Western Technical College

10660116 DC/AC 2

Course Outcome Summary

Course Information

Description	DC/AC 2 provides the fundamental concepts of analyzing complex resistive networks with network theorems such as the superposition theorem, Thevenin's Theorem and Norton's Theorem, and applied trigonometric concepts. Also covered in this course is complete coverage of capacitance, inductance and transformers, as well as RC, RL and RLC circuits. The course concludes with coverage of RC and L/R time constants, resonance and filters. Circuits will be constructed in the lab using both actual components and simulation software.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	72

Textbooks

Grob's Basic Electronics – with Connect. 13th Edition. Copyright 2021. Schultz, Mitchel E. Publisher: McGraw-Hill Publishing Company. **ISBN-13:** 978-1-264-09418-9. Required.

Program Outcomes

1. Apply electronic theory to practice.
2. Operate test equipment.
3. Build electronic circuits and systems.
4. Evaluate the operation of electronic circuits or systems.
5. Communicate technical information.

Course Competencies

1. Explore basic ideal transformer properties.

Assessment Strategies

1.1. Written Product

Criteria

You will know you are successful when

1.1. you calculate the turns ratio of a step-up transformer.
1.2. you calculate the turns ratio of a step-down transformer.
1.3. you calculate the reflected impedance of a transformer.
1.4. you list the ratings of a transformer.
1.5. you list the losses in a transformer.
1.6. you calculate the primary power.
1.7. you calculate the secondary power.
1.8. you calculate transformer voltages and currents given the turns ratio.
1.9. you list uses of transformer.

Learning Objectives

1.a. Describe what is meant by the term mutual inductance.
1.b. Define the term coefficient of coupling.
1.c. Describe what effect the turns ratio has on transformer currents.
1.d. Describe what effect the turns ratio has on transformer voltages.
1.e. Define the term turns ratio.
1.f. List the ratings on a transformer.
1.g. Describe the relationship of power in the primary versus the secondary in an ideal transformer.
1.h. List the losses present in non-ideal transformers.
1.i. List typical uses for the transformer.

2. Explain the DC and AC properties of capacitors.

Assessment Strategies

2.1. Written Product

Criteria

Your performance will be successful when:

2.1. you describe how energy is stored in a capacitor.
2.2. you calculate capacitance based on physical parameters.
2.3. you calculate capacitance given charge and voltage.
2.4. you identify capacitance value from the various types of coding.
2.5. you explain how a capacitor acts to a DC signal.
2.6. you explain how a capacitor acts to a changing signal.
2.7. you calculate total capacitance of series capacitors.
2.8. you calculate total capacitance of parallel capacitors.
2.9. you measure capacitance with appropriate instruments.
2.10. you list the characteristics of common types of capacitance.

Learning Objectives

2.a. Describe how energy is stored in a capacitor.
2.b. List the physical factors that affect the capacitance of a capacitor.
2.c. List the most common types of capacitors.
2.d. List the characteristics of the common types of capacitors.
2.e. Explain how capacitors are coded.
2.f. Explain how a capacitor reacts to a DC signal.
2.g. Explain how a capacitor reacts to a changing signal.

3. Explain the DC and AC properties of inductors.

Assessment Strategies

3.1. Written Product

Criteria

You will know you are successful when

3.1. you describe how energy is stored in an inductor.
3.2. you calculate inductance based on physical parameters.

3.3. you list common types of inductors.
3.4. you list the characteristics of common types of inductors.
3.5. you measure inductance with the appropriate instrument.
3.6. you calculate total inductance of parallel inductors.
3.7. you calculate total inductance of series inductors.
3.8. you explain how an inductor reacts to a DC signal.
3.9. you explain how an inductor reacts to a changing signal.

Learning Objectives

3.a. Describe how energy is stored in an inductor.
3.b. List the physical factors that affect the inductance of an inductor.
3.c. List the most common types of inductors.
3.d. List the characteristics of the common types of inductors.
3.e. Explain how an inductor reacts to a DC signal.
3.f. Explain how an inductor reacts to a changing signal.

4. Apply the time constant calculations to basic RC and RC series circuits.

Assessment Strategies

4.1. Written Product

Criteria

You will know you are successful when

4.1. you calculate the time constant of an RC circuit.
4.2. you calculate the time constant of an RL circuit.
4.3. you calculate the voltages in an RC circuit using the universal time constant graph.
4.4. you calculate the voltages in an RL circuit using the universal time constant graph.
4.5. you calculate the voltages in an RC circuit using the appropriate equation.
4.6. you calculate the voltages in an RL circuit using the appropriate equation.

Learning Objectives

4.a. Calculate the time constant of an RC circuit.
4.b. Calculate the time constant of an RL circuit.
4.c. Calculate the voltages in an RC circuit using the universal time constant graph method.
4.d. Calculate the voltages in an RC circuit using the equation method.
4.e. Calculate the voltages in an RL circuit using the universal time constant graph method.
4.f. Calculate the voltages in an RL circuit using the equation method.

5. Analyze two-element series RL and RC circuits using resistance and reactance.

Assessment Strategies

5.1. Written Product

Criteria

You will know you are successful when

5.1. you calculate the reactance of a capacitor.
5.2. you calculate the reactance of an inductor.
5.3. you calculate the impedance of an RC circuit.
5.4. you calculate the impedance of an RL circuit.
5.5. you calculate the currents in an RC circuit.
5.6. you calculate the currents in an RL circuit.
5.7. Learner can calculate the voltages in an RL circuit.
5.8. you calculate the voltages in an RC circuit.
5.9. you calculate the phase angle of the components voltage, current, and reactance.

Learning Objectives

5.a. Calculate the reactance of a capacitor.
5.b. Calculate the reactance of an inductor.
5.c. Calculate the impedance of an RC circuit.
5.d. Calculate the impedance of an RL circuit.
5.e. Calculate the current in an RC circuit.
5.f. Calculate the component voltages in an RC circuit.

5.g. Calculate the current in an RL circuit.
5.h. Calculate the component voltages in an RL circuit.
5.i. Calculate the phase angles of the components voltage, current and reactance.

6. Analyze steady state AC circuits using phasors and complex numbers.

Assessment Strategies

6.1. Written Product

Criteria

You will know you are successful when

6.1. you calculate the phase angle of voltages using complex numbers.
6.2. you calculate the phase angle of currents using complex numbers.
6.3. you calculate the impedance angle of the circuit using complex numbers.
6.4. you draw a phasor diagram of voltages in the circuit.
6.5. you draw a phasor diagram of currents in the circuit.
6.6. you draw a phasor diagram of reactance, resistance, and impedance in the circuit.

Learning Objectives

6.a. Calculate the phase angle of voltages using complex numbers.
6.b. Calculate the phase angle of currents using complex numbers.
6.c. Calculate the impedance angle of the circuit using complex numbers.
6.d. Draw a phasor diagram of voltages in the circuit.
6.e. Draw a phasor diagram of currents in the circuit.
6.f. Draw a phasor diagram of reactances, resistance and impedance in the circuit.

7. Analyze steady state multisource DC/AC circuits.

Assessment Strategies

7.1. Written Product

Criteria

You will know you are successful when

7.1. you calculate voltages in multisource circuits using superposition.
7.2. you calculate currents in multisource circuits using superposition.
7.3. you calculate voltages in multisource circuits using Thevenin's theorem.
7.4. you calculate currents in multisource circuits using Thevenin's theorem.
7.5. you calculate voltages in multisource circuits using Norton's theorem .
7.6. you calculate currents in multisource circuits using Norton's theorem .

Learning Objectives

7.a. Calculate the component voltages of steady state multisource DC/AC circuits.
7.b. Calculate the component currents of steady state multisource DC/AC circuits.

8. Analyze DC and AC circuits using software simulation tools.

Assessment Strategies

8.1. Simulation

Criteria

You will know you are successful when

8.1. you identify when to use actual or ideal components.
8.2. you import data to Excel if needed.
8.3. you produce a graph of predicted data.
8.4. you form conclusions based on measured data and predicted data.

Learning Objectives

8.a. Create a circuit using software simulation tools.
8.b. Simulate the circuit using software simulation tools.
8.c. Use the grapher functions of software simulation tools.
8.d. Interpret the results of the simulated circuit values.

9. Document analysis and measurements according to standard practice.

Assessment Strategies

9.1. Written Product

Criteria

You will know you are successful when

9.1. you record data accurately.
9.2. you write a lab report using proper terminology.
9.3. you write a lab report using correct spelling and punctuation.
9.4. you use previous knowledge to draw conclusions from the data.

Learning Objectives

9.a. Record data accurately and completely.
9.b. Justify differences between simulated and actual measurements.

10. Explore the Thevenin and Norton DC models.

Assessment Strategies

10.1. Written Product

Criteria

You will know you are successful when

10.1. you explain the steps needed to Theveninze a circuit.
10.2. you explain the steps needed to Nortonize a circuit.
10.3. you calculate the Thevenin voltage of a circuit.
10.4. you calculate the Thevenin resistance of a circuit.
10.5. you calculate the Norton current of a circuit.
10.6. you calculate the Norton resistance of a circuit.

Learning Objectives

10.a. Determine the Thevenin equivalent of a circuit.
10.b. Determine the Norton equivalent of a circuit.
10.c. Apply Thevenin's theorem to solve for circuit values.
10.d. Apply Norton's theorem to solve for circuit values.

11. Analyze bridge circuits.

Assessment Strategies

11.1. Written Product

Criteria

You will know you are successful when

11.1. you use Thevenin's theorem to solve for the voltages.
11.2. you use Thevenin's theorem to solve for the currents.
11.3. you use a bridge circuit to measure unknown resistances.

Learning Objectives

11.a. Calculate the voltages of a balanced bridge.
11.b. Solve for unknown resistances using bridge circuit.

12. Calculate RMS quantities and powers in balanced three-phase circuits.

Assessment Strategies

12.1. Written Product

Criteria

You will know you are successful when

12.1. you calculate the voltages in a wye connected balanced three-phase circuit.
12.2. you calculate the currents in a wye connected balanced three-phase circuit.
12.3. you calculate the voltages in a delta connected balanced three-phase circuit.
12.4. you calculate the voltages in a delta connected balanced three-phase circuit.
12.5. you calculate the power in a delta connected balanced three-phase circuit.

12.6. you calculate the power in a wye connected balanced three-phase circuit.

Learning Objectives

12.a. Calculate the current in balanced three-phase circuits.
12.b. Calculate the voltage in balanced three-phase circuits.
12.c. Calculate the power in balanced three-phase circuits.

13. Determine the power factor in an AC circuit.

Assessment Strategies

13.1. Written Product

Criteria

You will know you are successful when

13.1. you calculate the power factor of an RL circuit using the power triangle.
13.2. you calculate the power factor of an RC circuit using the power triangle.
13.3. you define the power factor equation for a series circuit.
13.4. you define the power factor equation for a parallel circuit.

Learning Objectives

13.a. Calculate the power factor of an RL circuit.
13.b. Calculate the power factor of an RC circuit.

14. Determine the power factor correction in an AC circuit.

Assessment Strategies

14.1. Written Product

Criteria

You will know you are successful when

14.1. you calculate the value of inductance needed for power factor correction in and RC circuit.
14.2. you calculate the value of capacitance needed for power factor correction in and RL circuit.
14.3. you define real power.
14.4. you define apparent power.
14.5. you define reactive power.

Learning Objectives

14.a. Calculate the power factor correction needed in an RC circuit.
14.b. Calculate the power factor correction needed in an RL circuit.

15. Identify the break frequency and roll off for a two-element RC and RL circuit from a Bode plot.

Assessment Strategies

15.1. Written Product

Criteria

You will know you are successful when

15.1. you determine the break frequency of an RL circuit from the bode plot.
15.2. you determine the break frequency of an RC circuit from the bode plot.
15.3. you calculate the rate of roll off in dB's for an RC circuit from the bode plot.
15.4. you calculate the rate of roll off in dB's for an RL circuit from the bode plot.

Learning Objectives

15.a. Determine the break frequency of a RC circuit from a bode plot.
15.b. Determine the break frequency of a RL circuit from a bode plot.
15.c. Calculate the rate of roll off for an RC circuit from a bode plot.
15.d. Calculate the rate of roll off for an RC circuit from a bode plot.

16. Calculate the electrical quantities in series and parallel resonant circuits.

Assessment Strategies

16.1. Written Product

Criteria

You will know you are successful when

16.1. you calculate the resonant frequency of an RLC circuit.
16.2. you calculate the half-power points of a resonant circuit.
16.3. you measure the half-power points of a resonant circuit.
16.4. you calculate the Q of a series resonant circuit.
16.5. you calculate the Q of a parallel resonant circuit.
16.6. you calculate the bandwidth of a series resonant circuit.
16.7. you calculate the bandwidth of a parallel resonant circuit.
16.8. you measure the bandwidth of a parallel resonant circuit.
16.9. you measure the bandwidth of a series resonant circuit.
16.10. you measure the resonant frequency of an RLC circuit.

Learning Objectives

16.a. Calculate the resonant frequency of an RLC circuit.
16.b. Calculate the circuit parameters of a series resonant circuit.
16.c. Calculate the circuit parameters of a parallel resonant circuit.