Engineering Principles 1

Exam Information

Exam number
601

Items
34

Points
51

Prerequisites
None

Recommended course length
One semester

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

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Engineering Principles 1 industry certification exam assesses the application of basic math and science principles used in engineering. Learners demonstrate their ability to tie observations and concepts common to a variety of engineering disciplines through problem-solving skills in a laboratory environment. The exam evaluates their understanding of fundamental principles and their knowledge of skills and attitudes that impact and expand occupational opportunities in the Engineering pathway.

Exam Blueprint

Standard	Percentage of exam
1. Safety Practices	8%
2. Career Opportunities	12%
3. Ethics, Communication, and Leadership Skills	12%
4. Engineering Design	29%
5. Civil Engineering	12%
6. Computer Engineering	14%
7. Bioengineering	14%

Standard 1

Students will follow safety practices.

Objective 1 Identify potential safety hazards and follow general laboratory safety practices.

1. Assess workplace conditions regarding safety and health.
2. Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/job site.
3. Locate and understand the use of shop safety equipment.
4. Select appropriate personal protective equipment.

Objective 2 Use safe work practices.

1. Use personal protective equipment according to manufacturer rules and regulations.
2. Follow correct procedures when using any hand or power tools.

Objective 3 Complete a basic safety test without errors (100%) before using any tools or shop equipment.

Standard 1 Performance Evaluation included below (Optional)

Standard 2

Students will investigate career opportunities within the world of Engineering.

Objective 1 Identify occupations related to Engineering.

Objective 2 Differentiate among various Engineering disciplines.

1. Bioengineering
2. Chemical Engineering
3. Civil & Environmental Engineering
4. Computer Engineering
5. Electrical Engineering
6. Mechanical Engineering
7. Materials Science

Objective 3 Investigate different types of occupational training and educational opportunities.

Standard 3

Students will understand and develop positive work ethics, communication skills, and leadership skills.

Objective 1 Demonstrate positive work ethics and leadership skills.

1. Responsibility
2. Reliability
3. Dependability
4. Effective Communication
5. Delegation
6. Cooperation
7. Teamwork
8. Integrity

Objective 2 Employ the Technology Student Association (TSA) student organization's program as an integral element of the curriculum.

Objective 3 Participate in problem-solving, both individually and as part of a team.

Objective 4 Understand the importance of interdisciplinary teams.

Objective 5 Take minutes of a team meeting.

Objective 6 Make accurately proportioned sketches using correct drawing conventions.

1. Notes are neat and legible
2. Objects should be drawn to correct proportions
3. Dimensions are used appropriately
4. Views can be isometric, orthogonal, sections, or assemblies

Objective 7 Create and utilize an engineering notebook per established conventions.

1. Sequential and chronological
2. Accurate and complete reflection of the progress being recorded
3. Sketches or pictures are included where appropriate
4. No loose entries or pages
5. Each page is dated and witnessed
6. Unused spaces are identified and lined out
7. Errors are not erased or obliterated
8. Test data and calculations are included

Standard 4

Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design process.

Objective 1 Identify the qualities of good design and their relationship to the design's user.

1. Examine a design concerning its quality and usability.
2. Understand that these qualities are the result of choices made and constraints applied during the design process.

Objective 2 Recognize and identify the role of engineering and engineered products in society.

Objective 3 Identify the requirements for and role of intellectual property in design.

Objective 4 Recall education requirements for professional success as a designer/engineer.

Objective 5 Identify and explain the elements of an engineering design process.

1. Identify & define the design problem
2. Brainstorm solutions
3. Create models & build a prototype
4. Test the prototype
5. Redesign and optimize

Objective 6 Understand the concept of a problem statement and design requirements.

Objective 7 Create design specifications considering such factors as:

1. Performance
2. Time and financial constraints
3. Ergonomics
4. Safety
5. The state-of-the art

Objective 8 Translate design requirements into a design solution.

Objective 9 Use brainstorming methods to identify solutions to a design problem.

Objective 10 Recognize and demonstrate that there are many possible successful designs and that a design process does not always result in a single best design.

Objective 11 Explain the role of and be able to utilize mathematical and functional modeling in the creation and assessment of a design.

Objective 12 Perform a design-of-experiments.

Objective 13 Build and test designs against design specifications, evaluate the results of those tests, and present their analyses.

Objective 14 Demonstrate that design is an iterative process, subject to continuous evolutionary improvement.

Standard 5

Students will understand ways in which Civil Engineering can enhance health and well-being of individuals.

Objective 1 Identify several different careers that support large-scale civil or environmental projects.

1. Transportation Engineering
2. Structural Engineering
3. Construction Engineering
4. Environmental Engineering
5. Geotechnical Engineering
6. Water Resources Engineering

Objective 2 Use idealized equations that are fundamental to Civil Engineering.

1. Hydrostatic pressure from density and height.
2. Flow velocity in an ideal (frictionless) system using Bernoulli's equation.
3. Internal forces in a simple truss structure

Objective 3 Describe how real-world factors change performance from the ideal to:

1. Water tower height affects pressure driving force.
2. Pressure driving force affects the flow rate from a pipe.
3. Fittings, bends, pipe length, and pipe diameter affect the flow rate in a pipe.

Objective 4 Work in teams to design and build a project related to Civil Engineering.

1. Water distribution network.
2. Tower building.

Objective 5 Write a reflection on the project.

1. What was the objective?
2. What worked?
3. What didn’t work and why didn’t it work?
4. How did the design compare with the best and worst performers?
5. What you would do differently?
6. Was the objective accomplished

Objective 6 Give a brief presentation on an existing or an emerging Civil Engineering technology.

Standard 6

Students will understand ways in which Computer Engineering can enhance health and well-being of individuals.

Objective 1 Identify several different careers that support the computer industry.

1. Computer hardware design
2. Network design
3. Network management
4. Programming
5. Systems support

Objective 2 Identify the main internal and external components of a computer.

1. Memory
2. Processor
3. Video and Sound
4. Input and Output Peripherals

Objective 3 Explain the basic components of a computer's programming design.

1. Purpose of software
2. Difference between software and data
3. Purpose of computer programming languages

Objective 4 Understand various elements of coding structure.

1. Explain the difference between a variable's name and its value.
2. Predict the results of code snippets that use:
    a. Variables
    b. Operators
    c. Branching structures
    d. Lopping structures
    e. Function calls

Objective 5 Work in teams to design and build a project related to Computer Engineering

1. Pinball game
2. Rehabilitation therapy game

Objective 6 Write a reflection on the project.

1. What was the objective?
2. What worked?
3. What didn't work and why didn't it work?
4. How did the design compare with the best and worst performers?

Objective 7 Give a brief presentation on an existing or an emerging Computer Engineering technology.

Standard 7

Students will understand ways in which Bioengineering can enhance the lives of individuals.

Objective 1 Identify several different careers that support bioengineering or Biomanufacturing.

1. Bioinstrumentation
2. Biomechanics
3. Biomaterials
4. Medical Imaging
5. Rehabilitation Engineering

6. Systems Physiology

Objective 2 Understand the role of specialists in solving bioengineering problems.

Objective 3 Work in teams to design and build a project related to Bioengineering.

Objective 4 Write a reflection of the project.

1. What was the objective?
2. What worked?
3. What didn't work and why didn't it work?
4. How did the design compare with the best and worst performers?
5. What you would do differently?
6. Was the objective accomplished?

Objective 5 Give a brief presentation on an existing or an emerging Bioengineering technology.

Engineering Principles 1

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

- Create and utilize an engineering notebook per established conventions.
- Demonstrate practice of the Technology & Engineering Professional Workplace Skills.
- Participate in a significant activity that provides each student with an opportunity to render service to others, employ leadership skills, or demonstrate skills they have learned through this course, preferably through participation in a Career & Technical Student Organization (CTSO) such as the Technology Student Association (TSA).

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____