Digital Electronics

Exam Information

Exam number
652

Items
34

Points
41

Prerequisites
Electronics 1

Recommended course length
One semester

National Career Cluster
Manufacturing
Science, Technology, Engineering, & Mathematics

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Electronics 2 industry certification exam assesses learners' ability to apply technical knowledge and knowledge of skills to assemble and operate electrical/electronic equipment used in business, industry, and manufacturing. The exam includes training in safety, numbering systems, Boolean algebra, logic diagrams, digital devices, and combinational logic circuits.

Exam Blueprint

Standard	Percentage of exam
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%

Standard 1

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

Objective 1 Students will demonstrate a habit of Electrical Safety.

1. Students will demonstrate safety while using test equipment.
2. Students will properly care and maintenance of test equipment.

Objective 2 Demonstrate safe use of a Soldering Iron

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

Objective 3 Students 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.

Performance Skills

1. Students can complete a safety test without error (100%) before using any tools or shop equipment.
2. Students will demonstrate proper use of PPE.
3. Students will demonstrate safe practices while working with electricity.

Standard 1 Performance Evaluation included below (Optional)

Standard 2

Students will learn to describe and demonstrate the use of different number 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

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

Performance Skills

1. Students can accurately convert between decimal and binary

Standard 2 Performance Evaluation included below (Optional)

Standard 3

Students 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)

Performance Skills

1. Given a logic gate diagram with associated binary inputs, students will be able to determine the logic outputs for the diagram.
2. Using simulation software, students will be able to recreate a given logic diagram and verify the operation of the logic diagram.

Standard 3 Performance Evaluation included below (Optional)

Standard 4

Students will understand, construct, and test combinational logic circuits.

Objective 1 Given a digital design situation or schematic:

3. Develop a truth table for the digital design situation
4. Develop a Boolean Expression for the truth table.
5. Simplify the Boolean Expression as needed using various theorems and logical equivalencies (including
6. Karnaugh Maps).
7. 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.

Performance Skills

1. Students can design and construct a logic circuit to meet the needs of a design challenge
2. Students can use a logic probe to fix a broken/buggy logic circuit

Standard 4 Performance Evaluation included below (Optional)

Standard 5

Students will demonstrate an understanding of microcontrollers.

Objective 1 Students 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 Students will use microcontrollers to control digital outputs

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

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

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

Performance Skills

1. Students can program a microcontroller
2. Students can use a microcontroller to control digital inputs and outputs
3. Students can use a microcontroller to control analog inputs and outputs

Standard 5 Performance Evaluation included below (Optional)

Electronics 2

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Standard 1 – Safety Practices **Score:**

- Follow safety practices.

Standard 2 – Number Systems **Score:**

- Understand various number systems used in digital electronics
- Will practice communication skills through public speaking using one or more of the following activities: memorized speech, prepared speech, extemporaneous speech, parliamentary practice, group presentation, or serving in a leadership capacity.

Standard 3 – Logic Gates and their Logic States **Score:**

- Understand the functions of typical logic gates and their logic states.

Standard 4 – Combinational Logic Circuits **Score:**

- Understand, construct, and test combinational logic circuits.

Standard 5 – Sequential Logic Circuits **Score:**

- Understand, construct, and test sequential logic circuits.

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____