Day 5 | Course | Active |
| LP | Day 6 | Course | Active |
| LP | Day 7 | Course | Active |
| LP | Day 8 | Course | Active |
| LP | Day 9 | Course | Active |
| LP | Day 10 | Course | Active |
| LP | Day 11 | Course | Active |
| LP | Day 12 | Course | Active |