Career and Technical Education TEKS Review Draft Recommendations

Texas Essential Knowledge and Skills (TEKS) for Career and Technical Education Draft Recommendations

Programming for Engineers Work Group

Courses: Programming for Engineers

The document reflects the draft recommendations to the career and technical education (CTE) Texas Essential Knowledge and Skills (TEKS) that have been recommended by the State Board of Education's TEKS review work group for: **Programming for Engineers.**

Proposed additions and new courses are shown in green font with underline (additions). Proposed deletions are shown in red font with strikethroughs (~~deletions~~). Text proposed to be moved from its current student expectation is shown in purple italicized font with strikethrough (~~*moved text*~~) and is shown in the proposed new location in purple italicized font with underlines (*new text location*). Numbering for the knowledge and skills statements in the document will be finalized when the proposal is prepared to file with the *Texas Register*.

Comments in the right-hand column provide explanations for the proposed changes. The following notations may be used as part of the explanations.

Abbreviation	Description
CCRS	refers to the College and Career Readiness Standards
CDS	refers to cross disciplinary standards in the CCRS
ELA	refers to English language arts standards in the CCRS
M	refers to mathematics standards in the CCRS
SCI	refers to science standards in the CCRS
SS	refers to social studies standards in the CCRS
KS	refers to knowledge and skills statement
SE	refers to student expectation

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§127.XX Programming for Engineers (One Credit), Adopted 2025.		
	TEKS with edits	Work Group Comments/Rationale
(a)	Implementation. The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.	
(b)	General requirements. This course is recommended for students in Grades 9-12. Prerequisite: Algebra I and Principles of Applied Engineering, Physics for Engineering, Introduction to Computer-Aided Design and Drafting, Introduction to Engineering Design, or Engineering Essentials. Recommended prerequisite: None.	
(c)	Introduction.	
(1)	Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.	
(2)	The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining of machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and to mapping technician.	
(3)	Students enrolled in Programming for Engineers will focus on understanding, writing, evaluating and troubleshooting code to solve engineering problems. Students will use the engineering process and computational thinking to write computer programs for real-world solutions. Student will explore autonomous systems, sensors, and careers to integrate computational thinking within their engineering mindset. Students will spend at least 40% of the instructional time completing hands-on, real-world projects.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(d)	Knowledge and skills.	

(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;	
(B)	analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;	
(C)	present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;	
(D)	use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results independently and in groups;	
(E)	describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;	
(F)	explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers applies to engineering practice;	
(G)	demonstrate respect for diversity in the workplace;	
(H)	identify consequences relating to discrimination, harassment, and inequality;	
(I)	analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;	
(J)	identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and	
(K)	compare skills and characteristics of managers and leaders in the workplace.	
(2)	The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:	
(A)	describe and implement the stages of an engineering design process to construct a model;	
(B)	explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, and technology, impact stages of the engineering design process;	

(C)	explain how stakeholders impact an engineering design process; and	
(D)	analyze how failure is often an essential component of the engineering design process.	
(3)	The student explores the methods and aspects of project management in relation to projects. The student is expected to:	
(A)	research and explain the process and phases of project management, including initiating and planning; executing; and closing;	
(B)	explain the roles and responsibilities of team members, including project managers and leads;	
(C)	research and evaluate methods and tools available for managing a project;	
(D)	discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;	
(E)	describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;	
(F)	explain how a project budget is developed and maintained, including materials, equipment, and labor; and	
(G)	describe the importance of management of change (MOC) and how it applies to project planning.	
(4)	Computational thinking--foundations. The student explores the core concepts of computational thinking related to engineering solutions, a set of problem-solving processes that involve decomposition, pattern recognition, abstraction, and algorithms. The student is expected to:	
(A)	decompose real-world engineering problems into structured parts by using visual representation;	
(B)	analyze and use industry specific symbols, patterns and sequences found in visual representations such as flow-charts, pseudocode, concept maps, or other representations of data;	
(C)	define and practice abstraction in the context of writing a program to solve an engineering problem;	
(D)	design a plan collaboratively using visual representation to document a problem, possible solutions, and an expected timeline for the development of a coded engineering solution;	
(E)	analyze different techniques used in debugging and apply them to an algorithm;	

(F)	analyze the benefits of using iteration (code and sequence repetition) in algorithms, including loops and functions;	
(G)	define and analyze Boolean expressions;	
(H)	define and analyze conditional statements;	
(I)	write code that uses conditional statements such as if, then, while, and else;	
(J)	compare the differences between scripting and programming languages, for example interpretation versus compiling; and	
(K)	define and demonstrate when to use a compiler and editor for programming design.	
(5)	Computational thinking--applications. The student applies the fundamentals of programming within the context of engineering. The student is expected to:	
(A)	analyze how programming parallels the iterative design within the engineering design process such as problem solving and critical thinking illustrated in an engineering notebook;	
(B)	modify and implement previously written code to develop improved programs;	
(C)	solve an engineering problem by creating block-based and text-based programs that include sequences, functions, loops, conditionals, and events;	
(D)	define and label variables that relate to their programming or algorithm;	
(E)	manipulate and rename variables and describe different data types;	
(F)	write comments while coding programs within the context of engineering solutions to enhance readability and functionality, including descriptive identifiers, internal comments, white space, spacing, punctuation, indentation and standardized programming style;	
(G)	write code that uses comparison operators such as greater than, less than, equal to, and modulus to perform mathematical computations;	
(H)	write code that uses strings to sort types of data such as Boolean, floats, and integers; and	
(I)	perform user testing on code to assess and improve their program.	

(6)	The student understands physical computing systems to integrate input and output functions in engineering concepts. The student is expected to:	
(A)	write programming to process data and control physical devices for efficient and optimized solutions;	
(B)	apply coding to demonstrate the correct operation of the output device such as motors, video displays, speakers, rapid prototype machines, and lights;	
(C)	apply coding to demonstrate the correct operation of the input device such as buttons, sensors, and switches;	
(D)	apply critical problem-solving skills to troubleshoot any errors and miscommunication such as wiring, code and physical hardware;	
(E)	demonstrate basic circuit theory as it pertains ground and power systems for input and output devices and use tools such as a multimeters, microcontrollers, sensors, and LEDs; and	
(F)	demonstrate script writing and its importance automating input and output devices to develop engineering solutions such as automatic data collecting, data analysis, programmable logic controllers, power system programming, robotics, and scripting for commercial engineering related software.	
(7)	The student understands the roles of sensors and programming sensors in engineering. The student is expected to:	
(A)	identify and describe how sensors were used in past and used currently in real-world engineered products, including new and innovative methods for sensors;	
(B)	identify and describe the proper input sensors to measure light, distance, sound, and color such as photoresistors, thermistors, sonar, switches, and buttons;	
(C)	identify and analyze the specifications of sensors and other input devices used in engineering problems, including units of measurement, upper limits, lower limits, and errors;	
(D)	differentiate the proper sensor and defend their choice in developing a solution to an engineering problem;	
(E)	write code that will control the sensors and accurately collect information pertaining to the function of the sensor;	
(F)	debug, asses, and test code to evaluate and improve sensor performance; and	
(G)	document the steps of sensor integration in an engineering notebook such as flowcharts and technical drawings.	
(8)	The student understands how automation plays a role in engineering and manufacturing. The student is excepted to:	

(A)	research and define how automated machines are used in engineering and manufacturing;	
(B)	define and present on the different job roles and required level of education in the field of automation;	
(C)	compare the roles of engineers, technicians, and technologists in automation;	
(D)	describe the role of safety and ethics among automation within engineering; and	
(E)	convert a manual mechanical system to an automated system using code and hardware.	
(9)	The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	
(A)	master relevant safety tests;	
(B)	follow lab safety guidelines as prescribed by instructor in compliance with local, state, and federal regulations;	
(C)	recognize the classification of hazardous materials and wastes;	
(D)	dispose of hazardous materials and wastes appropriately;	
(E)	maintain, safely handle, and properly store laboratory equipment;	
(F)	describe the implications of negligent or improper maintenance;	
(G)	demonstrate the use of precision measuring instrument;	
(H)	identify areas where quality, reliability, and safety can be designed into a circuit;	
(I)	identify governmental and organizational regulations for health and safety in the workplace related to electronics; and	
(J)	identify areas where quality, reliability, and safety can be designed into a product.	