

**ARIZONA CTE CAREER PREPARATION STANDARDS & MEASUREMENT CRITERIA****ELECTRONIC TECHNOLOGIES, 15.0300.00****STANDARD 1.0 EXPLORE THE ELECTRONIC TECHNOLOGY INDUSTRY**

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| 1.1 | Investigate occupations and jobs within the electronics                           |
| 1.2 | Identify environmental issues and trends in the electronics industry              |
| 1.3 | Describe how changing technology and the economy impacts the electronics industry |
| 1.4 | Examine how the quality of work affects profitability in electronic technology    |
| 1.5 | Sequence the steps in the process flow to manufacture a product                   |

**STANDARD 2.0 APPLY COMMUNICATION SKILLS SPECIFIC TO ELECTRONIC TECHNOLOGY**

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| 2.1 | Identify barriers to effective communication in the workplace       |
| 2.2 | Practice skills used to communicate technical information           |
| 2.3 | Demonstrate the ability to communicate with a nontechnical audience |
| 2.4 | Demonstrate the ability to interpret and transfer data              |

**STANDARD 3.0 DEMONSTRATE TECHNOLOGICAL LITERACY FOR THE ELECTRONIC TECHNOLOGY ENVIRONMENT**

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| 3.1 | Demonstrate basic usage of computers (e.g., input, storage, and output) |
| 3.2 | Apply file and disk management techniques, including backup technology  |

**STANDARD 4.0 PRACTICE SAFE WORKING PROCEDURES IN THE ELECTRONIC TECHNOLOGY ENVIRONMENT**

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| 4.1 | Identify safety precautions for common workplace hazards              |
| 4.2 | Wear and/or use personal safety clothing, gear, and equipment         |
| 4.3 | Apply hazardous materials (HAZMAT) procedures                         |
| 4.4 | Identify types of fires and fire extinguishers                        |
| 4.5 | Maintain worksite safety and housekeeping                             |
| 4.6 | Demonstrate appropriate handling and lifting methods                  |
| 4.7 | Demonstrate safe use, storage, and maintenance of tools and equipment |
| 4.8 | Describe ESD (electrostatic discharge) and protection methods         |

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4.9	Identify OSHA regulations as they apply to electronic technology
<b>STANDARD 5.0 APPLY MATHEMATICAL PROCESSES TO PROBLEMS IN ELECTRONIC TECHNOLOGY</b>	
5.1	Use numeric, symbolic, and/or graphic representations to express problems
5.2	Perform mathematical calculations in the context of electronic technology problems
5.3	Recognize and use metric units of length, weight, volume, and/or temperature
5.4	Solve basic arithmetic equations and identify the relationship/dependency of variables within the equation (i.e., as "x" value increases, "z" value decreases as a result of...)
5.5	Demonstrate basic knowledge of statistics
5.6	Interpret graphic display of data, e.g., control chart, bar charts, etc.
<b>STANDARD 6.0 APPLY MEASUREMENT TECHNIQUES TO PROBLEMS IN ELECTRONIC TECHNOLOGY</b>	
6.1	Demonstrate knowledge of units English and metric measurements
6.2	Perform conversions between English and metric measurements
6.3	Identify common measurement tools and their functions used in electronic technology
6.4	Select an appropriate measurement technique for a specific measurement need
6.5	Use the appropriate measurement tool for the task
6.6	Determine the degree of accuracy required for a specific task or situation in scientific and mathematical notations used in engineering
6.7	Explain the differences among theoretical versus simulation versus real-world tests
<b>STANDARD 7.0 APPLY PROBLEM-SOLVING AND DECISION-MAKING PROCESSES TO ELECTRONIC TECHNOLOGY SITUATIONS</b>	
7.1	Identify and apply problem-solving processes (e.g., Lean, 6 Sigma, and scientific method)
7.2	Solve electronic technology problems individually and as part of a team
7.3	Generate new and creative ideas using critical thinking skills in solving electronic technology related problems
7.4	Evaluate facts and use logic and reason in decision making
7.5	Access information using reference materials to solve a problem
7.6	Explain the use of a decision matrix to solve a problem
<b>STANDARD 8.0 UNDERSTAND SCHEMATICS, BLUEPRINTS, AND TECHNICAL DRAWINGS UTILIZED IN ELECTRONIC TECHNOLOGY</b>	
8.1	Interpret dimensions, symbols, legends, scales, and directions

These technical knowledge and skill standards were validated by a Skill Standards Validation Committee on March 22, 2012, and approved by the Arizona Skill Standards Commission on May 16, 2012.

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8.2	Demonstrate drawing and visualization skills used in the electronic technology field
8.3	Identify CAD tools commonly used in the field
8.4	Identify the basics on building a design document
<b>STANDARD 9.0 DESCRIBE ELECTRICITY CONCEPTS</b>	
9.1	Express the basic scientific laws of electricity and how they are utilized
9.2	Identify basic concepts of work and energy, unit of energy, energy conversion, efficiency, structure of matter, and electric charge
9.3	Describe atomic structure, components of the atom, and their charges and their importance to electronic technology
<b>STANDARD 10.0 DETERMINE ELECTRICAL QUANTITIES, UNITS, AND CIRCUITS</b>	
10.1	Identify common electrical components, quantities, and units
10.2	Define continuity and its purpose
10.3	Explain voltage, current, and resistance in electric circuits
10.4	Calculate Ohm's law, energy, and power
10.5	Build a DC series circuit and make measurements
10.6	Build a DC parallel circuit <b>and</b> make measurements
10.7	Build a DC series-parallel circuit <b>and</b> make measurements
10.8	Build DC voltage divider circuits <b>and</b> make measurements
10.9	Demonstrate knowledge of magnetism and electromagnetism
10.10	Determine the current, voltage, and resistance in electric circuits without damaging the meter or circuit
10.11	Explain the relationship between scales and ranges on multi-scale, multi-range meters
10.12	Build a simple electronic circuit/device/component to solve a simulated scenario
10.13	Apply Kirchoff's law related to current, voltage, and electric circuits
<b>STANDARD 11.0 APPLY FUNDAMENTALS OF ALTERNATING CURRENT (AC)</b>	
11.1	Explain alternating current and voltage
11.2	Describe four ways to express the magnitude of alternating current
11.3	Analyze capacitors through calculation and measurement

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<b>STANDARD 12.0 SOLVE MAGNETISM AND ELECTROMAGNETISM CIRCUIT PROBLEMS</b>	
12.1	Explain magnetism, magnets, magnetic fields, flux and poles, and electromagnetism
12.2	Determine the direction of the magnetic field created by a current-carrying conductor
12.3	Predict the direction of the force between current-carrying conductors
12.4	Solve magnetic circuit problems using magnetic quantities and units
12.5	Analyze inductors through calculation and measurement
12.6	Analyze transformers through calculation and measurement
<b>STANDARD 13.0 ASSEMBLE RC, RL, AND RCL CIRCUITS</b>	
13.1	Calculate impedance and phase angle for RC, RL and RCL circuits when the components are connected in either series or parallel
13.2	Classify and explain the uses of simple filter circuits
13.3	Calculate the resonant frequency, the quality factor and the bandwidth of LC circuits
13.4	Perform circuit analysis on RL circuits including time constant
13.5	Perform circuit analysis on RC circuits including time constant
13.6	Analyze through calculation RCL circuits and resonance
13.7	Build an AC series circuit and make measurements
13.8	Build an AC parallel circuit and make measurements
13.9	Build an AC series-parallel circuit and make measurements
<b>STANDARD 14.0 DETERMINE TRANSFORMER RATINGS</b>	
14.1	Determine the transformer ratings that are appropriate for the job
14.2	Connect transformer windings in series and/or parallel to obtain the desired voltage and current capabilities and make measurements
<b>STANDARD 15.0 CALCULATE VARIOUS POWER SUPPLIES PROBLEMS</b>	
15.1	Describe how common rectifier circuits work
15.2	List the characteristics of filter configurations
15.3	Calculate power-supply ripple percentage and voltage regulation
15.4	Calculate the DC output voltage for filtered and unfiltered power supplies

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15.5	Build a simple linear power supply and make measurements
<b>STANDARD 16.0 SUMMARIZE REGULATED POWER SUPPLIES OPERATIONS</b>	
16.1	Identify power supply regulator circuits
16.2	Differentiate regulated power supplies problems
16.3	Explain the operation of switching power supplies
<b>STANDARD 17.0 – DESCRIBE ELECTRIC MOTORS AND THEIR USE IN ELECTRONICS</b>	
17.1	Describe basic DC and AC motor theory
17.2	Select an appropriate motor for a specific application by using motor ratings
17.3	Explain the characteristics of 3-phase motors
17.4	Explain the characteristics of each type of single-phase motor
17.5	Explain the characteristics of major types of DC motors
17.6	Explain the basics of statics and dynamics
<b>STANDARD 18.0 EXPLAIN THE USES OF SEMICONDUCTORS</b>	
18.1	List common electronic elements as insulators, conductors, or semiconductors
18.2	Estimate the effect of temperature on insulators, conductors, and semiconductors
18.3	Illustrate the directions of electron and hole currents in semiconductors
18.4	Identify the majority and minority carriers in N-type semiconductors
18.5	Identify the majority and minority carriers in P-type semiconductors
<b>STANDARD 19.0 CALCULATE PROBLEMS RELATED TO DIODES</b>	
19.1	Estimate the conductivity of diodes under the conditions of forward and reverse bias
19.2	Interpret the current-voltage characteristic curves for diodes
19.3	Inspect diodes to determine the cathode and anode leads
19.4	Describe types of diodes and their functions
19.5	Build a diode circuit and make measurements
<b>STANDARD 20.0 EXPLAIN THE USES OF TRANSISTORS</b>	

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20.1	Estimate decibel gain and loss of amplifiers
20.2	Describe amplification and power gain
20.3	Calculate the correct bias polarity for several types of transistors
20.4	Estimate current gain from data and from characteristic curves
20.5	Calculate collector dissipation from data and from characteristic curves
20.6	Analyze bipolar transistors with an ohmmeter
20.7	Build a transistor circuit and make measurements
<b>STANDARD 21.0 – ANALYZE THE CHARACTERISTICS OF AMPLIFIERS</b>	
21.1	Estimate decibel gain and loss of amplifiers
21.2	Locate the operating point for a basic common-emitter amplifier
21.3	Build common-emitter amplifier and make measurements
21.4	Explain the importance of impedance matching
21.5	Describe the characteristics of the standard methods of signal coupling
21.6	Estimate the input impedance of common-emitter amplifiers
21.7	Calculate voltage gain in cascade amplifiers
21.8	Build FET amplifier circuits and make measurements
21.9	Determine component-level defects by using voltage analysis
<b>STANDARD 22.0 PREDICT AUDIO FREQUENCY OSCILLATOR OPERATION</b>	
22.1	Estimate decibel gain and loss of audio frequency oscillators
22.2	Explain the importance of impedance matching
22.3	Estimate gain and feedback of audio frequency oscillators
22.4	Estimate the frequency of the operation of audio frequency oscillators
22.5	Analyze problems with radio frequency oscillators
<b>STANDARD 23.0 PREDICT RADIO FREQUENCY OSCILLATOR OPERATION</b>	
23.1	Estimate decibel gain and loss of radio frequency oscillators

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23.2	Explain the importance of impedance matching
23.3	Estimate gain and feedback of radio frequency oscillators
23.4	Estimate the frequency of the operation of radio frequency oscillators
23.5	Analyze problems with radio frequency oscillators
<b>STANDARD 24.0 EXAMINE OPERATION OF BASIC RADIO RECEIVERS</b>	
24.1	Describe modulation and demodulation
24.2	Compare and contrast the characteristics of AM, SSB, and FM
24.3	Calculate the oscillator frequency for super heterodyne receivers
24.4	Troubleshoot receivers
<b>STANDARD 25.0 ANALYZE INTEGRATED CIRCUIT TECHNOLOGY</b>	
25.1	Compare and contrast integrated circuit (IC) technology to discrete technology
25.2	Build 555 timer circuits and make measurements
25.3	Recognize analog, digital, and mixed-signal ICs
25.4	Analyze circuits with ICs
25.5	Predict the power bandwidth for operational amplifiers
25.6	Verify voltage gain for operational
25.7	Calculate the small-signal bandwidth for operational amplifiers
25.8	Build operational-amplifier circuits and make measurements
<b>STANDARD 26.0 EXPLORE NANOTECHNOLOGY CONCEPTS AND APPLICATIONS</b>	
26.1	Contrast the nanotechnology bottom-up approach with the semiconductor top-down approach
26.2	Identify new nanotechnology devices, such as the single electron transistor and quantum dot lasers
<b>STANDARD 27.0 ANALYZE ELECTRONIC CONTROL DEVICES AND CIRCUITS</b>	
27.1	Estimate efficiency in control circuits
27.2	Recognize the schematic symbols for thyristors
27.3	Describe how thyristors operate

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27.4	Explain conduction angle in thyristor circuits
27.5	Describe commutation in thyristor circuits
27.6	Predict the power bandwidth for operational amplifiers
27.7	Verify voltage gain for operational amplifiers
27.8	Calculate the small-signal bandwidth for operational amplifiers
27.9	Build control circuits and make measurements
<b>STANDARD 28.0 ANALYZE DIGITAL SIGNAL PROCESSING CIRCUITS</b>	
28.1	Build combinational logic circuits using logic gates and predict/describe/verify operation
28.2	Build sequential logic circuits using flip-flops and predict/describe/verify operations
28.3	Explain the operation of serial and parallel shift registers and compare attributes of each
28.4	Explain operation of A-D converters, D-A converters
28.5	Describe operation of Programmable Logic Controllers (PLCs)
28.6	Input Source and OP code for a processor controlled system
28.7	Input high-level code programming (BASIC, C++, etc.) in a PC based system
28.8	Describe operation of a typical computer system (PC) to the component level
28.9	Describe Common Peripheral and pointing devices and interfacing methods (Serial, Parallel, USB, docking ports, etc.)
28.10	Explain operation of MODEMS
28.11	Demonstrate capability to open, operate and configure Microsoft operating systems and applications
<b>STANDARD 29.0 ANALYZE OPTICAL ELECTRONIC COMPONENTS</b>	
29.1	Describe the operation of fiber optic communications system and compare to hardline systems
29.2	Build a simple fiber optic circuit and make measurements
29.3	Describe L.E.D.s
29.4	Build L.E.D. circuits and make measurements
29.5	Describe photo diodes
29.6	Describe photo diode circuits and make measurements

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29.7	Describe laser L.E.D.s
29.8	Build a laser L.E.D. circuit and make measurements