Content Standard 1: Safety and Tools

Performance Standard 1.1: Demonstrate general lab safety rules and procedures

1.1.1 Describe the physiological reactions electrical shock causes; list various degrees of current the human body can tolerate
1.1.2 Describe the roles of OSHA in the workplace
1.1.3 Identify and use proper lifting procedures and proper use of support equipment
1.1.4 Utilize proper ventilation procedures for working within the lab/shop area
1.1.5 Identify marked safety areas
1.1.6 Describe the type and usage of the fire extinguishers
1.1.7 Identify the location of the posted evacuation routes
1.1.8 Explain eye and ear protection needed by technicians, and appropriate clothing for lab/shop activities
1.1.9 Explain the concepts of First Aid and its particular importance to workers in electronic and electronics fields; explain precautions for untrained people
1.1.10 Describe fusing and circuit breaker rules and reasons for different types of fuses
1.1.11 Explain how electrostatic discharge (ESD) damages sensitive electronic components
1.1.12 Demonstrate proper procedures for preventing damage from ESD (ground straps, mats, etc.)

Performance Standard 1.2: Identify and safely utilize tools and equipment

1.2.1 Identify the appropriate usage of tools and equipment
1.2.2 Demonstrate the proper techniques when using tools and equipment
1.2.3 List tools hazards that are associated with technician activities in the workplace and in the field
1.2.4 Demonstrate proper cleaning, storage, and maintenance of tools and equipment
1.2.5 Identify meter protection, safety and usage
1.2.6 Explain care of equipment and test leads
1.2.7 List the purposes and types of signal generators
1.2.8 Describe meter loading and precautions
1.2.9 Describe oscilloscope usage; explain the purpose of each front panel control

Content Standard 2: Electronic Theory

Performance Standard 2.1: Explain the principles of electronic theory

2.1.1 Describe the atomic structure, the components of the atom, their charges and importance to electronics technology
2.1.2 Explain the characteristics of voltage, current, and resistance (unit of measure, letter/symbol)
2.1.3 Explain basic uses for electricity
2.1.4 Describe the basic methods of using electricity to operate a motor and how to mechanical motion causes a generator to produce electrical current
2.1.5 List different types of resistive materials and how resistors are used in electronics
2.1.6 Describe the purposes of capacitors. List common types and construction designs
2.1.7 Explain how inductance relates to magnetism and describe coil construction, cores and usages
2.1.8 Compare impedance with reactance and resistance, and describe current/voltage relationships.
2.1.9 List voltage sources, AC and DC, batteries and natural generation (solar, wind, hydro, etc.)
2.1.10 List Ohms law formulas for current, voltage, resistance and power. Solve math problems utilizing each
2.1.11 Calculate power consumption and its effects on circuit design

**Performance Standard 2.2: Utilize schematics and block diagrams**

2.2.1 Draw and interpret common electrical/electronic symbols
2.2.2 Explain how block diagrams are used for troubleshooting and maintenance of electronics products
2.2.3 Explain the differences between wiring prints, schematics and block diagrams
2.2.4 Describe the purpose and use of test points.
2.2.5 Explain how schematics are used to locate component and wiring failures in electronics products
2.2.6 Explain the methods of using flow diagrams/charts
2.2.7 Draw common electrical/electronic symbols
2.2.8 Explain how block diagrams are used for troubleshooting and maintenance of electronics products
2.2.9 Explain the differences between wiring prints, schematics and block diagrams

**Performance Standards 2.3: Identify basic wiring principles**

2.3.1 List wire types and construction
2.3.2 List American wire gauges used for various purposes
2.3.3 Explain the effects of proper and improper termination
2.3.4 Explain the purposes of grounding and common conventions used in electrical systems and electronics

**Content Standard 3: Electronic Components**

**Performance Standard 3.1: Identify electronic components**

3.1.1 Illustrate schematic symbols for various types of electrical and electronic components
3.1.2 Recognize the effects of environmental conditions on electronic components
3.1.3 Identify capacitor types; list common usages; methods of varying capacitance and explain the terms charge and coulomb
3.1.4 Identify inductor types and reasons for various core materials; how diameter and wire size affects inductance
3.1.5 Identify common types of transformers and list uses for each; explain step up/down voltage methods; explain why laminations are used
3.1.6 List common optical devices (LEDs, LCDs, etc.) and describe how a photovoltaic cell is activated. Draw symbols for photo resistors, photodiodes and phototransistors; list materials from which these devices are made

**Performance Standard 3.2: Analyze quantities utilized in electronics**

3.2.1 Identify and utilize the basic units of electronic measurements
3.2.2 Express and convert numbers in scientific, engineering and metric notation
3.2.3 Convert from scientific notation to engineering notation
3.2.4 Identify resistor values from color code or other marks and list composition and reasons for different usages

### Content Standard 4: DC and AC Circuit Configuration

#### Performance Standard 4.1: Analyze series circuit configuration

- 4.1.1 Identify series circuit configuration
- 4.1.2 Calculate voltage drops in a series circuit
- 4.1.3 Utilize Kirchhoff’s Voltage Law
- 4.1.4 Recognize polarity in a series circuit
- 4.1.5 Calculate voltage, current, resistance, and power in a series circuit
- 4.1.6 Construct, measure, and analyze simple series circuits

#### Performance Standard 4.2: Analyze parallel circuit configuration

- 4.2.1 Identify parallel circuit configuration
- 4.2.2 Calculate voltage drops in a parallel circuit
- 4.2.3 Utilize Kirchhoff’s Current Law
- 4.2.4 Recognize polarity in a parallel circuit
- 4.2.5 Calculate voltage, current, resistance, and power in a parallel circuit
- 4.2.6 Construct, measure, and analyze simple parallel circuits

#### Performance Standard 4.3: Analyze series-parallel circuit configuration

- 4.3.1 Identify series-parallel circuit configuration
- 4.3.2 Calculate voltage drops in a series-parallel circuit
- 4.3.3 Utilize Kirchhoff’s Voltage and Current Laws where appropriate
- 4.3.4 Recognize polarity in a series-parallel circuit
- 4.3.5 Calculate voltage, current, resistance, and power in a series-parallel circuit
- 4.3.6 Utilize Thevenin’s and Norton’s theorems

#### Performance Standard 4.4: Analyze alternating circuits (AC)

- 4.4.1 Construct and test AC circuits
- 4.4.2 Identify AC waveform characteristics: effective voltage (RMS), average voltage, negative alternation, positive alternation, wavelength, amplitude, period, and frequency
- 4.4.3 Calculate peak, peak-to-peak, RMS, and average voltage values for an AC waveform
- 4.4.4 Explain cycle, hertz, phase, and frequency
- 4.4.5 Describe the requirement for inductance in AC electrical circuits (self and mutual inductance)
- 4.4.6 Compare and contrast reactance, resistance, and impedance
- 4.4.7 Explain phase relationships for series, and series-parallel RL, RC, and RCL circuits
- 4.4.8 Analyze high and low pass filter circuits

### Content Standard 5: Digital Electronic Principles

#### Performance Standard 5.1: Analyze digital concepts design and circuitry

- 5.1.1 Identify and convert numbers between numbering systems (decimal, binary, hexadecimal, BCD)
- 5.1.2 Compare and contrast between 1 (high) and 0 (low or ground)
- 5.1.3 Perform numerical calculations in numbering systems (binary, hexadecimal, octal)
- 5.1.4 Identify and describe basic logic operations (AND, OR, buffer, inverter, NAND)
- 5.1.5 Explain Boolean Algebra and its use in digital circuitry
- 5.1.6 Utilize Karnaugh Maps
5.1.7 Interpret data sheet information
5.1.8 Evaluate logic circuit truth tables
5.1.9 Analyze clock and timing circuit operations
5.1.10 Analyze combinational logic circuits for a given application (relay logic)
5.1.11 Assess the operation of analog-to-digital and digital-to-analog convertors
5.1.12 Describe ASCII code
5.1.13 List the uses and precautions for logic test probes
5.1.14 Explain how logic pulsers are used

Performance Standard 5.2: Utilize microcontroller devices
5.2.1 Describe basic principles of microcontrollers
5.2.2 Describe the process of executing instructions in a microcontroller
5.2.3 Draw a flowchart for a typical program or process
5.2.4 Describe the procedure for instruction coding and program debugging
5.2.5 Describe the fundamental principles for microcontroller interfacing
5.2.6 Demonstrate basic wiring procedures for microcontrollers
5.2.7 Write, deploy, and test an original microcontroller program

Content Standard 6: Soldering and Desoldering Techniques

Performance Standard 6.1: Apply soldering techniques
6.1.1 Describe solder safety as it pertains to burns and potential fires, damage to facilities or customer products
6.1.2 Explain the causes of solder fumes and the effects of lead poisoning
6.1.3 List causes and precautions to prevent or reduce solder splatter
6.1.4 Explain the reasons for flux usage and describe types
6.1.5 List types of solder and reasons for choosing each
6.1.6 Explain heat sinks, why and how they are used
6.1.7 Identify cold solder joints and explain causes
6.1.8 Describe the difference between good and bad mechanical and electrical solder connections
6.1.9 Demonstrate proper care of solder-desolder equipment and aids
6.1.10 Demonstrate proper soldering techniques for through-hole and surface mount components

Performance Standard: 6.2: Apply desoldering techniques
6.2.1 Explain desoldering principles
6.2.2 Describe various types of desoldering equipment and how it is used
6.2.3 Demonstrate the use of braid-wick and pump solder removers

Content Standard 7: Troubleshooting and Maintenance Techniques

Performance Standard 7.1: Apply troubleshooting techniques
7.1.1 Explain troubleshooting techniques
7.1.2 Create and utilize a non-routine task form (job hazard analysis)
7.1.3 Utilize all safety procedures necessary while troubleshooting (lock-out tag-out, etc.)
7.1.4 Select and utilize appropriate tools for electronics troubleshooting
7.1.5 Research various sources of repair/maintenance/troubleshooting documentation (print media, electronic media, tech support, local expert, and manufacturer)
7.1.6 Interpret electronic schematic diagrams
7.1.7 Measure electrical characteristics of voltage, current, and resistance in basic electronic
circuits using multimeters, oscilloscopes, logic probes, etc.

**Performance Standard 7.2: Demonstrate repair documentation techniques**

- **7.2.1** Explain the difference between maintenance and repair
- **7.2.2** Identify the common causes of system and equipment failures
- **7.2.3** Use electrostatic discharge (ESD) control devices and techniques when handling ESD-sensitive equipment and components
- **7.2.4** Isolate common faults in wiring and equipment
- **7.2.5** Identify common preventive maintenance measures (lubrication, housekeeping, alignment, and filters)
- **7.2.6** Explain the purposes and requirements for proper recordkeeping
- **7.2.7** Interpret preventative maintenance and inspection schedules