

# Missouri Educator Gateway Assessments

## FIELD 046: TECHNOLOGY & ENGINEERING TEST FRAMEWORK

January 2014

**DRAFT**

<b>Content Domain</b>	<b>Range of Competencies</b>	<b>Approximate Percentage of Test Score</b>
I. Core Principles of Technology and Engineering Design	0001–0004	24%
II. Information and Communication Systems	0005–0007	17%
III. Energy, Power, and Transportation Systems	0008–0010	17%
IV. Materials, Manufacturing, and Construction Systems	0011–0013	17%
V. Medical and Biotechnologies	0014–0015	12%
VI. Fundamentals of Technology Education	0016–0017	13%

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**TEST FRAMEWORK**  
**FIELD 046: TECHNOLOGY & ENGINEERING**

**CORE PRINCIPLES OF TECHNOLOGY AND ENGINEERING DESIGN**

**0001 Understand the nature of technology.**

For example:

- 1.1 Describe the role of technology in solving problems.
- 1.2 Identify factors that affect the development of technology.
- 1.3 Analyze types and properties (e.g., open loop, closed loop) of technological systems.
- 1.4 Analyze the relationship between technology, STEM, and other disciplines.

**0002 Understand interrelationships between technology and society.**

For example:

- 2.1 Identify significant events and individuals in the historical development of technology.
- 2.2 Analyze the interrelationships between technology and social, cultural, and political factors.
- 2.3 Analyze interrelationships between economics and technological innovation.
- 2.4 Demonstrate knowledge of environmental issues related to the development and use of technology.

**0003 Understand technological and engineering design.**

For example:

- 3.1 Demonstrate knowledge of the nature of design (e.g., trade-offs, optimization, aesthetics, visionary thinking).
- 3.2 Apply concepts associated with research and development, invention and innovation, and experimentation.
- 3.3 Identify steps in the iterative design process.
- 3.4 Apply characteristics of the iterative design process to solve problems.

## **FIELD 046: TECHNOLOGY & ENGINEERING TEST FRAMEWORK**

### **0004 Understand abilities for a technological world.**

For example:

- 4.1 Demonstrate knowledge of the correct and safe operation of tools and machines.
- 4.2 Select an appropriate tool or machine for a given purpose.
- 4.3 Demonstrate knowledge of measurement units and instruments.
- 4.4 Apply principles of troubleshooting to ensure safe and proper operation of technological systems.
- 4.5 Demonstrate knowledge of procedures for maintaining technological systems.
- 4.6 Demonstrate knowledge of federal and state health and safety regulations and agencies (e.g., OSHA, EPA, DNR).

## **INFORMATION AND COMMUNICATION SYSTEMS**

### **0005 Understand principles of information processing.**

For example:

- 5.1 Describe fundamental communication principles, models, and processes.
- 5.2 Analyze communication systems and their components (e.g., source, encoder, receiver).
- 5.3 Describe the characteristics of a variety of communication systems and technologies (e.g., printing, television, wireless).
- 5.4 Analyze fundamental principles of digital information processing (e.g., computer networks, protocols).

### **0006 Understand drafting and graphic communication.**

For example:

- 6.1 Apply knowledge of the types of drawings used in graphic design and drafting (e.g., thumbnail, isometric, orthographic).
- 6.2 Apply knowledge of the elements (e.g., color, shape) and principles (e.g., proportion, balance, symmetry) of graphic design.
- 6.3 Identify and apply drafting concepts (e.g., drafting tools, alphabet of lines).
- 6.4 Demonstrate knowledge of computer-aided design (CAD).
- 6.5 Apply a variety of processes (e.g., storyboarding, image processing) in the design and creation of communication products.

**FIELD 046: TECHNOLOGY & ENGINEERING  
TEST FRAMEWORK**

**0007 Understand principles of electronic communication.**

For example:

- 7.1 Apply concepts of electronics (e.g., voltage, resistance, energy) to analyze series and parallel circuits and interpret schematics.
- 7.2 Analyze characteristics of electromagnetic waves and analog communication systems.
- 7.3 Analyze characteristics of digital circuits and digital communication systems.
- 7.4 Analyze characteristics of a variety of electronic communication systems (e.g., telephone, satellite, radio, computer).

**ENERGY, POWER, AND TRANSPORTATIONS SYSTEMS**

**0008 Understand principles of energy and power.**

For example:

- 8.1 Apply concepts of work, potential energy, kinetic energy, and power.
- 8.2 Demonstrate knowledge of renewable and nonrenewable energy sources.
- 8.3 Analyze mechanical power systems and their components (e.g., pulleys and belts, gear systems).
- 8.4 Analyze fluid power systems and their components (e.g., pumps, valves, actuators).
- 8.5 Apply basic principles of electricity and magnetism to energy systems (e.g., relays, motors, generators).

**0009 Understand energy and power technologies.**

For example:

- 9.1 Analyze energy and power conversion devices (e.g., transducers, turbines, engines).
- 9.2 Apply knowledge of electrical power generating systems (e.g., steam, solar, nuclear, geothermal).
- 9.3 Apply knowledge of technologies and processes for the transmission and control of power and energy.
- 9.4 Demonstrate knowledge of robotic systems.

**FIELD 046: TECHNOLOGY & ENGINEERING  
TEST FRAMEWORK**

**0010 Understand transportation technologies.**

For example:

- 10.1 Analyze the general features of transportation systems and processes (e.g., safety, managing, holding).
- 10.2 Analyze characteristics of vehicular systems and their subsystems (e.g., suspension, propulsion).
- 10.3 Analyze characteristics of land, air, water, and space transportation systems and their subsystems.
- 10.4 Describe characteristics of intermodal transportation systems.

**MATERIALS, MANUFACTURING, AND CONSTRUCTION SYSTEMS**

**0011 Understand properties of materials.**

For example:

- 11.1 Demonstrate knowledge of the atomic structure of materials.
- 11.2 Analyze physical and mechanical (e.g., elasticity, plasticity, ductility) properties of materials.
- 11.3 Analyze properties and characteristics of materials used in technology and engineering (i.e., metals, ceramics, polymers, composites).
- 11.4 Select an appropriate material for a given purpose.

**0012 Understand manufacturing technologies.**

For example:

- 12.1 Apply knowledge of manufacturing processes (e.g., separating, forming, finishing).
- 12.2 Apply knowledge of tools and machines used in manufacturing (e.g., milling machine, CNC).
- 12.3 Apply knowledge of manufacturing production systems (e.g., mass manufacturing, job lot, lean).
- 12.4 Demonstrate knowledge of trends in manufacturing (e.g., globalization, microfabrication) and quality control.

## **FIELD 046: TECHNOLOGY & ENGINEERING TEST FRAMEWORK**

### **0013 Understand construction technologies.**

For example:

- 13.1 Apply knowledge of legal issues related to construction (e.g., zoning, building codes).
- 13.2 Analyze structural properties of various construction designs (e.g., truss, beam) and structures (e.g., bridge, arch).
- 13.3 Apply knowledge of construction processes (e.g., scheduling, subcontracting, inspecting).
- 13.4 Apply knowledge of construction systems (e.g., foundation, wall, plumbing).
- 13.5 Apply knowledge of materials, tools, and equipment used in construction.

## **MEDICAL AND BIOTECHNOLOGIES**

### **0014 Understand fundamentals of agriculture and related biotechnologies.**

For example:

- 14.1 Demonstrate knowledge of basic biology concepts (e.g., cells, DNA, ecosystems).
- 14.2 Demonstrate knowledge of basic biological processes (e.g., photosynthesis, fermentation).
- 14.3 Demonstrate knowledge of tools and equipment used in agriculture.
- 14.4 Demonstrate knowledge of applications of biotechnology in agriculture (e.g., biofuels, disease resistant crops).

### **0015 Understand fundamentals of medical technologies.**

For example:

- 15.1 Demonstrate knowledge of how various medical technologies combat sickness and disease (e.g., vaccines, antibiotics).
- 15.2 Demonstrate knowledge of various medical devices (e.g., stethoscope, blood pressure meter) and their operation.
- 15.3 Describe knowledge of fundamental concepts of genetic engineering.
- 15.4 Apply knowledge of the design process to solve problems involving medical technologies.
- 15.5 Demonstrate knowledge of social and ethical issues involving biotechnical and medical technologies.

**FIELD 046: TECHNOLOGY & ENGINEERING  
TEST FRAMEWORK**

**FUNDAMENTALS OF TECHNOLOGY EDUCATION**

**0016 Understand careers and career development.**

For example:

- 16.1 Identify career opportunities in industry and technology and engineering.
- 16.2 Apply knowledge of sources of information about technology careers; and personal interests, education, and experience needed for careers in technology and engineering.
- 16.3 Apply knowledge of career-planning strategies and skills related to job search and job acquisition.
- 16.4 Demonstrate knowledge of career, technical, student, and professional organizations related to technology engineering.

**0017 Understand instruction and assessment in technology education.**

For example:

- 17.1 Demonstrate knowledge of safety practices in the technology engineering laboratory.
- 17.2 Apply strategies for providing all students with opportunities to integrate science, mathematics, and technology to solve engineering design problems.
- 17.4 Demonstrate knowledge of strategies (e.g., differentiated instruction) for providing all students with opportunities to transform ideas into products that satisfy specific requirements.
- 17.5 Demonstrate knowledge of strategies for assessing student learning.