Career and Technical Education TEKS Review Draft Recommendations

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

Engineering Foundations Work Group

Courses: Fluid Mechanics, Mechanics of Materials, Statics

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: **Fluid Mechanics, Mechanics of Materials, and Statics.**

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
CD	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

Table of Contents

Course	**Pages**
Fluid Mechanics…………………………………………………………………………	2–9
Mechanics of Materials……………………………………………………………	10–16
Statics…………………………………………………………………………………………	17–22

§127.XX ~~Introduction to Fluids~~ Fluid Mechanics (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 11-12. Prerequisite or Corequisite: Algebra II Prerequisite: Geometry and at least one credit from the Engineering Career Cluster. Students shall be awarded one credit for successful completion of this course. This course satisfies a high school science graduation requirement.	
(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 Fluid Mechanics will investigate the behavior and properties of fluids including liquids and gasses. Through hands-on experiments, simulations, and real-world examples, students will learn about concepts such as viscosity, pressure, buoyancy, and flow dynamics. Students will explore how fluids interact with solid objects, understanding phenomena like lift and drag, which are critical to the operation of ships, airplanes, and vehicles. Students will engage in case studies and problem-solving activities to gain insights into how fluid mechanics shape our everyday lives, technological advancements, and industrial applications. This course will prepare students to progress in careers in engineering and scientific disciplines such as aerospace, mechanical, civil, chemical, materials, and physics.	
(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.	
(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;	CCRS: ELA.III.A.1

(B)	apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;	CCRS: ELA.I.A.3; SS IV.B.1,3
(C)	use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;	CCRS: CD II.C.7; SS IV.B.1
(D)	use appropriate tools such as dial calipers, protractors, scale rulers, tape measures, load cells, micrometers, scales, tensiometer, multimeter, and thermometers;	
(E)	collect quantitative data using the System International (SI) and United States customary units and qualitative data as evidence;	CCRS: CD II.D.2; SS IV.B.3
(F)	organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;	CCRS: CD II.D.1; ELA.I.A.2
(G)	develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and	CCRS: CD II.C.8
(H)	distinguish between scientific hypotheses, theories, and laws.	CCRS: CD II.C.1; ELA.II.B.1; SS IV.A.4
(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;	CCRS: CD II.A.4; SS IV.A.3
(B)	analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	CCRS: CD II.D.1; SS IV.A.3
(C)	use mathematical calculations to assess quantitative relationships in data; and	CCRS: CD II.D.2; SS IV.B.1
(D)	evaluate experimental and engineering designs.	CCRS: CD II.C.4; SS IV.A.3
(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;	CCRS: CD II.D.3; SS IV.D.1
(B)	communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	CCRS: CD I.A.1; ELA.I.A.3, III.A.1; SS V.A.1

(C)	engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	CCRS: CD I.A.2; ELA.III. A.2; SS V.A.1, B.1
(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:	CCRS: ELA.II.A.4 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;	CCRS: ELA.II.A.5; CD II.A.5; SS IV.A.3
(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	CCRS: ELA.II.A.4; CD II.C.7; SS I.B.2
(C)	research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.	CCRS: ELA.II.A.8, V.B.1, V.B.3; CD II.C.2; SS I.F.1
(6)	The student explains the application of fluids in historical and modern applications. The student is expected to:	
(A)	describe the efficient transportation and storage of fluids through various means such as gravity flow (aqueducts and water towers), natural phenomena (winds and currents), and compression;	CCRS: SS IV.A.4
(B)	explain the use of fluids in power generation and transmission, including hydraulics, pneumatics, pumps, compressors, and turbomachinery; and	
(C)	explain how lift and drag impacts moving objects.	CCRS: M III.A.1
(7)	The student describes basic concepts of fluid mechanics. The student is expected to:	
(A)	differentiate and compare the properties that distinguish a solid from a fluid;	CCRS: SCI V.A.2; SS IV.A.4
(B)	identify different types of fluids and define the characteristics of a fluid, including gasses, liquids, Newtonian, and non-Newtonian;	CCRS: SCI V.A.2; VII.I.1; SS IV.A.1
(C)	define and list examples of compressible and incompressible (approximately) fluids;	
(D)	explain the properties of fluids, including density, specific weight, specific gravity, viscosity, and compressibility;	CCRS: M I.C.1, I.C.2; SCI VII.I.5
(E)	describe methods to measure and calculate the density, specific weight, specific gravity, viscosity, and compressibility of a Newtonian fluid;	CCRS: M I.C.1, I.C.2; SS IV.A.1

(F)	measure and calculate density, specific weight, and specific gravity for a variety of fluids;	CCRS: M I.C.1, I.C.2
(G)	explain the appropriate use and differences of material and spatial reference frames, including boundary conditions, control surfaces, and control volumes;	CCRS: M III.A.1, III.D.1-3
(H)	identify and explain the variables in the ideal gas law and apply the law to constructed problems;	CCRS: s II.C.3,VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VII.I.3; SS IV.A.1
(I)	explain and demonstrate the laws of conservation of energy and conservation of mass, including the algebraic version of Reynold's Transport theorem; and	CCRS: M II.C.3,VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI V.B.2, VIII.D.1, VIII.D.2; SS IV.A.1
(J)	identify appropriate boundary conditions, including no-slip and ambient pressure boundary conditions in fluid flow.	CCRS: M III.A.1, III.C.1, III.D.1-3; SS IV.A.1
(8)	The student demonstrates an understanding of pressure and hydrostatics and calculates values in a variety of systems. The student is expected to:	
(A)	describe the relationship between force, area, and pressure;	CCRS: M VII.B.1; SCI VIII.F.1, VIII.F.2
(B)	calculate force proportionalities in hydraulic and pneumatic cylinders using Pascal's law and explain the impact of the cylinders' diameter;	CCRS: M VII.B.1; SCI VIII.F.2
(C)	differentiate between atmospheric pressure, gauge pressure, and absolute pressure;	CCRS: SS IV.A.4
(D)	describe the working principles of a pressure gauge and measure fluid pressure with dial gauges and manometers;	
(E)	calculate the buoyant force of floating and submerged objects according to Archimedes' principle; and	CCRS: M II.C.3,VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VIII.F.3; SS IV.A.3
(F)	define and calculate hydrostatic pressure.	CCRS: M II.C.3,VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VIII.F.3

(9)	The student demonstrates an understanding of fluid flows in steady-state pipes, channels, and free jets. The student is expected to:	
(A)	compare developing, fully developed, and steady-state Newtonian fluid flows in pipes and channels;	CCRS: SS IV.A.3
(B)	compare fluid flow profiles, including uniform and parabolic;	CCRS: M VI.A.2; SS IV.A.4
(C)	describe experimental measurements of fluid flow field lines, including stream, streak, and pathlines in fluid flow;	CCRS: SS IV.C.1
(D)	apply the continuity equation and conservation of mass to calculate volumetric flow rate in a steady state system;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VIII.D.2, VIII.F.4
(E)	explain how Bernoulli's equation relates to the total energy of a steady-state system;	CCRS: M III.A.1, VII.D.1, IX.B.2; SCI VIII.D.2, VIII.F.4
(F)	apply Bernoulli's equation and the conservation of energy to calculate unknown variables in varying conditions, including changes in height, velocity, and cross-sectional area of a steady-state system;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VIII.D.2, VIII.F.4
(G)	derive Torricelli's equation from Bernoulli's equation and calculate the exit velocity and mass flow rates of free jets;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2; SCI VIII.D.2, VIII.F.4
(H)	calculate fluid flows in pipes, channels, and free jets using the Reynolds Transport theorem and conservation of mass; and	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(I)	calculate the resultant force of a free jet at the outlet based on the density of the fluid, cross-sectional area, pressure, and velocity of the fluid.	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(10)	The student demonstrates an understanding of the effects of an object moving through a fluid. The student is expected to:	
(A)	differentiate turbulent and laminar flows;	CCRS: SS IV.A.4
(B)	calculate the Reynolds number of given flows to determine if they are turbulent or laminar;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(C)	define lift and drag as applied to fluid flows;	CCRS: SCI VIII.C.2; SS I.F.1
(D)	explain the relationship between viscosity and shear force in a fluid flow;	

(E)	explain the variables of lift and drag formulas and how the variables relate to fluid flow; and	CCRS: M II.B.1
(F)	design an experiment to measure the drag coefficient for a solid body in a fluid flow.	
(11)	The student understands compressible flow and the relationship between sound transmission through a fluid and fluid compression. The student is expected to:	
(A)	differentiate between compressible and incompressible (approximately) fluids and the effect on the speed of sound through a fluid;	
(B)	explain how density impacts the speed of sound through a fluid;	CCRS: M III.A.1, VII.D.1, IX.B.2
(C)	calculate and use the Mach number to model a fluid as compressible or incompressible (approximately); and	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(D)	explain the effects on fluid, including shock waves, when the sound barrier is broken.	
(12)	The student designs and analyzes fluid systems. The student is expected to:	
(A)	explain the function of weirs in an open channel and describe an application such as flow control or flow measurement;	
(B)	calculate the fluid flow in open channels with different shapes, slopes, and weirs;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(C)	design an application of the principle of buoyancy using hydrostatics such as a boat, submarine, floating dock, or hot air balloon;	
(D)	analyze and design a fluid device such as a clepsydra, water tower, pressure regulator, or nozzle using the principles of fluid dynamics;	CCRS: M II.C.3, VII.A.1-5, VII.D.1, VIII.A.1, IX.B.2
(E)	describe applications and processes of different types of pumps, including centrifugal pumps, peristaltic pumps, gear pumps, and positive displacement pumps;	
(F)	describe the operation of a centrifugal pump and explain the data presented in a pump curve, including head, flow rate, efficiency, and power;	
(G)	design a hydraulics system with components, including hydraulic fluid, pump, reservoir, motor, cylinders, valves, and flow controllers;	
(H)	identify and compare different types of turbomachines including pumps and turbines;	CCRS: ELA.V.B.1

(I)	describe and differentiate the applications of turbomachines, including pumps and turbines; and	
(J)	explain the concept of tribology and identify the associated variables such as film thicknesses and pressures.	

§127.XX ~~Introduction to~~ Mechanics of Materials (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 10-12. Prerequisite: Algebra I, at least one credit from the Engineering Career Cluster. Recommended prerequisite: Geometry.	
(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 Mechanics of Materials describe the mechanical behavior of engineering materials, including metals, ceramics, polymers, composites, welds, and adhesives. Applications of load, deformation, stress and strain relationships for deformable bodies and mechanical elements relevant to engineers. The course will include axially loaded members, buckling of columns, torsional members, beams, and failure.	
(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.	
(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;	CCRS: ELA.I.A.3;
(C)	use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;	CCRS: CD II.C.7
(D)	use appropriate tools such as dial calipers, protractors, scale rulers, tape measures, load cells, micrometers, scales, tensometer, multimeter, and thermometers;	
(E)	collect quantitative data using the System International (SI) and United States customary units and qualitative data as evidence;	CCRS: CD II.D.2
(F)	organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;	CCRS: CD II.D.1

(G)	develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and	CCRS: CD II.C.8
(H)	distinguish between scientific hypotheses, theories, and laws.	CCRS: CD II.C.1
(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;	CCRS: CD II.A.4
(B)	analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	CCRS: CD II.D.1
(C)	use mathematical calculations to assess quantitative relationships in data; and	CCRS: CD II.D.2
(D)	evaluate experimental and engineering designs.	CCRS: CD II.C.4
(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;	CCRS: CD II.D.3
(B)	communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	CCRS: CD I.A.1
(C)	engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	CCRS: CD I.A.2
(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:	CCRS: ELA.II.A.4; 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 to encourage critical thinking by the student;	CCRS: ELA.II.A.5; CCRS: CD II.A.5
(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	CCRS: ELA.II.A.4; CCRS: CD II.C.7
(C)	research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.	CCRS: ELA.V.B.1, CCRS: ELA.V.B.3; CCRS: CD II.C.2

(6)	The student examines the historical developments that led to the field of mechanics of materials and material science. The student is expected to:	
(A)	describe the contribution of historical scientists to the field of mechanics such as Pascal, Galileo, Euler, Navier, Lame, Poisson, Hooke, and Young;	CCRS: SCI IV.A.1, IV.C.1, IV.C.2; CCRS: CD II.A.8
(B)	describe key historical advancements related to the development of different materials such as bronze, iron, steel, Damascus steel, and Roman concrete;	CCRS: SCI IV.A.1, IV.C.1, IV.C.2; CCRS: CD II.A.4
(C)	explain how materials have influenced historical events or products such as the steel in the Titanic, the space race, and smartphones;	CCRS: SCI IV.A.1, IV.C.1, IV.C.2; CCRS: CD II.A.5
(D)	evaluate the impact of modern development of materials such as composites, nanotechnology, semi-conductors, alloys, and the effects of processes on materials such as subtractive manufacturing, additive manufacturing, and welding; and	CCRS: ELA.V.B.1, CCRS: ELA.V.B.3;
(E)	describe the development of shapes in structures and architecture such as columns, arches, domes, keystones, and suspension bridges.	CCRS: CD II.A.4
(7)	The student identifies and measures different properties of an object them. The student is expected to:	
(A)	classify properties of an object as geometric, structural, or material;	CCRS: SCI V.A.1;
(B)	identify and describe the application of tools used to measure material properties, including rulers, calipers, micrometers, weighing scales, tensile testers (tensometers), and thermometers;	CCRS: SCI V.E.3; CCRS: CD II.A.4,5
(C)	measure common properties of materials, including length, width, height, and mass;	CCRS: SCI V.E.3, II.F.1; CCRS: M I.C.1;
(D)	measure and observe intrinsic properties of materials such as hardness, thermal conductivity, impact resistance;	CCRS: SCI VII.A.1; CCRS: M I.C.1, I.C.2;
(E)	analyze data and calculate density, cross-sectional area, specific gravity, thermal expansion, modulus of elasticity, Poisson's ratio, bulk modulus, yield, and ultimate stress;	CCRS: SCI II.B.1, VII.A.1, VIII.A.3, VIII.A.4; CCRS: M I.C.1, I.C.2, II.C.3, VII.A.1-5, VIII.A.1; CCRS: CD II.D.2
(F)	differentiate material properties, including ductility, malleability, resilience, toughness, and reflectivity;	CCRS: SCI V.D.1, VII.A.1, VIII.A.2;
(G)	classify material properties as geometric (extrinsic), material (intrinsic), or structural; and	

(H)	classify types of materials including metals and alloys, polymers, ceramics, biomaterials, composites, and semiconductors.	Metals and alloys should not be broken out (like rules and regulations)
(8)	The student understands various manifestations of forces acting on solids. The student is expected to:	
(A)	illustrate forces including axial, radial, normal, torsional and shear and identify different units such as newtons, pounds, and KIPS utilized in force measurement;	CCRS: SCI VIII.B.1-3; CCRS: M I.C.1, I.C.2, III.C.1;
(B)	explain force intensity of distributed forces, including forces distributed over a line, area, and volume;	CCRS: CD I.C.1
(C)	calculate and simplify multiple loads to a single combined load;	CCRS: SCI II.A.6, VIII.B.1-3; CCRS: M III.C.1, VI.C.1, IX.B.2;
(D)	distinguish between normal forces and shear forces; and	
(E)	identify and calculate different types of stress, including axial stress, shear stress, and bending stress.	CCRS: M III.C.1, VI.C.1, VII.A.1-5, IX.B.2; CCRS: CD II.A.4
(9)	The student evaluates the effect of temperature on the properties of a material. The student is expected to:	
(A)	describe engineering applications of thermo-mechanical properties such as thermometers, thermocouples, thermistors, thermostatic valves and controllers, and fuses;	CCRS: CD II.A.5
(B)	explain the atomic origin of thermal expansion resulting in measurable effects such as building height change, and material distortion;	
(C)	describe potential failure modes due to thermal expansion for kinematically constrained structures;	
(D)	explain how to accommodate thermal expansion in construction such as buckling of railroad rails, U-runs in piping, and expansion joints; and	
(E)	explain the effect of temperature on the mechanical properties of materials including modulus of elasticity, yield strength, ductility, and toughness.	
(10)	The student determines the material properties from different mechanical material tests and how they are graphically represented. The student is expected to:	
(A)	describe a tensile test, the different possible shapes of tensile testing specimens, and the measurements obtained in a tensile test, including force, elongation, and change in thickness;	CCRS: M I.C.1, I.C.2, II.B.1, VII.B.1; CCRS: CD II.A.2
(B)	analyze data from a tensile test to calculate engineering stress and strain for various materials such as aluminum, brass, cast iron, steel, and nylon at significantly different temperatures;	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, VI.C.1, VII.B.1, IX.B.2; CCRS: CD II.D.2

(C)	plot engineering stress and strain on a two-dimensional graph;	CCRS: M VIII.C.1; CCRS: CD II.D.3
(D)	identify regions of a stress-strain curve, including elastic deformation, plastic deformation, resilience, strain hardening, fracture, and tension toughness;	CCRS: CD II.A.4
(E)	estimate the values from a stress-strain curve, including 0.2% offset, modulus of elasticity, yield stress, ultimate stress, resilience, and tension toughness;	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, VI.C.1, VII.B.1, IX.B.2;
(F)	compare and explain differences in testing plots based on differences in specimen geometry;	
(G)	compare different types of material testing, including compression tests, tensile tests, and three-point bending tests;	
(H)	analyze testing results from compression and three-point bending tests with different specimen geometries, including length, cross-sectional shape, and cross-sectional area; and	CCRS: M VII.D.1, IX.B.2; CCRS: CD II.D.2
(I)	describe modern mechanical testing such as digital image correlation, thermography, acoustic emission, and x-ray diffraction.	CCRS: CD II.A.4
(11)	The student analyzes the impact of the cross-sectional geometry on the second moment of area for beams and shafts. The student is expected to:	
(A)	calculate the area and the second moment of area for primitive shapes, including rectangles, triangles, circles, and semi-circles;	CCRS: M II.B.1, III.A.1, III.A.2, III.C.1, III.D.1, VI.C.1, VII.B.1;
(B)	explain the parallel-axis theorem and use the parallel axis theorem to calculate the second moment of area for complex shapes;	CCRS: M II.B.1, VI.C.1, VII.B.1; CCRS: CD I.C.1
(C)	calculate area, centroid, and second moment of area for complex shapes composed of primitive shapes such as an H-beam, square tubes, round tubes, and angle iron; and	CCRS: M II.B.1, III.A.1, III.A.2, III.C.1, III.D.1, VI.C.1, VII.B.1;
(D)	hypothesize the best cross-sectional shape for different types of loads such as tension, compression, torsion, bending, and combinations of these loads.	
(12)	The student represents point and distributed forces on a sketch and calculates the maximum deflection and factor of safety of bars, cables, columns, beams, and shafts using algebraic equations. The student is expected to:	
(A)	describe the consequences of stresses such as elastic deformation, plastic deformation, and fracture on solid objects with mass;	CCRS: CD II.A.5
(B)	calculate the maximum deflection of various homogenous prismatic beams, including simply supported, cantilever, and overhang beams using algebraic formulas;	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, VI.C.1, VII.A.1-5, VII.B.1, VII.D.1, IX.B.2;

(C)	calculate the factor of safety of various homogenous prismatic beams including simply supported, cantilever, overhang beams, and columns using algebraic formulas;	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, VI.C.1, VII.A.1-5, VII.B.1, VII.D.1, IX.B.2;
(D)	analyze the impact of cross-sectional area and length on the potential for various homogenous prismatic columns to buckle under load;	CCRS: M III.C.1, VII.B.1, VII.D.1;
(E)	explain the impact of or the reason for using a tapered object in structural applications; and	CCRS: M II.B.1, III.C.1, VII.B.1, VII.D.1;
(F)	describe why pre-stress is utilized in applications such as shot-peening, tempered glass, wheel spokes, flatbed trailers, and bridges.	CCRS: CD II.A.4
(13)	Students demonstrate an understanding of stress, strain, and displacement fields throughout a structure, including bars and beams. The student is expected to:	
(A)	identify compression and tension regions in a bent beam;	
(B)	describe the kinematics of a bent member, including elongation due to tension, shortening due to compression, the neutral axis, and the linear displacement profile; and	CCRS: SCI VIII.C.1;
(C)	identify regions of compression and tension in digital image correlation data.	
(14)	The student understands that the mechanics of materials are required to analyze a multi-member structure for strength and stability in real-world applications. The student is expected to:	
(A)	compare permanent and non-permanent joints, including welding, brazing, soldering, adhesives, bolting, screwing, and riveting joints;	
(B)	analyze a bolted connection for pre-stress, load, factor of safety, grade, size, yield stress, and applied torque; and	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, III.D.1, VI.C.1, VII.A.1-5, VII.B.1, VII.D.1, IX.B.2;
(C)	design a structure to support a specified load with materials of adequate properties, size, and geometry and with an appropriate factor of safety.	CCRS: M I.C.1, I.C.2, II.B.1, III.C.1, III.D.1, VI.C.1, VII.A.1-5, VII.B.1, VII.D.1, IX.B.2;

§127.XX ~~Introduction to~~ Statics (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 11-12. Prerequisite: Algebra II. Recommended prerequisite: Physics.	
(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)	Introduction to Statics is a gateway course into most engineering majors such as aerospace, mechanical, civil, and biomedical engineering. Students will learn the elements of statics that include the forces in structures that are in equilibrium and usually not moving. This includes forces calculated in two dimensions, free-body diagrams, distributed loads, centroids, and friction as applied to cables, trusses, beams, machines, gears, and mechanisms. Students will explore scenarios where objects remain stationary, emphasizing the importance of balance and stability in engineering design. This course not only equips students with theoretical knowledge but empowers them with practical skills that are indispensable in real-world engineering scenarios.	
(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.	
(2)	The student describes milestones in structural design and construction throughout history. The student is expected to:	
(A)	research and evaluate the contribution of pioneering historical structures such as the Eiffel Tower, Pyramids, Roman Aqueducts, Ferris Wheel, Sydney Opera House, and St. Louis Bridge to the field of structural design;	CCRS: SCI IV.C.1; ELA V.B.1; CD II.C.2, II.C. 4

(B)	analyze how locally available materials and technology have impacted the construction of structures through time;	CCRS: SCI IV.C.1; ELA V.B.1, V.B.3; CD II.A.5; SS I.A.2
(C)	identify the contributions of historical pioneers to the field of structural design such as Archimedes, Leonardo DaVinci, Galileo, René Descartes, and Albert of Saxony; and	CCRS: SCI IV.C.2; ELA.V.A.1; CD II.A.8;
(D)	identify careers that use the field of statics and predict the future application of statics.	CCRS: ELA II.A.4; CD I.C.1
(3)	The student measures and converts units in the System International (SI) units and United States (US) customary systems of measurement. The student is expected to:	
(A)	measure objects using different units of measurement such as feet, inches, centimeters, meters, pounds force, Newtons, slugs, and kilograms in decimal and fractional measurements;	CCRS: SCI II.F.1; M I.C.1, VII.B.1; CD II.D.3
(B)	apply prefixes to units of measure and convert between units in U.S. customary and SI systems such as kgs and kips; and	CCRS: M I.C.2
(C)	identify physical examples of different units of measurement including one Newton, one pound, and one kip.	CCRS: M I.C.1
(4)	The student develops an understanding of point and distributed forces and moments, including torque and couples and their respective units. The student is expected to:	
(A)	explain how Newton's third law of motion applies to static systems;	CCRS: SCI VIII.C.2; CD I.B.2
(B)	explain the purpose and operation of mechanical components, including gears, sprockets, pulleys, and simple machines;	CCRS: CD II.A.4
(C)	explain how mechanical components, including gears, sprockets, pulley systems, and simple machines are used in mechanisms;	CCRS: CD II.A.5
(D)	explain distributed loads and simplify distributed loads to point loads;	CCRS: SCI VIII.C.2; M III.A.2, III.C.1, VII.B.1; CD II.A.5
(E)	compare a two-dimensional distributed load applied over a line to a distributed load applied over an area and a volume;	CCRS: M III.A.2, III.C.1; CD II.A.5
(F)	calculate and use applicable units for forces, torque, distances, and mechanical advantages related to levers, gears, and pulleys;	CCRS: SCI VIII.E.2; M I.X.1, II.B.1, VII.A.1-5, VII.B.1, VIII.A.1, VIII.A.3

(G)	define and calculate the efficiency of mechanical systems; and	CCRS: M II.B.1, VII.B.1, IX.B.2
(H)	identify and explain couples in a static system.	CCRS: CD II.D.I
(5)	The student applies vector algebra to calculate the equivalent force and moment vectors. The student is expected to:	
(A)	differentiate between scalar and vector quantities;	CCRS: SCI VIII.B.1; CD II.A.5
(B)	identify properties of a vector, including magnitude and direction;	CCRS: SCI VIII.B.1; CD II.A.4
(C)	convert forces represented graphically to vector notation;	CCRS: SCI VIII.B.2; M III.C.1
(D)	represent a force vector in its horizontal and vertical components;	CCRS: SCI VIII.B.3; M III.A.3
(E)	calculate resultant vectors from multiple vectors using a strategy including vector addition and the parallelogram rule;	CCRS: M III.C.1
(F)	simplify free-body diagrams by using strategies including the principle of transmissibility, couples, and the summation of moments;	CCRS: M III.C.1
(G)	calculate moments of a rigid body system using strategies, including the product of force and perpendicular distance to a specified axis and the right-hand rule;	CCRS: M II.B.1, VI.C.1
(H)	calculate moments from component forces using Varignon's principle; and	CCRS: M III.C.1
(I)	apply equivalent transformation to simplify external loads in a structural system.	CCRS: M III.C.1
(6)	The student locates and applies the geometric centroid and the center of mass of homogenous and heterogeneous objects. The student is expected to:	
(A)	explain the difference between geometric centroid and center of mass;	CCRS: SCI VIII.A.3; M III.C.1; ELA.I.A.2
(B)	locate the geometric centroid of simple and complex shapes using the composite parts method; and	CCRS: M III.C.1, III.D.2
(C)	locate the center of mass for two-dimensional and three-dimensional homogeneous and heterogeneous objects.	CCRS: M III.A.1, III.C.1, III.D.2, VII.A.1-5

(7)	The student determines the stability of simple and complex objects with a variety of applied forces. The student is expected to:	
(A)	identify potential pivot points at which objects could potentially rotate leading to a tip-over;	CCRS: CD II.D.1
(B)	use the relative location of the center of mass and object pivot point to determine the stability of simple and complex objects with only frictional force;	CCRS: M III.A.1, III.C.1, VI.C.1, VII.A.1-5
(C)	calculate the stability of simple and complex objects with external forces applied at different locations on the object and a reaction force caused by friction; and	CCRS: M III.A.1, III.C.1, VI.C.1, VII.A.1-5
(D)	describe how the friction reaction forces when combined with applied forces at different locations affect the stability of an object and how to stabilize unstable systems.	CCRS: CD II.A.4
(8)	The student differentiates supports, including fixed, pin, and roller supports for structures. The student is expected to:	
(A)	define and compare the applications of different structural supports, including fixed, pin, and roller supports;	CCRS: CD II.A.4
(B)	explain the degrees of freedom for fixed, pin, and roller supports;	CCRS: CD II.A.5
(C)	describe how fixed, pin, and roller supports affect a structural system; and	CCRS: CD II.A.4
(D)	describe and sketch the different reaction forces and moments for structural supports, including fixed, pin, and roller supports.	CCRS: CD II.A.4
(9)	The student constructs free-body diagrams of particles and rigid bodies around various supports and determines the reaction forces of the static body. The student is expected to:	
(A)	sketch a complete free-body diagram which includes applied and reaction forces for a structure;	CCRS: SCI VIII.C.2; CD II.D.3
(B)	define static equilibrium;	CCRS: CD II.A.4
(C)	formulate translational and rotational static equilibrium equations into a system of algebraic equations; and	CCRS: SCI VIII.C.1, VIII.E.1; M II.B.1, VII.A.1-2

(D)	solve for unknown forces in a structure using equations of equilibrium.	CCRS: SCI VIII.A.5; M II.B.1, II.C.3, VII.A.3-5
(10)	The student analyzes statically determinant plane trusses. The student is expected to:	
(A)	test if a plane truss is statically determinant;	CCRS: M II.C.3; CCRS: CD II.C.4
(B)	use the method of sections and method of joints to calculate the internal forces of a statically determinant plane truss;	CCRS: M II.C.3, III.A.3, III.C.1, VII.A.1-5, VII.D.1, IX.B.2
(C)	explain the difference between tension and compression forces;	CCRS: CD II.A.5
(D)	describe capabilities of members including beams, cables, ropes, bars, and columns to bear tension, compression, or both;	CCRS: CD II.A.4
(E)	identify internal members as being in tension or compression, the members bearing the maximum loads, and the member most likely to fail; and	CCRS: CD II.A.4
(F)	design structures such as bridges, tensegrity structures, or trusses to support external loads.	CCRS: M IX.B.2
(11)	The student recognizes the limitations of a two-dimensional model. The student is expected to:	
(A)	identify the differences between a two-dimensional and three-dimensional system;	CCRS: M III.A.1
(B)	explain the implications of adding a third dimension to a structure and how a two-dimensional analysis is insufficient to model a three-dimensional structure; and	CCRS: M III.A.2
(C)	describe how a third dimension can cause instability in a structure.	CCRS: M III.A.2