



## PURPOSE

To evaluate each competitor's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of electronics technology.

First, download and review the General Regulations at: <http://updates.skillsusa.org>.

## ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with industrial electronics or electronics technology as the occupational objective.

## CLOTHING REQUIREMENTS

### **Class E: Competition Specific — Business Casual**

- Official SkillsUSA white polo shirt
- Black dress slacks or black dress skirt (knee-length minimum)
- Black closed-toe dress shoes

*Note:* Wearing socks or hose is no longer required. If worn, socks must be black dress socks and hose must be either black or skin-tone and seamless/nonpattern.

These regulations refer to clothing items that are pictured and described at: [www.skillsusastore.org](http://www.skillsusastore.org). If you have questions about clothing or other logo items, call 1-888-501-2183.

*Note:* Competitors must wear their official competition clothing to the competition orientation meeting.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
  - a. All materials, supplies and job information needed to construct and test the designed circuit.
  - b. The technical committee will not supply tools, test equipment or calculators.
2. Supplied by the competitor:
  - a. Small pliers
  - b. Wire cutter
  - c. Wire stripper for No. 28 and No. 30 gauge wire
  - d. Small, assorted screwdriver set (Phillips and slotted)
  - e. 25-watt soldering iron and associated soldering supplies (*Note*: No soldering guns allowed)
  - f. Other hand tools as desired, subject to the approval of the technical committee
  - g. Digital multimeter capable of measuring ohms, volts and current
  - h. 20 or more MHz dual trace oscilloscope
  - i. Two 10x probes
  - j. Calculators (can have scientific notation but cannot be programmable)
  - k. All competitors must create a one-page resume. See “Resume Requirement” below for guidelines.

### RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA national competitors should submit their resume by June 1. The link for resume submission will be published on <http://updates.skillsusa.org> on May 1. Failure to submit a resume will result in a 10-point penalty.

**Your resume must be saved as a PDF file type using file name format of “Last Name\_First Name.”** For example, “Amanda Smith” would save her resume as **Smith\_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](#) for more information.

*Note*: Check the Competition Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

### PROHIBITED DEVICES

Cell phones or other electronic devices not approved by a competition’s national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

#### Penalties for Prohibited Devices

If a competitor’s electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the SkillsUSA Championships director. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor’s scores may be canceled.

## SCOPE OF THE COMPETITION

The competition will assess the ability to apply theoretical and practical knowledge of state-of-the-art electronic industry standards as determined by the International Society of Certified Electronics Technicians. Additionally, the competition also requires competitor proficiency of competencies listed by the National Coalition for Electronics Education — Basic Electronics. Competitors will demonstrate their ability to perform jobs or skills from the following list of competencies as determined by the SkillsUSA Championships technical committee, which includes NIDA Corporation Changes may occur as needs or standards are updated. Any modifications and or changes will be posted to the SkillsUSA website.

### KNOWLEDGE PERFORMANCE

The competition includes two written knowledge tests: a certified electronics technician exam and a customer service test. The exam is an industry-standard written test. This may change as needs or standards are updated. If there is a need to revise the exam, the change will be posted on the SkillsUSA website.

### SKILL PERFORMANCE

The skill performance portion of the competition will include circuit construction, soldering and circuit/system troubleshooting. Competitors will read and follow instructions, interpret circuit design drawings, analyze and identify circuit faults, solder various electronic components and properly use electronic components in accordance with their design specifications.

### COMPETITION GUIDELINES

1. Competitors will be provided with the characteristics, parameters and information to accomplish the assigned tasks.
2. Time limit:
  - a. Competitors will begin upon a signal from the timekeeper.
  - b. As soon as competitors have completed the assignment and are fully satisfied with the operation and quality of their work, they will signal the judge and stop their work. This signal will determine elapsed time and speed.
3. The completed projects will be tested by the judges for quality of work and operating specifications.

### STANDARDS AND COMPETENCIES

#### ET 1.0 — Interpret, record and report technical data from provided materials to related ISCED standards

- 1.1. Draw and interpret electronic schematics
- 1.2. Record data and design curves and graphs
- 1.3. Write reports
- 1.4. Maintain test logs
- 1.5. Make equipment failure reports
- 1.6. Specify and requisition simple electronic components

- 1.7. Compose technical letters
- 1.8. Write formal reports of laboratory experiences

**ET 2.0 — Apply knowledge of DC circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 2.1. Solve basic algebraic problems as applicable to electronics
- 2.2. Relate electricity to nature of matter
- 2.3. Identify sources of electricity
- 2.4. Define voltage, current, resistance, power and energy
- 2.5. Apply and relate Ohm's Law
- 2.6. Read and interpret color codes to identify resistors
- 2.7. Measure properties of a circuit using VOM and DVM meters
- 2.8. Compute and measure conductance and resistance of conductors and insulators
- 2.9. Analyze, construct and troubleshoot series circuits, parallel circuits, series-parallel circuits and voltage dividers
- 2.10. Solve network theorem problems using Kirchhoff, Thevenin, Norton, Superposition and Delta-Wye
- 2.11. Analyze, construct and troubleshoot maximum power transfer theory
- 2.12. Define magnetic properties of circuits and devices
- 2.13. Determine physical and electrical characteristics of capacitors and inductors
- 2.14. Analyze and measure RL and RC time constants
- 2.15. Set up and operate a VOM, DVM, power supplies and oscilloscopes for DC circuits

**ET 3.0 — Apply knowledge of AC circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 3.1. Solve basic trigonometric problems as applicable to electronics (prerequisite to AC)
- 3.2. Identify properties of an AC signal
- 3.3. Identify AC sources
- 3.4. Analyze and measure AC signals using oscilloscope, frequency meters and generators
- 3.5. Analyze, construct and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (Series, Parallel, Complex) series and parallel resonant circuits, filter circuits and polyphase circuits
- 3.6. Analyze basic motor theory and operation
- 3.7. Analyze basic generator theory and operation
- 3.8. Set up and operate VOM, DVM and power supplies for AC circuits
- 3.9. Set up and operate oscilloscopes, frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for AC circuits
- 3.10. Analyze and apply principles of transformers to AC circuits

**ET 4.0 — Apply knowledge of solid-state devices to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 4.1. Identify properties of semiconductor materials
- 4.2. Analyze and measure characteristics of P-N junction diodes
- 4.3. Analyze and measure characteristics of special diodes
- 4.4. Analyze, construct and troubleshoot diode circuits

- 4.5. Identify, define and measure characteristics of bipolar transistors, thyristors and integrated circuits
- 4.6. Set up and operate VOM, DVM and power supplies for solid state devices
- 4.7. Set up and operate oscilloscopes, frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for solid state devices
- 4.8. Set up and operate curve tracers and transistor testers

**ET 5.0 — Apply knowledge of analog circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 5.1. Analyze, construct and troubleshoot single-stage amplifiers, multi-stage amplifiers, basic power supplies and filters, power supply regulators, active filters, and oscillators
- 5.2. Analyze motor or phase control circuits
- 5.3. Set up and operate VOM, DVM and power supplies for analog circuits
- 5.4. Set up and operate oscilloscopes, frequency counters, signal generators, and capacitor-inductor analyzers for analog circuits
- 5.5. Set up and operate impedance bridges for analog circuits
- 5.6. Set up and operate recorders for analog circuits

**ET 6.0 — Apply knowledge of digital devices to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 6.1. Define and apply number systems to codes and arithmetic
- 6.2. Analyze, construct and troubleshoot logic gates, logic arithmetic circuits, flip-flops, and encoders and decoders
- 6.3. Identify, define and measure characteristics of IC logic families
- 6.4. Analyze, construct and troubleshoot registers and counters, clock and timing circuits, multiplexers and demultiplexers, digital to analog, and analog to digital
- 6.5. Analyze, construct and troubleshoot displays and representative digital systems
- 6.6. Set up and operate VOM, DVM and logic probes for digital devices
- 6.7. Set up and operate power supplies, pulsers, oscilloscopes, logic analyzers, signature analyzers, pulse generators, and counters for digital devices

**ET 7.0 — Apply knowledge of microprocessors to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET**

- 7.1. Analyze, construct and troubleshoot CPUs, BUS systems, memory systems and input/output ports, microprocessor applications and systems
- 7.2. Execute computer instruction sets
- 7.3. Analyze and troubleshoot microprocessor systems
- 7.4. Set up and operate VOM, DVM, power supplies, pulsers, oscilloscopes, logic/data analyzers, signature analyzers, pulse generators, and counters for microprocessing

**ET 8.0 — Use laboratory practices common to industry situation**

- 8.1. Demonstrate proper OSHA-related safety standards
- 8.2. Make electrical connections
- 8.3. Identify and use hand and power tools used in electronics technology
- 8.4. Utilize standard troubleshooting procedures for defective circuits

## **COMMITTEE IDENTIFIED ACADEMIC SKILLS**

### **Math Skills**

- Solve practical problems involving percents
- Solve single variable algebraic expressions
- Solve multiple variable algebraic expressions
- Make comparisons, predictions and inferences using graphs and charts

### **Science Skills**

- Plan and conduct a scientific investigation
- Use knowledge of the particle theory of matter
- Describe characteristics of types of matter based on physical and chemical properties
- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color)
- Use knowledge of classification of elements as metals, metalloids and nonmetals
- Understand Law of Conservation of Matter and Energy
- Describe phases of matter
- Describe and identify physical changes to matter
- Use knowledge of potential and kinetic energy
- Use knowledge of mechanical, chemical, and electrical energy
- Use knowledge of heat, light and sound energy
- Use knowledge of temperature scales, heat and heat transfer
- Use knowledge of work, force, mechanical advantage, efficiency and power
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices
- Use knowledge of principles of electricity and magnetism
- Use knowledge of static electricity, current electricity and circuits
- Use knowledge of magnetic fields and electromagnets
- Use knowledge of motors and generators

### **Language Arts Skills**

- Demonstrate comprehension of a variety of informational texts
- Use text structures to aid comprehension
- Demonstrate knowledge of appropriate reference materials
- Use print, electronic databases and online resources to access information in books and articles

## **CONNECTIONS TO NATIONAL STANDARDS**

State-level academic curriculum specialists identified the following connections to national academic standards.

### **Math Standards**

- Numbers and operations
- Algebra
- Geometry

- Measurement
- Data analysis and probability
- Problem solving
- Reasoning and proof

*Source: NCTM Principles and Standards for School Mathematics. For more information, visit: [www.nctm.org](http://www.nctm.org).*

### **Science Standards**

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific knowledge
- Understands the nature of scientific inquiry

*Source: McREL compendium of national science standards. To view and search the compendium, visit: [www2.mcrel.org/compendium/browse.asp](http://www2.mcrel.org/compendium/browse.asp).*

### **Language Arts Standards**

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts.
- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

**Source:** *IRA/NCTE Standards for the English Language Arts. To view the standards, visit: [www.ncte.org/standards](http://www.ncte.org/standards).*