Western Technical College

10605138 Fundamentals of Electronics and Fabrication

Course Outcome Summary

Course Information

Description	Fundamentals of Electronics and Fabrication will introduce the student to basic AC and DC circuit theory, semiconductors, switches and relays, digital logic gates, circuit simulation software and test equipment. The course allows the student to learn by incorporating the electronics theory with the hands on fabrication of an electronics project.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree Courses
Total Credits	2
Total Hours	54

Pre/Corequisites

Prerequisite 10606115 Parametric Design

Textbooks

Open Education Resource: *Lessons in Electric Circuits*. Kuphaldt, Tony R. Copyright 2001. Publisher: All About Circuits. Required. https://www.allaboutcircuits.com/textbook/

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.

Course Competencies

1. Adhere to industry established safety procedures.

Assessment Strategies

1.1. In lab practicals.

Criteria

You will know you are successful when

1.1. you wear safety glasses in the lab.
1.2. you use power tools safely.
1.3. you maintain a clean work environment.
1.4. you use hand tools safely.

Learning Objectives

1.a. Explain the importance of maintaining a clean and organized work environment.
1.b. Give examples of industry established safety procedures.

2. Describe solder and the soldering process.

Assessment Strategies

2.1. In lab practicals and on written exams.

Criteria

You will know you are successful when

2.1. you describe fusion characteristics of tin/lead solders.
2.2. you describe the characteristics of a good solder connection.
2.3. you list the advantages of soldering.
2.4. you describe the wetting action of a soldered connection.
2.5. you explain the role of flux in soldering.
2.6. you explain the heat cycle of the work when soldering.

Learning Objectives

2.a. List the advantages of soldering.
2.b. Describe the wetting action of a soldered connection.
2.c. Explain the role of flux in soldering.
2.d. Explain the heat cycle of the work when soldering.
2.e. Describe the characteristics of a good solder connection.

3. Solder industry-standard electronic components and connectors.

Assessment Strategies

3.1. In lab practicals and on written exams.

Criteria

You will know you are successful when

3.1. you demonstrate the appropriate technique for soldering components.
3.2. you solder wire conductors to terminals.
3.3. you solder axial and radial lead components to PC board.

Learning Objectives

3.a. Properly solder components.
3.b. Properly solder wire conductors to terminals.
3.c. Properly solder axial and radial lead components to PC board.

4. Explain the elements and properties of a basic electrical circuit.

Assessment Strategies

4.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

4.1. you describe the electrical components that make up an electrical circuit.
4.2. you describe voltage, current and resistance as they apply to an electrical circuit.

Learning Objectives

4.a. Describe the electrical components that make up an electrical circuit.
4.b. Describe voltage, current, and resistance as they apply to an electrical circuit.

5. Measure DC electrical quantities.

Assessment Strategies

5.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

5.1. you determine an open circuit condition and their properties.
5.2. you determine a closed circuit (short circuit) condition and their properties.
5.3. you measure voltage current and resistance using a digital multimeter.

Learning Objectives

5.a. Determine an open circuit condition and their properties.
5.b. Determine a closed circuit (short circuit) condition and their properties.
5.c. Measure voltage current and resistance using a digital multi-meter.

6. Analyze voltage, current, resistance and power relationships using Ohm's Law and Watt's Law.

Assessment Strategies

6.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

6.1. you calculate the voltage, current or resistance in a simple resistive circuit.
6.2. you calculate the power in a resistive load when given any of the two; voltage, current or resistance.
6.3. you calculate the power used by a circuit and determine the cost given the KWH rate.
6.4. you apply Ohm's Law to determine the resistance needed to limit the current to a specified value.
6.5. you identify various types and compositions of resistors, potentiometers and rheostats.

Learning Objectives

6.a. Calculate the voltage, current or resistance in a simple resistive circuit.
6.b. Calculate the power in a resistive load when given any of the two; voltage, current or resistance.
6.c. Calculate the power used by a circuit and determine the cost given the Kwhr rate.
6.d. Use Ohm's law to determine the resistance needed to limit the current to a specified value.
6.e. Identify various types and compositions of resistors, potentiometers, and rheostats.

7. Analyze series circuits

Assessment Strategies

7.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

7.1. you identify a series resistive circuit containing a multiple number of resistors.
7.2. you apply Ohm's Law, Kirchhoff's Voltage Law and Watt's Law to calculate values in a series circuit.
7.3. you troubleshoot an improperly working series circuit.

Learning Objectives

7.a. Identify a series resistive circuit containing a multiple number of resistors.
7.b. Apply Ohm's law, Kirchove's voltage law, and Watt's laws to calculate values in a series circuit.
7.c. Troubleshoot an improperly working series circuit.

8. Apply skills to fabricate an electronic project.

Assessment Strategies

8.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

8.1. you create a 1:1 scale drawing of the power supply.
8.2. you prepare the chassis for mounting of components.
8.3. you install components on the chassis.
8.4. you solder the PCB components.
8.5. you wire the components together using hook-up wire in a neat and functional manner.
8.6. you test the power supply.
8.7. you troubleshoot the power supply, if required.

Learning Objectives

8.a. Create a 1:1 scale drawing of the power supply
8.b. Prepare the chassis for mounting of components.
8.c. Install components on the chassis .
8.d. Solder the PCB components.
8.e. Wire the components together using hook-up wire in a neat and functional manner.
8.f. Test the power supply.
8.g. Troubleshoot the power supply if required.

9. Analyze Parallel circuits.

Assessment Strategies

9.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

9.1. you identify a parallel circuit containing a multiple number of resistors.
9.2. you apply Ohm's Law and Watt's Law to calculate all values in a parallel circuit.
9.3. you calculate the resistance of a parallel circuit.
9.4. you construct a parallel circuit from a schematic diagram.
9.5. you apply circuit reduction techniques to simplify a circuit for calculation of circuit values.

Learning Objectives

9.a. Identify a parallel circuit containing a multiple number of resistors.
9.b. Use Ohm's law and Watt's law to calculate all values in a parallel circuit.
9.c. Calculate the resistance of a parallel circuit.
9.d. Properly construct a parallel circuit from a schematic diagram.
9.e. Use circuit reduction techniques to simplify a circuit for calculation of circuit values.
9.f. Troubleshoot a parallel circuit.

10. Explain the various types of mechanical or magnetic switches and circuit protection devices.

Assessment Strategies

10.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

10.1. you apply simple switching devices to open and close electrical circuits.
10.2. you define the terms "pole" and "throw" as they relate to mechanical switches.
10.3. you identify a variety of switch types.
10.4. you discuss typical circuit protection devices.
10.5. you explain the principles for the magnetic field surrounding the permanent or electromagnet.
10.6. you identify a relay by electrical characteristics and contact form.
10.7. you construct and test a relay circuit.

Learning Objectives

10.a. Apply simple switching devices to open and close electrical circuits.
10.b. Define the terms "pole" and "throw" as the relate to mechanical switches.
10.c. Become familiar with a variety of switch types.
10.d. Discuss typical circuit protection devices.
10.e. Explain the principles for the magnetic field surrounding the permanent or electromagnet.

10.f. Identify a relay by electrical characteristics and contact form.
10.g. Construct and test a relay circuit.

11. Describe AC voltage and the characteristics of the AC sinewave shape.

Assessment Strategies

11.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

11.1. you recognize the most common AC voltage sources used in electronic design.
11.2. you calculate the frequency and period of a AC waveform.
11.3. you convert to peak or peak-to-peak values from RMS.
11.4. you apply the principles of magnetics to understand how a transformer is used to step-up or step-down an AC voltage.

Learning Objectives

11.a. Recognize the most common AC voltage sources used in electronic design.
11.b. Calculate the frequency and period of a AC waveform.
11.c. Convert to peak or peak-to-peak values from RMS.
11.d. Use the principles of magnetics to understand how a transformer is used to step-up or step-down an AC voltage.

12. Explain the difference between single phase and three phase voltage sources and loads.

Assessment Strategies

12.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

12.1. you explain how a three-phase voltage is generated.
12.2. you describe the advantages of three-phase power over single-phase.
12.3. you list common applications for three-phase power.

Learning Objectives

12.a. Explain how a three phase voltage is generated.
12.b. Describe the advantages of three phase power over single phase.
12.c. List common applications for three phase power.

13. Describe the characteristics of commom semiconductor devices and logic gates.

Assessment Strategies

13.1. in lab practicals and on written exams.

Criteria

You will know you are successful when

13.1. you describe how diodes are used as a switch.
13.2. you describe how transistors can be used as a switch or as an amplifier.
13.3. you construct circuits consisting of diodes and transistors using simulation software.
13.4. you identify the symbols used for common semiconductor and logic devices.
13.5. you identify the proper bias voltages needed for NPN, PNP and other types of PN junction devices.
13.6. you create a simple logic circuit from a Boolean expression.
13.7. you create a Boolean expression from a simple logic circuit.

Learning Objectives

13.a. Describe how diodes are used as a switch.
13.b. Describe how transistors can be used as a switch or as an amplifier.
13.c. Construct circuits consisting of diodes and transistors using simulation software.
13.d. Identify the symbols used for common semiconductor and logic devices.
13.e. Identify the proper bias voltages needed for NPN, PNP and other types of PN junction devices.
13.f. Create a simple logic circuit from a boolean expression.
13.g. Create a boolean expression from a simple logic circuit.