

Digital Electronics

Exam Information	Description
Exam number 652 Items 34 National Career Cluster Manufacturing Science, Technology, Engineering, & Mathematics Certification available Yes	This entry-level course provides a comprehensive introduction to the fundamentals of electricity and electronics. Learners will not only grasp core electrical principles (like voltage, current, and resistance) but will also develop essential hands-on skills. Learners will be proficient in tasks such as assembling basic electronic circuits, reading schematics, and safely operating standard electrical/electronic test and measurement equipment. This foundational knowledge directly supports careers in engineering, product development, and manufacturing.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Safety Practices	12%
2. Number Systems in Digital Electronics	27%
3. Logic Gates and Logic States	22%
4. Combinational Logic Circuits	27%
5. Microcontrollers	12%

*Includes performance skill evaluation

Standard 1 - Safety Practices

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

Objective 1 Candidates will demonstrate a habit of Electrical Safety.

1. Candidates will demonstrate safety while using test equipment.
2. Candidates will properly care and maintain test equipment.

Objective 2 Demonstrate safe use of a Soldering Iron

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

Objective 3 Candidates 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.

Optional: Standard performance evaluations on the final page of this document

Standard 2 - Number Systems In Digital Electronics

Candidates will learn to describe and demonstrate the use of different numbers of systems in digital electronics.

Objective 1 Understand the difference between analog and digital

Objective 2 Understand the analog and digital number systems used

1. Decimal number system – Analog
2. Binary number system – Digital

Objective 3 Convert between decimal and binary

Objective 4 Recognize the use of hexadecimal number systems in defining locations in memory

1. (Candidates must recognize where hexadecimal is used but does not need to understand how it is used)

Standard 3 - Logic Gates And Logic States

Candidates will understand the functions of typical logic gates and their logic states.

Objective 1 Describe the function of and create truth tables for typical logic gates.

1. AND, NAND
2. OR, NOR
3. XOR, XNOR
4. Buffer (YES), Inverter (NOT)

Objective 2 Understand the difference between TTL and CMOS digital logic circuits including advantages and disadvantages of using each.

Objective 3 Identify logic gates by their associated chip number

1. AND (7408)
2. NAND (7400)
3. OR (7432)
4. NOR (7402)
5. XOR (7486)
6. Buffer (YES) (7407)
7. Inverter (NOT) (7404)

Standard 4 - Combinational Logic Circuits

Candidates will understand, construct, and test combinational logic circuits

Objective 1 Given a digital design situation or schematic:

1. Develop a truth table for the digital design situation
2. Develop a Boolean Expression for the truth table.
3. Simplify the Boolean Expression as needed using various theorems and logical equivalencies (including
4. Karnaugh Maps).
5. Develop a combinational logic diagram of the digital logic gates needed to perform the function of the digital design situation.

Objective 2 Using simulation software, construct the combinational digital logic circuit and verify the operation of the digital design solution.

Objective 3 Construct a combinational logic circuit to verify the operation of the digital design solution.

Objective 4 Use a logic probe to test and verify logic levels in all parts of combinational logic circuits.

Standard 5 - Microcontrollers

Candidates will demonstrate an understanding of microcontrollers.

Objective 1 Candidates will learn how to use the basic elements of a programming language

1. Declare, initialize, and assign values to constants and variables.
2. Demonstrate the ability to use input and output commands.
3. Demonstrate the ability to make decisions with IF – THEN – ELSE statements
4. Create loops using commands like FOR, WHILE, SELECT, etc.
5. Troubleshoot bugs within a program

Objective 2 Candidates will use microcontrollers to control digital outputs

Objective 3 Candidates will use digital inputs and microcontrollers to control digital outputs

Objective 4 Candidates will use analog inputs and microcontrollers to control digital outputs

Objective 5 Candidates will use microcontrollers and Pulse Width Modulation to control analog outputs

Optional: Standard performance evaluations on the final page of this document

Performance Skills Evaluation

Exam name: Digital Electronics

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Standard 1 – Safety Practices • Candidates can complete a safety test without error (100%) before using any tools or shop equipment. • Candidates will demonstrate proper use of PPE. • Candidates will demonstrate safe practices while working with electricity.	Pass:
Standard 2 – Number Systems • Candidates can accurately convert between decimal and binary	Pass:
Standard 3 – Logic Gates and their Logic State • Given a logic gate diagram with associated binary inputs, candidates will be able to determine the logic outputs for the diagram. • Using simulation software, candidates will be able to recreate a given logic diagram and verify the operation of the logic diagram.	Pass:
Standard 4 – Combinational Logic Circuits • Candidates can design and construct a logic circuit to meet the needs of a design challenge • Candidates can use a logic probe to fix a broken/buggy logic circuit	Pass:
Standard 5 – Microcontrollers • Candidates can program a microcontroller • Candidates can use a microcontroller to control digital inputs and outputs • Candidates can use a microcontroller to control analog inputs and outputs	Pass:

Evaluator Name: _____

Date: _____