Career and Technical Education TEKS Review Draft Recommendations

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

Engineering Foundations-Design Work Group

Courses: Engineering Design Process, Engineering Design and Presentation I, Engineering Design and Presentation II, Engineering Design and Problem Solving

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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: **Engineering Design Process, Engineering Design and Presentation I, Engineering Design and Presentation II, and Engineering Design and Problem Solving.**

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 Engineering Design Process (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 9-10. Prerequisite: Algebra I; Recommended prerequisite:	9-10, Recommended prereq: Algebra I, Level I Engineering Course
(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 Engineering Design Process will transition from teacher given engineering problems to problems that students find independently and creating solutions.	
(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:	New employability strand
(A)	explain the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;	

(B)	describe teamwork, group dynamics, and conflict resolution and how they can impact the collective outcome;	
(C)	present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences;	
(D)	identify time-management skills such as prioritizing tasks, following schedules, and tending to goal-relevant activities and how these practices optimize efficiency and results;	
(E)	define work ethic and discuss the characteristics of a positive work ethic, including punctuality, dependability, reliability, and responsibility for reporting for duty and performing assigned tasks;	
(F)	discuss the importance of professionalism and ethics in engineering design as defined by professional organizations such as the National Society of Professional Engineers;	
(G)	demonstrate respect for diversity in the workplace;	
(H)	identify consequences relating to discrimination, harassment, and inequality;	
(I)	identify and discuss elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers;	
(J)	discuss the importance of safety in the workplace and why it is critical for employees and employers to maintain a safe work environment; and	
(K)	describe the roles and responsibilities of managers.	
(2)	The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:	Engineering design process strand
(A)	explain the importance of defining an engineering problem as an initial step in the engineering design process;	CCRS SCI I.A.3
(B)	describe the research stage of the engineering design process;	CCRS SCI III.B.1; III.B.3; III.D.1; III.D.2; IV.B.1
(C)	define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;	
(D)	explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;	
(E)	describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;	

(F)	describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;	CCRS SCI I.A.4; I.B.1; III.B.2
(G)	explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and	
(H)	describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.	CCRS SCI I.E.1; III.C.1
(3)	The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:	CCRS SCI I.C.1
(A)	discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;	
(B)	identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;	
(C)	define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;	
(D)	identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and	
(E)	identify strategies to solve problems and describe how problem-solving is utilized to accomplish personal and team objectives.	
(4)	The student understands the foundations of occupational safety and health. The student is expected to:	CCRS SCI I.C.2; I.C.3
(A)	explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;	
(B)	explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;	
(C)	identify and explain the appropriate use of types of personal protective equipment used in industry;	
(D)	discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;	
(E)	describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace; and	
(F)	identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace.	

(5)	The student understands the value of maintaining documentation using an engineering notebook. The student is expected to:	CCRS SCI III.A.1
(A)	explain the purpose and legal value of maintaining an engineering notebook as intellectual property;	
(B)	describe the proper implementation of an engineering notebook, including notebook type, documentation, signatures, adding external materials, sealing, and dating;	And purpose
(C)	create and maintain an engineering notebook by recording ideas, notes, decisions, findings, and corrections; including deficiencies in the design process, and decisions throughout the entire design process; and	
(D)	communicate progress during the engineering design process at regular intervals using various methods such as written reports, informal presentations, and formal presentations.	
(6)	The student understands how to conduct research in the engineering design process. The student is expected to:	CCRS SCI III.B.1; III.B.3
(A)	explain the advantages and disadvantages of emerging technologies and practices in the research process;	CCRS SCI IV.B.1
(B)	explain the importance of identifying and synthesizing information from a variety of sources in the research process;	CCRS SCI III.D.2
(C)	explain the ethical acquisition and use of digital information;	CCRS SCI I.D.1; III.D.1; IV.B.1-2
(D)	explain how to use and cite source material ethically and appropriately;	CCRS SCI IV.B.1
(E)	define and discuss intellectual property laws such as patents, copyrights, and proprietary information in the research process; and	
(F)	identify limitations in the research process.	
(7)	The student understands the process of creating and refining a problem statement in the engineering design process. The student is expected to:	Create a problem statement, who/when/where/why/how; details of the problem, real or simulated; Properly formulating questions; include real or simulated budgets; design brief is a live document
(A)	explain the essential components of a problem statement such as who the problem affects, when it is a problem, where the problem happens, and the magnitude of the problem;	
(B)	describe different methods for creating and refining a problem statement such as questioning, observation, and stakeholder needs;	

(C)	create a problem statement that is concise, specific, and measurable;	
(D)	collect, analyze, and interpret information relevant to a problem statement;	CCRS SCI III.D.2
(E)	modify a problem statement as necessary based on information acquired from using processes or various analysis tools such as fishbone charts, root-cause analysis, 80-20 rule, heat maps, survey results, and end-user input;	
(F)	explain the purpose of a technical document that brings together the objectives, constraints, data, alternatives, and design solutions such as a design brief or design basis, in the engineering design process; and	CCRS SCI III.C.1
(G)	compile a technical document that includes a problem statement, constraints, resources, budget, timeline, deliverables, and solution criteria such as quality, risk, and extent to which problem is solved.	CCRS SCI II.A.7; III.A.1; III.C.1
(8)	The student understands the importance of conceptualizing a solution in the engineering design process. The student is expected to:	
(A)	discuss the importance of creativity in engineering, innovation, and problem solving;	
(B)	explain and use various techniques for idea generation such as brainstorming, mapping, storyboarding, sketching, questioning, reverse engineering, natural solutions, to create solution concepts;	
(C)	explain the similarities and differences between designing a solution in the classroom versus a solution in the real world;	
(D)	analyze and evaluate solutions using the criteria established from a technical document;	
(E)	explain the importance of capturing stakeholder feedback to refine solution concepts; and	
(F)	explain and use various techniques for gathering end-user input such as focus groups, interviews, and surveys to refine solution concepts.	
(9)	The student creates technical drawings in the engineering design process. The student is expected to:	Create Materials List for Prototype; Virtual Prototype; Prototype by hand, machine, or both CCRS SCI V.E.1-2
(A)	explain the role of freehand sketching, freehand modeling, technical drawing, and technical modeling in the development of a prototype or solution;	
(B)	create nontechnical representations such as sketches, drawings, or models of a solution with relevant annotations;	

(C)	use a nontechnical representation of a solution to develop a technical model of the solution; and	
(D)	create technical drawings, including single-view projections, multi-view projections, and orthographic views, using industry standards.	
(10)	The student creates prototypes in the engineering design process. The student is expected to:	
(A)	explain the role of prototypes in the development of a solution;	
(B)	identify and describe the steps needed to produce a prototype;	
(C)	identify and use appropriate tools, equipment, machines, and materials to produce the prototype; and	
(D)	present the prototype using presentation software.	CCRS SCI III.C.1
(11)	The student tests and evaluates a prototype or solution using experiments, data, and end-user feedback. The student is expected to:	CCRS SCI III.B.2; V.E.1-2
(A)	explain the purpose of conducting tests on a prototype or solution;	
(B)	design appropriate protocols for testing a prototype or solution;	
(C)	analyze, evaluate, and critique a prototype or solution by using observational and experimental testing, empirical evidence, and statistical analysis;	CCRS SCI I.A.4
(D)	collect end-user feedback using appropriate protocols such as focus groups, interviews, and surveys to evaluate a prototype or solution; and	
(E)	identify the successes and failures of a prototype or solution based on the criteria established in the testing protocols and technical document to determine next steps in the engineering design process.	
(12)	The student understands the iterative nature of the engineering design process to develop a solution. The student is expected to:	CCRS SCI II.A.6-7
(A)	analyze design flaws of a prototype or solution using various tools such as fishbone charts, root-cause analysis, 80-20 rule, heat maps, survey results, and end-user feedback;	
(B)	iterate steps of the design process, as necessary, to improve and optimize a solution; and	
(C)	evaluate the potential impact of a solution on the original problem identified during the design process.	

(13)	The student prepares and delivers a professional presentation detailing the experience of working through each step of the engineering design process to create a viable solution. The student is expected to:	CCRS SCI III.C.1
(A)	prepare and deliver a presentation detailing the experience of working through each step of the engineering design process to create a viable solution;	
(B)	solicit and evaluate feedback on implementation of the design process and the presentation; and	
(C)	present learning experiences such as essential skills gained, areas of personal growth, and challenges encountered throughout the design process.	

§127.783. Engineering Design and Presentation I (One Credit), Adopted 2025 ~~Adopted 2022~~.		
	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 ~~2024-2025~~ school year.	
(b)	General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I and at least one credit in a course from the ~~science, technology,~~ engineering~~, and mathematics~~ career cluster. Recommended prerequisite: Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.	
(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. ~~The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.~~	
(3)	Students enrolled in Engineering Design and Presentation I ~~will~~ demonstrate knowledge and skills of the design process as it applies to engineering fields and project management using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Through implementation of the design process, students ~~will~~ transfer advanced academic skills to component designs. Additionally, students ~~will~~ explore career opportunities in engineering, technology, and drafting and what is required to gain and maintain employment in these areas.	Need to create the course introduction
(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:	New employability strand
(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.	
~~(1)~~	~~The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~	Replaced with new employability strand KS(1)
~~(A)~~	~~demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site;~~	
~~(B)~~	~~cooperate, contribute, and collaborate as a member of a group to attain agreement and achieve a collective outcome;~~	

~~(C)~~	~~present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions;~~	
~~(D)~~	~~use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results; and~~	
~~(E)~~	~~demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed.~~	
(2)	The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:	Engineering design process strand
(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 understands the value of maintaining documentation using an engineering notebook. The student is expected to:	Engineering notebook strand
(A)	explain the legal value of maintaining an engineering notebook as intellectual property;	CCRS SCI III.A.1; III.C.1
(B)	describe the proper implementation of an engineering notebook, including notebook type, documentation, signatures, adding external materials, sealing, and dating; and	
(C)	create and maintain an engineering notebook by recording ideas, notes, decisions, findings, and corrections.	
(4)	The student explores the methods and aspects of project management in relation to projects. The student is expected to:	Project management strand CCRS SCI I.C.1
(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.	
(5)~~(2)~~	The student gains knowledge of and demonstrates the skills necessary for success in the engineering workplace. The student is expected to:	Employability related skills specific to engineering
(A)	describe and compare the roles of an industry technician, engineering technologist, and engineer; ~~distinguish between an engineering technician, engineering technologist, and engineer;~~	Clarity
(B)	identify employment and career opportunities in engineering and describe the educational requirements for each;	
(C)	research and describe the various engineering disciplines such as mechanical, civil, aerospace, biomedical, chemical civil, computer, electrical, petroleum, and other related and emerging fields;	It's important for students to understand the variety of careers within engineering
(D)~~(C)~~	investigate and describe the requirements of engineering licensure and industry-based certifications; ~~in engineering;~~	Added licensure
(E)~~(D)~~	investigate and describe elements ~~demonstrate the principles~~ of teamwork critical for success in ~~related to~~ the engineering and technology industries;	Note: Engineering and technology referred to as one industry CCRS SCI IV.C.2
(F)~~(E)~~	research and describe industry standards and governmental regulations~~,~~ such as ~~including~~ health and safety and environmental regulations; and	Clarifying terminology
(G)~~(F)~~	analyze ethical issues related to engineering and technology. ~~and incorporate proper ethics in submitted projects;~~	CCRS SCI IV.C.1
~~(G)~~	~~demonstrate respect for diversity in the workplace;~~	Replaced by employability strand KS(1)(A)&(B)
~~(H)~~	~~identify consequences relating to discrimination, harassment, and inequality;~~	Replaced by employability strand KS(1)(F)

~~(I)~~	~~demonstrate effective oral and written communication skills using a variety of software applications and media; and~~	Replaced by employability strand KS(1)(C)
~~(J)~~	~~investigate and present on career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training.~~	Update terminology to be consistent with state directives
(6)~~(3)~~	The student understands the roles and responsibilities of individual team members, how successful teams function, and how to constructively contribute to the team. ~~The student participates in team projects in various roles.~~ The student is expected to:	CCRS SCI I.C.1
(A)	describe the various roles and responsibilities of a project ~~on an engineering~~ team ~~and discuss characteristics of how effective teams function~~;	Clarify
(B)	describe and demonstrate how the knowledge and skills of individual team members are used to assign roles and distribute tasks within a team ~~apply teamwork to solve problems~~; and	Not observable and measurable
(C)	describe and demonstrate appropriate behaviors such as active listening and clear communication while serving as a team leader and member on projects.	
~~(C)~~	~~serve as both a team leader and member and demonstrate appropriate attitudes behaviors such as active listening, and clear communication while participating in team projects.~~	Clarify
~~(4)~~	~~The student develops skills for managing a project. The student is expected to:~~	Replace with new project management strand KS(3)
~~(A)~~	~~implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;~~	Items listed are not methodologies. Methodologies should be introduced in a more advanced class.
~~(B)~~	~~develop a project schedule and complete work according to established criteria;~~	
~~(C)~~	~~participate in the organization and operation of a real or simulated engineering project.; and~~	Too vague
~~(D)~~	~~develop a plan for production of an individual product.~~	Redundant to SE(B)
(7)~~(5)~~	The student practices safe and proper work habits. The student is expected to:	CCRS SCI I.C.2-3
(A)	identify and explain the appropriate use of types of personal protective equipment (PPE) used in industry;	
~~(A)~~	~~master relevant safety tests;~~	Too specific; combine with SE(B)

(B)	explain and comply with safety guidelines and procedures as described in relevant ~~various~~ manuals, instructions, and regulations;	Guidelines and procedures are two distinct things
(C)	discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;	It is necessary to be explicit with safety. Safety has to be the #1 concern when working with students.
(D)	describe the various types of electrical hazards in the workplace and the risks associates with these hazards;	It is necessary to be explicit with safety. Safety has to be the #1 concern when working with students.
(E)	describe the various control methods to prevent electrical hazards in the workplace;	
(F)~~(C)~~	identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and explain how these resources are used to make decisions in the workplace; ~~identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations;~~	By being more general, teachers can adjust to their particular needs
(G)~~(D)~~	describe the appropriate disposal of selected hazardous materials and wastes ~~appropriately~~;	Appropriate used twice
(H)~~(E)~~	perform routine maintenance on selected tools, equipment, and machines;	
(I)~~(F)~~	handle, use, and store tools and materials correctly; and	
(J)~~(G)~~	research and describe the consequences ~~results~~ of negligent or improper equipment maintenance.	
(8)	The student understands how visual and spatial reasoning applies to engineering design. The student is expected to:	Before students can successfully use CADD, they need to understand how to visualize geometric shapes in both 2d and 3d CCRS SCI II.C.1-4
(A)	compare characteristics and dimensional changes of two- and three- dimensional figures;	CCRS M III.A.1
(B)	draw and manipulate geometric shapes in three dimensions;	CCRS M III.A-D
(C)	create two-dimensional views of a three-dimensional object; and	
(D)	explain the symmetry of figures through the proportionate transformation of objects.	

(9)(6)	The student uses sketching and applies skills associated with computer-aided drafting and design to represent three-dimensional (3D) objects in a two-dimensional (2D) format needed for manufacturing an object. The student is expected to:	Clarify and add CCRS SCI V.E.1-2
(A)	use single and multi-view projections to represent 3D objects in a 2D format;	
(B)	use appropriate line types in engineering drawings to represent 3D objects in a 2D format;	
(C)(B)	use orthographic and pictorial views to represent 3D objects in a 2D format;	
(D)(C)	use auxiliary views to represent 3D objects in a 2D format;	
(E)(D)	use section views to represent 3D objects in a 2D format;	
(E)	use advanced construction techniques to generate engineering drawings;	Unclear and not specific
(F)	prepare and revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards;	
(G)	apply best practices for effective file structure and management to efficiently retrieve and edit files;	clarification
(H)	use advanced dimensioning techniques, including annotation scale; and	clarification
(I)	construct and use basic 3D parametric drawings to develop a 3D model or prototype for presentation. ; and	clarification
(J)	develop and use prototype drawings for presentation.	Combined above
(7)	The student uses engineering design methodologies. The student is expected to:	Replace KS and SEs with Design Process strand
(A)	describe principles of ideation and apply ideation techniques for to an engineering project;	
(B)	demonstrate critical thinking, identify and analyze the solution constraints, and make fact-based decisions;	
(C)	develop or improve a product using rational thinking;	
(D)	apply decision-making strategies when developing solutions;	
(E)	use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process; and	

~~(F)~~	~~use an engineering notebook or portfolio to record the final design, construction, and manipulation of finished projects.~~	
~~(8)~~	~~The student applies concepts of engineering to specific problems. The student is expected to:~~	Redundant to KS 12
~~(A)~~	~~*design components using a variety of technologies;*~~	Moved to KS(10)(A)
~~(B)~~	~~*investigate the applications of different types of computer-aided drafting and design software for various engineering problems; and*~~	Moved to KS(10)(B)
~~(C)~~	~~*use multiple software applications for concept presentations.*~~	Moved to KS(10)(G)
(10)~~(9)~~	The student designs products using appropriate engineering design processes and techniques. The student is expected to:	
(A)	*design* product *components using a variety of technologies;*	CCRS SCI I.D.2
(B)	research and analyze ~~investigate~~ *the applications of different types of computer-aided drafting and design software for various engineering problems;*	CCRS SCI II.C.1-4
~~(A)~~	~~interpret engineering drawings;~~	Repetitive with below (D)
(C)~~(D)~~	produce and interpret engineering drawings using ~~to~~ industry standards; ~~and~~	
(D)~~(B)~~	describe how ~~identify areas where~~ *quality, reliability, and safety can be designed into* specific products ~~a product~~*;*	
(E)~~(C)~~	modify a product design to meet a specified need such as considering a broader audience of users or users with special needs;	Universal design is an important concept for engineering students to learn
(F)~~(E)~~	research and explain the patenting process and analyze opportunities for potential patents related to a project; and ~~describe potential patents and the patenting process.~~	
(G)	*use multiple software applications for concept presentations.*	moved for clarity
(11)~~(10)~~	The student builds a prototype(s) using the appropriate tools, materials, and techniques. The student is expected to:	CCRS SCI IV.E.1-2
(A)	identify and describe the steps needed to produce a prototype;	
(B)	identify and use appropriate tools, equipment, machines, and materials to produce the prototype; ~~and~~	

(C)	present the prototype and explain how it meets the project requirements using a variety of media.; and	
(D)	evaluate the successes and failures of the prototype(s) in the context of an iterative design process.	The entire point of a prototype is to discover and learn from mistakes
(12)(11)	The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	
(A)	identify and define an engineering problem;	
(B)	formulate goals, objectives, and requirements to solve an engineering problem;	
(C)	investigate and select materials appropriate to the use of a particular product to be designed;	
(D)	explain the importance of manufacturability;	
(E)(C)	determine the design parameters such as materials, personnel, resources, funding, manufacturability, feasibility, and time associated with an engineering problem;	Repetitive. These items are mentioned above.
(F)(D)	identify establish and evaluate constraints of systems engineering, including health, safety, social, environmental, ethical, political, regulatory, and legal constraints, defining an engineering pertaining to a problem;	
(G)(E)	identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;	
(H)(F)	test and evaluate proposed solutions using tools such as models, prototypes and mockups and methods such as models, prototypes, mock-ups, simulations, critical design review, statistical analysis, and or experiments; and	clarity
(I)(G)	apply structured techniques such as a decision tree, design matrix, or cost-benefit analysis to select and justify a preferred solution to a problem.	CCRS SCI I.D.2
(13)	The student presents a solution derived through the engineering design process. The student is expected to:	
(A)	present the solution in a professional manner;	CCRS SCI III.C.1
(B)	solicit and evaluate feedback on the solution and presentation; and	
(C)	present learning experiences such as essential skills gained, areas of personal growth, and challenges and solutions encountered throughout the design process.	

§127.784. Engineering Design and Presentation II (Two Credits), Adopted 2025 ~~Adopted 2022~~.

	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 ~~2024-2025~~ school year.	
(b)	General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Principles of Applied Engineering or Engineering Design and Presentation I, Algebra I, and Geometry. Students shall be awarded two credits for successful completion of this course.	
(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. ~~The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.~~	New engineering career cluster introduction from engineering foundations program of study framework
(3)	Engineering Design and Presentation II is a continuation of knowledge and skills learned in Engineering Design and Presentation I. Students enrolled in this course will demonstrate advanced knowledge and skills of a system design process as it applies to engineering fields and project management using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Students will expand on the use of a variety of computer hardware and software applications to complete assignments and projects. Through implementation of a system design process, students will transfer advanced academic skills to component designs and engineering systems. Emphasis will be placed on transdisciplinary and integrative approaches using skills from ideation, prototyping, and project management methods.	Introduction needs to be updated
(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:	New employability strand
(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.	
~~(1)~~	~~The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~	Replaced by new KS(1) employability strand
~~(A)~~	~~distinguish between an engineering technician, engineering technologist, and engineer;~~	
~~(B)~~	~~identify employment and career opportunities in engineering and describe the educational requirements for each;~~	

~~(C)~~	~~investigate and describe the requirements of industry-based certifications in engineering;~~	
~~(D)~~	~~demonstrate the principles of teamwork related to engineering and technology;~~	
~~(E)~~	~~research and describe governmental regulations, including health and safety;~~	
~~(F)~~	~~analyze ethical issues related to engineering and technology and incorporate proper ethics in submitted projects;~~	
~~(G)~~	~~demonstrate respect for diversity in the workplace;~~	
~~(H)~~	~~identify consequences relating to discrimination, harassment, and inequality;~~	
~~(I)~~	~~demonstrate effective oral and written communication skills using a variety of software applications and media; and~~	
~~(J)~~	~~investigate and present on career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training.~~	
(2)	The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:	Engineering design process strand
(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:	Project management strand
(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)~~(6)~~	The student practices safe and proper work habits. The student is expected to:	Move safety KS/SEs here CCRS SCI I.C.2-3
(A)	identify and explain the appropriate use of types of personal protective equipment (PPE) used in industry;	
~~(A)~~	~~master relevant safety tests;~~	Too specific; Combined with SE below
(B)	explain and comply with safety guidelines and procedures as described in relevant ~~various~~ manuals, instructions, and regulations;	Guidelines and procedures are two different things
(C)	explain the importance of Lock Out Tag Out (LOTO) procedures in preventing the release of hazardous energy;	
(D)	explain the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;	Necessary to be explicit with safety
(E)	describe the various types of electrical hazards in the workplace and the risks associated with these hazards;	Necessary to be explicit with safety
(F)	describe the various control methods to prevent electrical hazards in the workplace;	
(G)~~(C)~~	identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and explain how these resources are used to make decisions in the workplace; ~~identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations;~~	Allow flexibility for instructors
(H)~~(D)~~	describe the appropriate disposal of selected hazardous materials and wastes ~~appropriately~~;	clarification
(I)~~(E)~~	perform routine maintenance on selected tools, equipment, and machines;	clarification
(J)~~(F)~~	handle, use, and store tools and materials correctly; and	clarification

(K)~~(G)~~	research and describe the consequences ~~results~~ of negligent or improper equipment maintenance.	clarification
(5)~~(2)~~	The student understands the roles and responsibilities of individual team members, how successful teams function, and how to constructively contribute to the team ~~participates in team projects~~. The student is expected to:	CCRS SCI I.C.1
(A)	describe the various roles and responsibilities of a project ~~on an engineering~~ team; ~~and discuss characteristics of how effective teams function;~~	Clarify and align with EDP1
(B)	describe and demonstrate how the knowledge and skills of individual team members are used to assign roles and distribute tasks within a team; ~~demonstrate teamwork to solve problems; and~~	Not observable and measurable
(C)	describe and demonstrate appropriate behaviors such as active listening and clear communication while serving as a team leader and member on projects; and ~~serve as team leader and member and demonstrate appropriate attitudes while participating in team projects.~~	Clarify and align with EDP1
(D)	describe and demonstrate the roles and responsibilities specific to team leaders, such as assigning roles and responsibilities, facilitating decision making, tracking progress, and soliciting and providing timely feedback to team members. ~~when serving as team leader.~~	Differentiate between serving as team leader and team member
(6)~~(7)~~	The student uses and documents engineering design processes ~~methodologies~~. The student is expected to:	Process versus methodologies is the correct word CCRS SCI III.A.1; III.C.1
(A)	use ~~describe principles of~~ solution ideation ~~and evaluate ideation~~ techniques for an engineering project; ~~including systems-based engineering and advanced prototyping;~~	
(B)	analyze and evaluate ~~demonstrate critical thinking, identify the~~ solution constraints;~~, and make fact-based decisions;~~	Critical thinking difficult to measure, clarification
(C)	develop or improve a solution using fact-based decision-making ~~rational thinking~~;	clarification
(D)	compare solutions using analysis tools such as a decision matrix or paired comparison analysis ~~apply decision-making strategies when developing solutions~~;	
~~*(E)*~~	~~*identify quality-control issues in engineering design and production;*~~	Move to KS about prototypes KS(9)
~~*(F)*~~	~~*describe perceptions of the quality of products and how they affect engineering decisions;*~~	Move to KS about prototypes KS(9)

(E)(G)	create and maintain an organized engineering notebook to record use an engineering notebook to record findings and corrections, including deficiencies in the design process, and decisions throughout the entire design process prototypes, corrections, and/or mistakes in the design process; and	Clarify the list CCRS SCI III.A.1
(F)(H)	use an engineering notebook or portfolio to record and justify the final design, construction, and manipulation of finished projects.	In this instance, we like the use of the engineering notebook or portfolio because at this level both are important and complementary, particularly for a final product
(3)	The student develops applies project management skills for managing to a complex, multi-phase, multi-system project. The student is expected to:	Replace with project management strand KS(3)
(A)	create, implement, and evaluate project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;	Break into smaller steps
(B)	develop a project schedule and complete projects according to established criteria;	Included above
(C)	use strategies such as decision matrices, flow charts, or Gantt charts to maintain the project schedule and quality of project;	
(D)	participate in the organization and operation of a real or simulated engineering project; and	
(E)	develop a plan for production of an individual product.	
(4)	The student demonstrates principles of project documentation, workflow, and evaluated results. The student is expected to:	Replaced by project management strand KS(3)
(A)	complete work orders and related documentation;	Clarify types of related documentation
(B)	identify and defend factors affecting cost and strategies to minimize costs;	Moved above to another SE
(C)	formulate a project budget;	Moved to another SE
(D)	develop a production schedule;	redundant
(E)	identify intellectual property and other legal restrictions; and	Redundant
(F)	read and interpret technical drawings, manuals, and bulletins.	redundant

(7)~~(9)~~	The student understands how systems impact the design, integration, and management of engineering solutions. ~~The student addresses a need or problem using appropriate systems engineering design processes and techniques.~~ The student is expected to:	Rewrite KS
(A)	explain systems in engineering;	
(B)	explain reverse engineering;	
(C)	reverse engineer a multi-system product and explain how the systems work in the product; and	
~~(A)~~	~~create and interpret engineering drawings;~~	Redundant with SEs in KS(8)
~~(B)~~	~~identify areas where quality, reliability, and safety and multidisciplinary optimization and stakeholder analysis can be designed into a solution such as a product, process, or system;~~	redundant
(D)~~(C)~~	improve a system design, including properties of materials selected, to meet a specified need.~~;~~	
~~(D)~~	~~produce engineering drawings to industry standards; and~~	Redundant with SE in KS(8)
~~(E)~~	~~*describe potential patents and the patenting process.*~~	Moved to KS(9)(J)
(8)~~(5)~~	The student uses ~~applies the concepts and skills of~~ computer-aided drafting and design software as part of the engineering design process ~~to perform the following tasks.~~ The student is expected to:	CCRS SCI I.D.2; II.C.1-4
(A)	*research different types of computer-aided drafting and design software and evaluate* ~~their~~ *applications for use in design systems and problem solving;* ~~and~~	Moved from KS(8)(C)
(B)~~(A)~~	identify industry standards such as ~~prepare drawings to~~ American National Standards Institute (ANSI) and International Organization for Standardization (ISO) graphic standards, and create drawings that meet industry standards;	
(C)~~(B)~~	customize software user interface options such as buttons, tabs, and ribbons to match different work environments;	clarification
(D)~~(C)~~	prepare and use advanced views such as auxiliary, section, and break-away;	
(E)~~(D)~~	draw detailed parts, assembly diagrams, and sub-assembly diagrams;	
(F)~~(E)~~	indicate tolerances and standard fittings using appropriate library functions;	
(G)~~(F)~~	establish and apply annotation styles and setup by defining units, fonts, dimension styles, notes, and leader lines;	

(H)(G)	identify and incorporate the use of advanced layout techniques and viewports using paper-space and modeling areas;	
(I)(H)	create and use layers to organize objects in drawings; use management techniques by setting up establish properties to define and control individual layers by using software management features;	clarification
(J)(I)	create and use custom templates for advanced project management;	
(J)	prepare and use advanced development drawings such as assembly and subassembly drawings;	Redundant with KS(8)(E)
(K)	use advanced polar tracking and blocking techniques to increase drawing efficiency;	
(L)	create drawings that incorporate external referencing;	
(M)	create and render objects using parametric modeling tools; and	
(N)	model individual parts or assemblies and produce rendered or animated output.	
(8)	The student applies demonstrates knowledge of how concepts of engineering are applied to specific problems. The student is expected to:	Vague and broad KS; SEs moved to better locations or removed
(A)	design solutions from various engineering disciplines such as electrical, mechanical, structural, civil, or biomedical engineering;	redundant
(B)	*experiment with the use of tools, laboratory equipment, and precision measuring instruments to develop prototypes;*	Move to KS(9)
(C)	*research different types of computer-aided drafting and design software and evaluate their applications for use in design systems and problem solving; and*	Move to KS(8)
(D)	*use multiple software applications for concept presentations.*	Moved to KS(11)
(9)(10)	The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	Add SEs regarding quality to this section CCRS SCI IV.E.1-2
(A)	delineate and implement and delineate the steps needed to produce a prototype such as defining the problem and generating concepts;	
(B)	identify industry-appropriate tools, equipment, machines, and materials;	Combined with SE below

(B)	develop prototypes using tools, equipment, machines, or precision measuring instruments; experiment with the use of tools, laboratory equipment, machines, and precision measuring instruments to develop prototypes;	Added SE above
(C)	select and justify the use of materials for prototyping and manufacturing;	Address the use of specific materials
(D)	describe how design quality concepts including performance, usability, accessibility, reliability, and safety affect product development;	Brought over from Introduction to Engineering Design
(E)	identify quality-control issues in engineering design and production;	CCRS SCI I.A.4; I.B.1
(F)	describe perceptions of the product quality of products and how these perceptions they affect engineering decisions;	
(G)(C)	fabricate the prototype using a systems engineering approach to compare the performance and use of materials; and	
(H)(D)	present the prototype and explain how it meets the project requirements; and present and validate the prototype using a variety of media and defend engineering practices used in the prototype.	Clarify CCRS SCI III.C.1
(I)	describe potential patents related to the prototype and the patenting process.	Moved from KS(9)(E)
(10)(11)	The student creates justifiable solutions to open-ended real-world problems within a multitude of engineering disciplines such as aerospace, bio, civil, electrical, mechanical, or structural engineering mechanical, electrical, civil, structural, bio, or aerospace using engineering design practices and processes. The student is expected to:	
(A)	identify and define engineering problems from different engineering disciplines such as aerospace, bio, civil, electrical, mechanical, or structural civil, mechanical, civil, structural, electrical, bio, or aerospace engineering;	Changed order of disciplines
(B)	formulate and document goals, objectives, and requirements to solve an engineering problem;	
(C)	determine the design parameters such as materials, personnel, resources, funding, manufacturability, feasibility, and time associated with an engineering problem;	
(D)	identify establish and evaluate constraints of systems engineering, including health, safety, social, environmental, ethical, political, regulatory, and legal constraints, defining an engineering pertaining to a problem;	
(E)	identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;	

(F)	test and evaluate proposed solutions using tools such as models, prototypes and mockups and methods such as models, prototypes, mock-ups, simulations, critical design review, statistical analysis, and or experiments; and	
(G)	apply a structured technique problem such as a decision tree, design matrix, or cost-benefit analysis to select and justify a preferred solution to a problem.	CCRS SCI I.D.2
(11)	The student presents a solution derived through the engineering design process. The student is expected to:	CCRS SCI III.C.1
(A)	present the solution in a professional manner to an appropriate audience, such as peers, educators, potential clients, potential employers, community members, or engineering professionals;	
(B)	solicit and evaluate feedback from the audience on the solution and presentation; and	
(C)	present learning experiences such as essential skills gained, areas of personal growth, and challenges and solutions encountered throughout the design process.	

§127.785. Engineering Design and Problem Solving (One Credit), Adopted 2025 ~~Adopted 2021~~.		
	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 ~~2022-2023~~ school year.	
(b)	General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Algebra I, Geometry, and at least one credit in a Level 2 or higher course in the science, technology, engineering, and mathematics career cluster. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.	
(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. ~~The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.~~	New engineering career cluster introduction from engineering foundations program of study framework
(3)	The Engineering Design and Problem Solving course teaches ~~is~~ the creative process of solving problems by identifying needs and then devising solutions using scientific and engineering practices. The solution may be a product, technique, structure, or process depending on the problem. Science aims to understand the natural world, while engineering seeks to shape this world to meet human needs and wants. *Various engineering disciplines address a broad spectrum of design problems using specific concepts from the sciences and mathematics to derive a solution.* Engineering design takes into consideration limiting factors or "design under constraint." ~~*Various engineering disciplines address a broad spectrum of design problems using specific concepts from the sciences and mathematics to derive a solution*~~. The design process and problem solving are inherent to all engineering disciplines.	Consider a definition for “engineering” similar to the definition of “science” used below.
~~(4)~~	~~Engineering Design and Problem Solving reinforces and integrates skills learned in previous mathematics and science courses. This course emphasizes solving problems, moving from well-defined toward more open-ended, with real-world application. Students will apply critical-thinking skills to~~	Too many introductions. Needed to be more concise.

	~~justify a solution from multiple design options. Additionally, the course promotes interest in and understanding of career opportunities in engineering.~~	
~~(5)~~	~~This course is intended to stimulate students' ingenuity, intellectual talents, and practical skills in devising solutions to engineering design problems. Students use the engineering design process cycle to investigate, design, plan, create, and evaluate solutions. At the same time, this course fosters awareness of the social and ethical implications of technological development.~~	
(6)	Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.	
(7)	Scientific hypotheses and theories. Students are expected to know that:	
(A)	hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and	
(B)	scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.	
(8)	Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.	
(A)	Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.	
(B)	Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.	

(9)	Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).	
(10)	Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(11)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(12)	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:	New employability strand
(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; and	

(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.	
~~(1)~~	~~The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~	Replaced by new KS1 – employability strand
~~(A)~~	~~demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;~~	
~~(B)~~	~~show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;~~	
~~(C)~~	~~present written and oral communication in a clear, concise, and effective manner;~~	
~~(D)~~	~~demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and~~	
~~(E)~~	~~demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.~~	
(2)	The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	Scientific and engineering practices strand
(A)	ask questions and define problems based on observations or information from text, phenomena, models, or investigations;	
(B)	apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;	
(C)	use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;	

(D)	use appropriate tools such as dial caliper, micrometer, protractor, compass, scale rulers, multimeter, and circuit components;	
(E)	collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;	
(F)	organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;	
(G)	develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and	
(H)	distinguish between scientific hypotheses, theories, and laws.	
(3)	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:	Scientific and engineering practices strand
(A)	identify advantages and limitations of models such as their size, scale, properties, and materials;	
(B)	analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	
(C)	use mathematical calculations to assess quantitative relationships in data; and	
(D)	evaluate experimental and engineering designs.	
(4)	The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:	Scientific and engineering practices strand
(A)	develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;	
(B)	communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	
(C)	engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	

(5)	The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:	Scientific and engineering practices strand
(A)	analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;	
(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	
(C)	research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.	
(6)	The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:	Engineering design process stand
(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.	
(7)	The student explores and implements the methods and aspects of project management for complex, multi-phase, multi-system projects. The student is expected to:	Project management strand modified CCRS SCI I.C.1
(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;	
(G)	describe the importance of management of change (MOC) and how it applies to project planning; and	
(H)	create and implement a project management plan for an engineering project.	
(8)	The student conducts research, analyzes data, and creates a problem statement in the engineering design process. The student is expected to:	Research/Problem Statement CCRS SCI I.A.3
(A)	create and maintain an organized engineering notebook to record research, findings and corrections, including deficiencies in the design process, and decisions throughout the entire design process prototypes, corrections, and/or mistakes in the design process;	CCRS SCI III.A.1; III.C.1
(B)	identify and select an open-ended real-world problem that can be solved using scientific and engineering practices and the engineering design process;	
(C)	collect, organize, analyze, and summarize scientific and technical articles, data, and information to support the development of a problem statement;	CCRS SCI III.B.1
(D)	identify relevant scientific and technical vocabulary;	CCRS SCI III.B.3
(E)	evaluate information from sources for quality, accuracy, completeness, and reliability and conduct additional research as appropriate in the context of an iterative design process; and	CCRS SCI III.D.2
(F)	create a problem statement that is concise, specific, and measurable.	
(9)	The student identifies potential solutions and uses structured techniques to select and justify a preferred solution using scientific and engineering practices and the engineering design process. The student is expected to:	Conceptualization and Solution Selection
(A)	*identify or create alternative solutions to a problem using a variety of techniques such as* sketching, *brainstorming, reverse engineering, and researching engineered and* nature-based ~~natural~~ *solutions;*	CCRS SCI I.A.4; III.B.1-3
(B)	*select* ~~and justify~~ *a preferred solution to a problem by apply*ing *structured techniques such as a decision tree, design matrix, or cost-benefit analysis;*	
(C)	evaluate whether the preferred solution meets the requirements of the problem statement in the context of an iterative design process;	

(D)	identify material properties that are important to the solution design such as physical, mechanical, chemical, electrical, and magnetic properties and explain how material properties impact material selection;	
(E)	explain how different engineering solutions can have significantly different impacts on individuals, society, and the natural world; and	
(F)	document concepts, solutions, findings, and structured decision-making techniques in the engineering notebook.	CCRS SCI III.A.1
(10)	The student creates technical drawings, models, and prototypes using the appropriate tools, materials, and techniques. The student is expected to:	Technical Drawing, Modeling, Prototype CCRS SCI II.C.1-4; V.E.1-2
(A)	determine and explain the type of technical drawing that will best represent the solution;	Technical drawings
(B)	create a technical drawing(s) that includes dimensions, scale, views, annotations, tolerances, legends, symbols, and material specifications;	
(C)	create a mathematical or physical model(s)to make predictions, identify limitations, and optimize design criteria;	CCRS SCI V.E.1
(D)	create a prototype for physical testing;	CCRS SCI I.B.1
(E)	evaluate the successes and failures of the prototype(s) in the context of an iterative design process; and	
(F)	revise technical drawings, models, and prototypes as the solution evolves to better meet objectives.	
(11)	The student develops, implements, and documents experiments and tests using scientific and engineering practices to determine whether a prototype meets design requirements. The student is expected to:	Test and Experiment Experimental and observational testing Experimental investigations
(A)	design and conduct experiments and tests to determine whether the prototype meets the requirements of the problem statement;	CCRS SCI I.B.1
(B)	document quantitative and qualitative data obtained through experiments and tests in the engineering notebook;	CCRS SCI I.D.1-3
(C)	create charts, data tables, or graphs to organize information collected in an experiment;	

(D)	identify sources of random error and systematic error and differentiate between both types of error;	
(E)	analyze data using statistical methods to recognize patterns, trends and proportional relationships; and	CCRS SCI II.E.1; V.C.1
(F)	evaluate and determine whether the prototype meets the requirements of the problem statement by analysis of data collected in the context of an iterative design process.	
(12)	The student develops and presents a comprehensive report that describes the problem, research and information collected and analyzed, concepts and solutions considered, prototypes developed and tested, and final results. The student is expected to:	Formal Report CCRS SCI III.C.1
(A)	create and present the comprehensive report in a professional manner to an appropriate audience, such as peers, educators, potential clients, potential employers, community members, or engineering professionals;	
(B)	solicit and evaluate feedback from the audience on the comprehensive report and presentation;	
(C)	present learning experiences such as essential skills gained, areas of personal growth, and challenges and solutions encountered throughout the design process; and	
(D)	predict the local and global impacts or risks of an engineering solution to segments of the society, such as the economy or the environment.	CCRS SCI IV.A.1; IV.B.1-2
~~(6)~~	~~The student uses critical thinking, scientific reasoning, scientific and engineering practices, engineering design processes, and problem solving to make informed decisions. within and outside the classroom. The student is expected to:~~	Expanded and embedded into new engineering design process, KS9, KS10, KS11 to better support and align to scientific and engineering practices
~~(A)~~	~~communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials; and~~	
~~(B)~~	~~draw inferences based on data related to promotional materials for products and services.~~	
~~(7)~~	~~The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:~~	Expanded and embedded into new engineering design process, KS9, KS10, KS11 to better support and align to scientific and engineering practices

~~(A)~~	~~select appropriate mathematical models to develop solutions to engineering design problems;~~	
~~(B)~~	~~integrate advanced mathematics and science skills as necessary to develop solutions to engineering design problems;~~	
~~(C)~~	~~judge the reasonableness of mathematical models and solutions;~~	
~~(D)~~	~~investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems;~~	
~~(E)~~	~~identify the inputs, processes, outputs, control, and feedback associated with open and closed systems;~~	
~~(F)~~	~~describe the difference between open-loop and closed-loop control systems;~~	
~~(G)~~	~~evaluate different measurement tools such as dial caliper, micrometer, protractor, compass, scale rulers, and multimeter, make measurements with accuracy and precision, and specify tolerances; and~~	
~~(H)~~	~~use conversions between measurement systems to solve real-world problems.~~	
~~(8)~~	~~The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:~~	Rewritten for clarity and moved to new KS about formal report and presentation
~~(A)~~	~~communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards;~~	
~~(B)~~	~~read and comprehend technical documents, including specifications and procedures;~~	
~~(C)~~	~~prepare written documents such as memorandums, emails, design proposals, procedural directions, letters, and technical reports using the formatting and terminology conventions of technical documentation;~~	
~~(D)~~	~~organize information for visual display and analysis using appropriate formats for various audiences, including technical drawings, graphs, and tables such as file conversion and appropriate file types, in order to collaborate with a wider audience;~~	
~~(E)~~	~~evaluate the quality and relevance of sources and cite appropriately; and~~	
~~(F)~~	~~defend a design solution in a presentation.~~	

~~(9)~~	~~The student recognizes the history, development, and practices of the engineering professions. The student is expected to:~~	Similar to KS5 and too elementary for level 4 course. Possibly delete and/or create a KS on ethics in science/engineering.
~~(A)~~	~~identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers;~~	
~~(B)~~	~~recognize that engineers are guided by established codes emphasizing high ethical standards;~~	
~~(C)~~	~~explore the differences, similarities, and interactions between engineers, scientists, and mathematicians;~~	Too elementary for level 4 course
~~(D)~~	~~describe how technology has evolved in the field of engineering and consider how it will continue to be a useful tool in solving engineering problems;~~	Similar to 5B
~~(E)~~	~~discuss the history and importance of engineering innovation on the U.S. economy and quality of life; and~~	
~~(F)~~	~~describe the importance of patents and the protection of intellectual property rights.~~	
~~(10)~~	~~The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:~~	Reworded this KS as an SE in new research and problem statement KS(7)
~~(A)~~	~~identify and define an engineering problem;~~	
~~(B)~~	~~formulate goals, objectives, and requirements to solve an engineering problem;~~	
~~(C)~~	~~determine the design parameters associated with an engineering problem such as materials, personnel, resources, funding, manufacturability, feasibility, and time;~~	
~~(D)~~	~~establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal;~~	
~~(E)~~	~~*identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;*~~	Moved to KS(8)(A) “nature-based solutions”
~~(F)~~	~~test and evaluate proposed solutions using methods such as creating models, prototypes, mock-ups, or simulations or performing critical design review, statistical analysis, or experiments;~~	

~~(G)~~	~~*apply structured techniques to select and justify a preferred solution to a problem such as a decision tree, design matrix, or cost-benefit analysis;*~~	Moved to KS(8)(B) "select and justify a preferred solution to a problem using a structured technique such as..."
~~(H)~~	~~predict performance, failure modes, and reliability of a design solution; and~~	
~~(I)~~	~~prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process.~~	Strike "clearly"
~~(11)~~	~~The student manages an engineering design project. The student is expected to:~~	KS11 replaced by Project Management Strand-workgroup recommends modifying verbs to reflect students are "creating" project management
~~(A)~~	~~participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;~~	
~~(B)~~	~~develop a plan and project schedule for completion of a project;~~	
~~(C)~~	~~work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members;~~	
~~(D)~~	~~compare and contrast the roles of a team leader and other team member responsibilities;~~	
~~(E)~~	~~identify and manage the resources needed to complete a project;~~	
~~(F)~~	~~use a budget to determine effective strategies to meet cost constraints;~~	
~~(G)~~	~~create a risk assessment for an engineering design project;~~	
~~(H)~~	~~analyze and critique the results of an engineering design project; and~~	
~~(I)~~	~~maintain an engineering notebook that chronicles work such as ideas, concepts, inventions, sketches, and experiments.~~	