STRANDS AND STANDARDS
ELECTRONICS, INTRODUCTION

Learning that works for Utah
CTE®

Course Description

This is an entry-level course to introduce students to electricity and electronics. Students will develop skills to assemble electronic components and operate electrical/electronic equipment used in engineering, product development, and manufacturing.

Intended Grade Level	9-12
Units of Credit	0.5
Core Code	38.01.00.00.021
Concurrent Enrollment Core Code	38.01.00.13.021
Prerequisite	N/A
Skill Certification Test Number	651
Skill Certification Cut Score	**68%**
Test Weight	0.5
License Area of Concentration	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Technology & Engineering
Endorsement 2	Electronics

STRAND 1

Students will understand, demonstrate, and practice safe working habits in an electronics lab.

Standard 1

Students will demonstrate a habit of Electrical Safety.

1. Students will demonstrate safety while using test equipment.
2. Students will properly care and maintenance of test equipment.

Standard 2

Demonstrate safe use of a Soldering Iron

1. Students will identify potential hazards before and during use and take proper precautions.
2. Students will properly care for, maintain, and store soldering irons and soldering materials (solder, wick, tips, etc.)

Standard 3

Students will recognize safety hazards and demonstrate the proper behaviors to remove or minimize hazards.

1. Clean as you go
2. Always wear safety glasses and appropriate PPE (Personal Protective Equipment).
3. Deenergize circuits/equipment before testing. Demonstrate proper safety while testing/trouble shooting.

Performance Skill

Students can complete a safety test without error (100%) before using any tools or shop equipment.
Students will demonstrate proper use of PPE.
Student will demonstrate safe practices while working with electricity.

STRAND 2

Students will understand the fundamental principles of electricity and electrical theory.

Standard 1

Students will learn the basic structure of an atom

1. Protons
2. Neutrons
3. Electrons

Standard 2

Identify conductors and insulators and understand their differences at an atomic level.

Standard 3

Understand how electricity is produced by the flow of electrons.

1. Students can identify voltage sources and explain/demonstrate their operation.
    a. Battery cell
        i. Primary
        ii. Secondary
    b. Thermocouple
    c. Photovoltaic cell
2. Students can demonstrate application of batteries in series aiding and opposing configurations.
3. Students can demonstrate application of batteries in parallel configuration

Standard 4

Define electrical units of measure:

Term	Description	Symbol	Unit of Measure	Symbol of Base Units
Charge	Quantity of Accumulated Electrons	Q	Coulombs	C
Voltage	Electrical Potential Difference	V	Volts	V
Current	Rate of Electron Flow	I	Amps	A
Resistance	Opposition to Electron Flow	R	Ohms	Ω
Power	Rate of doing Electrical Work	P	Watts	W

Standard 5

Define the difference between AC and DC electricity.

Standard 6

Understand the relation between voltage, current, resistance, and power using the following laws:

1. Ohm's Law
    a. Current is directly proportional to voltage and inversely proportional to resistance.
    b. V=IR
2. Watt's Law
    a. Power in a component is the product of the voltage and the current.
    b. P=IV

Standard 7

Student will understand the principles of a series circuit.

1. Kirchoff's Voltage Law
    a. Sum of the voltage drops equals the voltage source.
    b. Voltage drops are additive.
2. Current is constant in series circuits.
3. Resistance is additive.

$$a. \quad R_t = R_1 + R_2 + R_3 + \dots R_n$$

4. Power is additive.

$$a. \quad P_t = P_1 + P_2 + P_3 + \dots P_n$$

Standard 8

Students will understand the principles of a parallel circuit.

1. Kirchoff's Current Law
    a. Sum of the current flowing into a node is equal to the current flowing out of a node.
2. Resistance is the inverse of the sum of the inverses of the individual branches.

$$R_t = \left(R_1^{-1} + R_2^{-1} + R_3^{-1} + \dots R_n^{-1}\right)^{-1}$$

3. Voltage is constant across each of the individual branches.
4. Power is additive.

Performance Skill

1. Students can identify and define:
    a. Voltage: An electromotive force or the potential difference expressed in volts
    b. Current: A flow of charged particles (electrons) moving through a conductor.
    c. Resistance: is a measure of the object's opposition to electrical current.
    d. Power: The rate of transfer of electrical energy in a circuit.
2. Students can calculate power, voltage, current, and resistance in a series circuit.
3. Students can calculate power, voltage, current, and resistance in a parallel circuit.
4. Students can calculate voltage, current, or resistance when given only two of the three values using proper units.

STRAND 3

Students will understand and demonstrate how to use and test electronic components.

Standard 1

Identify the following electrical components and their schematic symbols:

1. Battery/Cell
2. Resistor
3. Incandescent light bulb
4. Light Emitting Diode (LED)
5. Motor
6. Normally-open (N.O) switch
7. Normally-closed (N.C) switch
8. Single-pole single-throw switch (SPST)
9. Single-pole double-throw switch (SPDT)
10. Wire

Standard 2

Students can read and understand the resistor color code.

Standard 3

Students will learn how to use a breadboard.

Standard 4

Students will learn how printed circuit boards are made and how they work.

Standard 5

Students will learn how to safely use a soldering iron to solder components to a printed circuit board.

1. Correctly tinning a soldering iron
2. Proper heating of pad and component lead
3. Proper care and maintenance of soldering irons and materials

Performance Skill

Student can accurately read an electrical schematic drawing.
Student can identify the value of a resistor using the resistor color code.
Students can create a working circuit using a breadboard.
Student can select the proper components based on an electrical schematic drawing.

STRAND 4

Students will demonstrate the proper use of electrical testing equipment and troubleshooting techniques.

Standard 1

Students will learn to make accurate measurements, use, and maintenance of an Ohmmeter.

Standard 2

Students will learn proper placement and use of a voltmeter.

Standard 3

Students will learn proper placement and use of an ammeter including placement for accurate measurement in a circuit.

Standard 4

Students will learn proper use and safety of a DC voltage source in testing circuits.

Standard 5

Students will understand the effects of an "open" on a series or parallel circuit.

Standard 6

Students will understand the effects of a "short" on a series or parallel circuit.

Performance Skill

Students can use a digital multimeter to measure voltage, current, and resistance.
Students can troubleshoot and correct open and short circuits.

Skill Certification Test Points by Strand

Test Name	Test #	Number of Test Points by Strand										Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10		
Introduction to Electronics	651												