
ENGINEERING SCIENCES, 15.0000.00

An Industry Standards Validation Committee developed and approved these standards on March 10, 2016. The Arizona Career and Technical Education Quality Commission, the validating authority for the Arizona Skills Standards Assessment System and the end-of-program assessments, certificates, and transcripts, endorsed these standards on May 12, 2016. The first testing date for the end-of-program assessment for Engineering Sciences using the new standards is Fall 2016.

STANDARD 1.0 INVESTIGATE ENGINEERING AS A HUMAN ENDEAVOR AIMED TO ADDRESS THE NEEDS OF A GLOBAL SOCIETY

- 1.1 Explain how engineering integrates many fields of study and may lead to other occupations
- 1.2 Debate the societal, legal, and ethical responsibilities of engineering
- 1.3 Determine the impact of engineering from multiple perspectives, i.e., economic, environmental, political, sustainable, and health and safety
- 1.4 Compare and contrast various disciplines of engineering and how each contributes to the success of a solution
- 1.5 Identify the skills and education needed to enter a particular engineering discipline

STANDARD 2.0 APPLY A STRUCTURED PROBLEM-SOLVING PROCESS TO CREATE SOLUTIONS

- 2.1 Determine the problem
- 2.2 Interpret the problem based on known facts, research, and experience
- 2.3 Brainstorm solutions to the problem
- 2.4 Identify design criteria and constraints (e.g., cost, time, quality, manufacturability, testability, maintainability, human and environmental factors, and governmental regulatory requirements)
- 2.5 Assess potential solutions against design criteria and constraints to select a solution that meets all requirements
- 2.6 Implement the selected solution
- 2.7 Validate the effectiveness of the implemented solution
- 2.8 Reiterate the process as necessary

STANDARD 3.0 APPLY MATHEMATICAL LAWS AND PRINCIPLES RELEVANT TO ENGINEERING AND TECHNOLOGY

- 3.1 Use appropriate data collection and analysis methods to display data (e.g., graphs, tables, formulas, and texts)
- 3.2 Use statistical measures of central tendency as needed in the structured problem-solving process
- 3.3 Use algebraic, geometric, and trigonometric relationships, characteristics, and properties to solve engineering problems
- 3.4 Evaluate the validity of mathematical solutions
- 3.5 Use existing mathematical models as needed in the structured problem-solving process
- 3.6 Use English and metric systems of measurement and dimensional analysis

STANDARD 4.0 APPLY FUNDAMENTAL SCIENTIFIC LAWS AND PRINCIPLES RELEVANT TO ENGINEERING AND TECHNOLOGY

- 4.1 Use the relationships among energy, work, and power to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems
- 4.2 Use Newton's Laws of Motion to analyze static and dynamic systems with and without the presence of external forces
- 4.3 Use the laws of conservation of energy, charge, and momentum to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems
- 4.4 Assess relevant properties of materials used in engineering projects, i.e., chemical, environmental, mechanical (tension, compression, torque), electrical, and physical

STANDARD 5.0 APPLY ENGINEERING TECHNOLOGY AND TOOLS

- 5.1 Use spreadsheets and other mathematical software to solve problems, model, and display data
- 5.2 Use measurement devices such as calipers, oscilloscopes, and digital multimeters to gather data for analysis
- 5.3 Apply precision, accuracy, and tolerance in measurement systems
- 5.4 Use 3D CAD software to model and analyze engineering solutions
- 5.5 Interpret graphical data such as plans, diagrams, and working drawings
- 5.6 Practice safe use of tools, machines, equipment, and materials

- 5.7 Verify calibration status of measurement tools
- 5.8 Fabricate models using multiple methods (e.g., 3D printing, metalwork, wood, and breadboards)

STANDARD 6.0 APPLY DOCUMENTATION AND COMMUNICATION SKILLS

- 6.1 Demonstrate accurate documentation of data and results
- 6.2 Communicate status, assumptions, results, and conclusions using written and oral techniques

STANDARD 7.0 DEVELOP A PROJECT MANAGEMENT PLAN TO IMPLEMENT A SOLUTION

- 7.1 Estimate tasks and time needed to implement a solution
- 7.2 Identify resources needed (e.g., materials, funding, people, and approval)
- 7.3 Demonstrate the use of automated tools used to create project management plans
- 7.4 Track progress from implementation to completion using the project management plan