

ROBOTICS AND AUTOMATION TECHNOLOGY BLUEPRINT

This Blueprint contains the subject matter content of this Skill Connect Assessment. This Blueprint does **NOT** contain the information one would need to fully prepare for a SkillsUSA Championships contest. Please refer to the *SkillsUSA Championships Technical Standards* CD-ROM for the current year or purchase and download the relevant "Contest Singles." Both are available through www.skillsusa.org > Shop > Educational Materials Catalog.

Standards and Competencies

Demonstrate knowledge in safety rules and practices

- Maintain a safe work area
- Demonstrate correct use of hand tools
- Follow safety rules during installation and layout of a robotic workcell
- Program robot with appropriate use of safety devices

Demonstrate ability to read and interpret electrical drawings

- Interpret electric circuits used in a robotic workcell
- Wire series and parallel electric circuits
- Set up and operate DVM

Produce examples of basic computer programming and flowcharting in a given scenario

- Draw program flow chart using appropriate symbols representing robot program
- Develop basic computer program to control robot and peripherals

Demonstrate electrical wiring in a robotic workcell

- Adhere to electrical and safety standards
- Use the appropriate hand tools and electrical wiring standards
- Wire and connect different types of sensors used in a workcell including contact and inductive proximity sensors
- Wire and connect output devices such as warning lights, solenoids and relays and pneumatic actuators

Install and adjust electro-pneumatic parts feeder and press

- Adhere to safety practices
- Use the appropriate hand tools and electric wiring standards
- Wire and connect sensors used in a workcell

Create appropriate documentation used in a robotic work cell

- Define and document all safety issues
- Document and describe system (workcell) layout
- Describe and document controller input and output devices including peripheral device connections, input, output, program positions, wiring diagrams and system layout

Write and verify a robot program

- Develop a flowchart that outlines a robot program based on customer specifications
- Develop a robot program based on customer specifications
- Use program subroutines, variables and appropriate program remarks when developing a robot program
- Design interfacing to input and output devices
- Document workcell positions and show the standards used

- Program the use of a pneumatic part feeder and press
- Program the use of a conveyor
- Demonstrate consideration for operation and maintenance of robot

Demonstrate professional development skills in a simulated customer-service or employment situation. Examples may include:

- Job interview
- Customer service scenario
- Communications
- Decision making, problem solving and/or critical thinking

Committee Identified Academic Skills

The SkillsUSA national technical committee has identified that the following academic skills are embedded in the robotics and automation technology training program and assessment:

Math Skills

- Use fractions to solve practical problems
- Use proportions and ratios to solve practical problems
- Simplify numerical expressions
- Use scientific notation
- Solve practical problems involving percentages
- Solve single variable algebraic expressions
- Solve multiple variable algebraic expressions
- Measure angles
- Apply transformations (rotate or turn, reflect or flip, translate or slide and dilate or scale) to geometric figures
- Construct three-dimensional models
- Make comparisons, predictions and inferences using graphs and charts
- Organize and describe data using matrixes
- Solve problems using proportions, formulas and functions
- Use measures of interior and exterior angles of polygons to solve problems
- Find arc length and the area of a sector

Science Skills

- Plan and conduct a scientific investigation
- 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 sound and technological applications of sound waves
- Use knowledge of the nature and technological applications of light
- Use knowledge of speed, velocity and acceleration
- Use knowledge of Newton's laws of motion
- 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

- Provide information in conversations and in group discussions
- Provide information in oral presentations

- Demonstrate use of verbal communication skills, such as word choice, pitch, feeling, tone and voice
- Demonstrate use of nonverbal communication skills, such as eye contact, posture and gestures using interviewing techniques to gain information
- Analyze mass media messages
- Demonstrate comprehension of a variety of informational texts
- Use text structures to aid comprehension
- Identify words and phrases that signal an author's organizational pattern to aid comprehension
- Understand source, viewpoint and purpose of texts
- Organize and synthesize information for use in written and oral presentations
- Demonstrate knowledge of appropriate reference materials
- Use print, electronic databases and online resources to access information in books and articles
- Demonstrate narrative writing
- Demonstrate informational writing
- Edit writing for correct grammar, capitalization, punctuation, spelling, sentence structure and paragraphing

Connections to National Standards

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

Math Standards

- Numbers and operations
- Algebra
- Measurement
- Problem solving
- Reasoning and proof
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. To view high school standards, visit: standards.nctm.org/document/chapter7/index.htm. Select "Standards" from menu.

Science Standards

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

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- 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 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.readwritethink.org/standards/index.html.