Engineering Science

PRE-TEST/POST-TEST TEKS BLUEPRINT

Pre-Test/Post-Test Development Overview

TEKS Addressed Selection Process

The Texas Essential Knowledge & Skills (TEKS) included in the course pre-test and post-test were selected for their direct relevance to the course content. This selection process was guided by the goal of assessing learners' understanding of specific topics and skills that are integral to the course. As a result, TEKS related to general employability skills or broader topics were often excluded. This focus ensures that the assessments accurately measure students' mastery of the subject matter, allowing educators to gain a clear insight into areas where students excel or may need additional support. By concentrating on content-specific TEKS, the tests provide a more precise evaluation of the students' knowledge and understanding of the core material.

Test Question Development Process

The questions created for the pre-test and post-test were designed using psychometric principles to ensure they are of high quality and fairness. This approach helps to accurately assess student understanding. These principles guide the development of questions to be reliable, valid, and free from bias, ensuring that they effectively measure the knowledge and skills the students are expected to acquire in the course.

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Knowledge & Skills Statement	Student Expectation	iCEV Lesson Title
(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;	Conducting Lab & Field Investigations: Engineering Science
(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	(D) use appropriate tools such as such as dial caliper, micrometer, protractor, compass, scale rulers, multimeter, circuit components, etc.;	Tools & Equipment in Engineering Science
(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;	Conducting Lab & Field Investigations: Engineering Science
(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs and charts;	Conducting Lab & Field Investigations: Engineering Science
(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	(H) distinguish among scientific hypotheses, theories, and laws.	Science Explained: Engineering Science
(3) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:	(A) identify advantages and limitations of models such as their size, scale, properties, and materials;	Developing A Model: Engineering Science
(3) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:	(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	Analyzing Data: Engineering Science
(3) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:	(D) evaluate experimental and engineering designs.	Experimental Design: Engineering Science
(4) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:	(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	Communicating Findings in Engineering Science
(5) Scientific and engineering practices. The student knows the contributions of scientists and engineers recognizes the importance of scientific research and innovation on society. The student is expected to:	(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and	Impact of Science: Engineering Science
(6) The student investigates engineering related fields and career opportunities. The student is expected to:	(C) identify and differentiate between the different engineering disciplines; and	Introduction to Engineering Science
(7) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(A) solve design problems individually and in a team;	Solving Design Problems

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(7) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(C) use a design brief to identify problem specifications and establish project constraints;	Solving Design Problems
(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, including gears, sprockets, pulley systems, and simple machines;	Principles of Machines
(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(C) distinguish between the six simple machines and their attributes and components;	Principles of Machines
(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(D) measure forces and distances related to a mechanism;	Principles of Machines
(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(F) determine experimentally the efficiency of mechanical systems; and	Principles of Machines
(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(G) calculate mechanical advantage and drive ratios of mechanisms	Principles of Machines
(9) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(B) define and calculate work and power in electrical systems;	Principles of Energy
(9) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(C) calculate and explain how power in a system that converts energy from electrical to mechanical; and	Principles of Energy
(9) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law.	Principles of Energy
(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(A) explain the purpose of energy management;	Principles of Energy Management
(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(C) explain and design how multiple energy sources can be combined to convert energy into useful forms;	Principles of Energy Management
(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(D) describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity;	Principles of Energy Management

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(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	Principles of Energy Management
(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(F) analyze how thermal energy transfer is affected by conduction, thermal resistance values, convection, and radiation; and	Principles of Energy Management
(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(B) locate the centroid of structural members mathematically or experimentally	Principles of Force
(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(E) differentiate between scalar and vector quantities	Principles of Force
(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(F) identify properties of a vector, including magnitude and direction;	Principles of Force
(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(G) calculate the X and Y components given a vector:	Principles of Force
(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(H) calculate moment forces given a specified axis;	Principles of Force
(12) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(A) conduct investigative non-destructive material property tests on selected common household products	Advanced Material Properties
(12) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products; and	Advanced Material Properties
(13) The student uses material testing to determine a product's function and performance. The student is expected to:	(A) use a design process and mathematical formulas to solve and document design problems	Conducting Lab & Field Investigations: Engineering Science
(13) The student uses material testing to determine a product's function and performance. The student is expected to:	(D) identify and calculate test sample material properties using a stress-strain curve; and	Advanced Material Properties
(13) The student uses material testing to determine a product's function and performance. The student is expected to:	(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data	Advanced Material Properties
(14) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(A) create detailed flowcharts using a computer software application;	Advanced Control Systems
(14) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(B) create control system operating programs using computer software;	Advanced Control Systems

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(14) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(D) select appropriate input and output devices based on the need of a technological system; and	Advanced Control Systems
(15) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(A) identify and explain basic components and functions of fluid power devices;	Fluid Power Systems
(15) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(B) differentiate between pneumatic and hydraulic systems and between hydrodynamic and hydrostatic systems;	Fluid Power Systems
(15) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(C) use Pascal's Law to calculate values in a fluid power system;	Fluid Power Systems
(15) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(F) calculate and experiment with flow rate, flow velocity, and mechanical advantage in a hydraulic system model.	Fluid Power Systems
(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate and test the theoretical probability that an event will occur	Mathematic Principles: Statistics & Probability
(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(C) apply the Bernoulli process to events that only have two distinct possible outcomes;	Mathematic Principles: Statistics & Probability
(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(E) apply Bayes's theorem to calculate the probability of multiple events occurring;	Mathematic Principles: Statistics & Probability
(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(G) calculate data variation, including range, standard deviation, and variance; and	Mathematic Principles: Statistics & Probability
(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(H) create and explain a histogram to illustrate frequency distribution.	Mathematic Principles: Statistics & Probability
(17) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real world engineering design problems. The student is expected to:	(B) calculate experimentally the acceleration due to gravity given data from a free-fall device;	Principles of Kinematics
(17) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real world engineering design problems. The student is expected to:	(D) determine and test the angle needed to launch a projectile a specific range given the projectile's initial velocity.	Principles of Kinematics