Engineering Science
At-A-Glance - Lamar CISD

Ongoing Skills Imbedded All Year	**Professional Standards/Employability Skills/Technical Skills**		
	ES 1(B) The student will show the ability to cooperate, contribute, and collaborate as a member of a group to achieve a positive collective outcome. ES 1(C) The student will present written and oral communication in a clear, concise, and effective manner. ES 1(D) The student will demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results. ES 2(A) The student will demonstrate safe practices during laboratory and field investigations. ES 3(B) The student will know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories. ES 3(C) The student will know 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 exceptionally reliable explanations, but they may be subject to change as new areas of science and innovative technologies are developed. ES 4(A) The student will analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, to encourage critical thinking. **ES 6(B)** The student will create solutions to existing problems using a design process.		
Ongoing Ways to Show	ES 6(A) The student will solve design problems individually and in a team. ES 6(B) The student will create solutions to existing problems using a design process. ES 6(C) The student will use a design brief to identify problem specifications and establish project constraints. ES 6(D) The student will use communication to achieve a desired goal within a team. ES 6(E) The student will work as a member of a team to conduct research to develop a knowledge base, stimulate creative ideas, and make informed decisions.		
Grading Period	**Unit Name**	**Estimated Time Frame**	**TEKS**
Grading Period 1 28 Days	**Professional Standards & Safety**	**5 Days**	1A, 1B, 1C, 1D, 1E, 2A, 2B
	ES 1(A) The student will demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession. ES 1(B) The student will show the ability to cooperate, contribute, and collaborate as a member of a group to achieve a positive collective outcome. ES 1(C) The student will present written and oral communication in a clear, concise, and effective manner. ES 1(D) The student will demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results. ES 1(E) The student will demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed. ES 2(A) The student will demonstrate safe practices during laboratory and field investigations. ES 2(B) The student will demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.		
	Scientific Method, Reasoning & Problem Solving	**8 Days**	3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 4A, 4B, 4C, 4D, 4E
	ES 3(A) The student will know the definition of science and understand that it has limitations. ES 3(B) The student will know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories. ES 3(C) The student will know 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. ES 3(D) The student will distinguish between scientific hypotheses and scientific theories. ES 3(E) The student will plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology. ES 3(F) The student will collect and organize qualitative and quantitative data and make measurements with accuracy and precision using appropriate scientific and engineering tools. ES 3(G) The student will analyze, evaluate, make inferences, and predict trends from data. ES 3(H) The student will communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports. ES 4(A) The student will analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, to encourage critical thinking. ES 4(B) The student will communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials. ES 4(C) The student will draw inferences based on data related to promotional materials for products and services. ES 4(D) The student will) evaluate the impact of scientific research on society and the environment. ES 4(E) The student will evaluate models according to their limitations in representing objects or events.		

	Mechanical Advantage, Simple Machines	**15 Days**	5A, 5B, 5C, 5D, 5E, 5F
	ES 5(A) The student will differentiate between engineering and engineering technology. ES 5(B) The student will compare the roles or job descriptions for career opportunities in the fields of pure science, engineering, and engineering technology. ES 5(C) The student will identify and differentiate between different engineering disciplines. ES 5(D) The student will demonstrate appropriate oral, written, and visual forms of technical communication. ES 5(E) The student will identify and differentiate between various simple machines and understand how to determine their mechanical advantages theoretically as well as empirically. ES 5(F) The student will design and create complex machines by combining 3 or more simple machines and determine the overall mechanical advantage of the complex machine.		
Grading Period 2 25 Days	**Energy**	**15 Days**	8A, 8B, 8C, 8D
	ES 8(A) The student will identify and categorize energy sources as nonrenewable, renewable, or inexhaustible. ES 8(B) The student will define and calculate work and power in electrical systems. ES 8(C) The student will calculate power in a system that converts energy from electrical to mechanical. ES 8(D) The student will define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law.		
	Energy Requirements & Sources	**10 Days**	9A, 9B, 9C, 9D, 9E, 9F, 9G
	ES 9(A) The student will explain the purpose of energy management. ES 9(B) The student will evaluate system energy requirements in order to select the proper energy source. ES 9(C) The student will explain how multiple energy sources can be combined to convert energy into useful forms. ES 9(D) The student will describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity. ES 9(E) The student will measure and analyze how thermal energy is transferred via convection, conduction, and radiation. ES 9(F) The student will analyze how thermal energy transfer is affected by conduction, thermal resistance values, convection, and radiation. ES 9(G) The student will calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties.		
Grading Period 3 25 Days	**Material Properties**	**15 Days**	11A, 11B, 11C
	ES 11(A) The student will conduct investigative non-destructive material property tests on selected common household products. Property testing conducted to identify continuity, ferrous metal, hardness, and flexure. ES 11(B) The student will calculate weight, volume, mass, density, and surface area of selected common household product. ES 11(C) The student will identify the manufacturing processes used to create the selected common household product.		
	Material Testing	**10 Days**	12A, 12B, 12C, 12D, 12E
	ES 12(A) The student will use a design process and mathematical formulas to solve and document design problems. ES 12(B) The student will obtain measurements of material samples such as length, width, height, and mass. ES 12(C) The student will use material testing to determine a product's reliability, safety, and predictability in function. ES 12 (D) The student will identify and calculate test sample material properties using a stress strain curve. ES 12 (E) The student will identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points.		
Grading Period 4 33 Days	**Forces & Structural Design**	**15 Days**	10A, 10B, 10C, 10D, 10E, 10F, 10G, 10H, 10I, 10J
	ES 10(A) The student will illustrate, calculate, and experimentally measure all forces acting upon a given body. ES 10(B) The student will locate the centroid of structural members mathematically or experimentally. ES 10(C) The student will calculate moment of inertia of structural members. ES 10(D) The student will define and calculate static equilibrium. ES 10(E) The student will differentiate between scalar and vector quantities. ES 10(F) The student will identify properties of a vector, including magnitude and direction. ES 10(G) The student will calculate the X and Y components given a vector. ES 10(H) The student will calculate moment forces given a specified axis. ES 10(I) The student will calculate unknown forces using equations of equilibrium. ES 10(J) The student will calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations.		
	Kinematics	**18 Days**	16A, 16B, 16C, 16D
	ES 16(A) The student will calculate distance, displacement, speed, velocity, and acceleration from data. ES 16(B) The student will calculate experimentally the acceleration due to gravity given data from a free-fall device. ES 16(C) The student will calculate the X and Y components of an object in projectile motion. ES 16(D) The student will determine the angle needed to launch a projectile a specific range given the projectile's initial velocity.		

Lab Safety and Scientific Processes
Readiness Standards
Supporting Standards

Grading Period 5 34 Days	**Statistics (Could be Fluid Control here)**	**12 Days**	15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H
	ES 15(A) The student will calculate the theoretical probability that an event will occur. ES 15(B) The student will calculate the experimental frequency distribution of an event occurring. ES 15(C) The student will apply the Bernoulli process to events that only have two distinct possible outcomes. ES 15(D) The student will apply AND, OR, and NOT logic to solve complex probability scenarios. ES 15(E) The student will apply Bayes' theorem to calculate the probability of multiple events occurring. ES 15(F) The student will calculate the central tendency of a data array, including mean, median, and mode. ES 15(G) The student will calculate data variation, including range, standard deviation, and variance. ES 15(H) The student will create a histogram to illustrate frequency distribution.		
	Machine Control	**22 Days**	13A, 13B, 13C, 13D, 13E
	ES 13(A) The student will create detailed flowcharts using a computer software application. ES 13(B) The student will create control system operating programs using computer software. ES 13(C) The student will create system control programs that use flowchart logic. ES 13(D) The student will select appropriate input and output devices based on the need of a technological system. ES 13(E) The student will judge between open- and closed-loop systems in order to select the most appropriate system for a given technological problem.		
Grading Period 6 28 Days	**Systems Control Design Problems**	**18 Days**	7A, 7B, 7C, 7D
	ES 7(A) The student will brainstorm and sketch possible solutions to an existing design problem. ES 7(B) The student will create a decision-making matrix for a design problem. ES 7(C) The student will select an approach that meets or satisfies the constraints provided in a design brief. ES 7(D) The student will create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.		
	Fluid Control (Could be Statistics here)	**10 Days**	14A, 14B, 14C, 14D, 14E, 14F
	ES 14(A) The student will identify and explain basic components and functions of fluid power devices. ES 14(B) The student will differentiate between pneumatic and hydraulic systems and between hydrodynamic and hydrostatic systems. ES 14(C) The student will use Pascal's Law to calculate values in a fluid power system. ES 14(D) The student will distinguish between gauge pressure and absolute pressure and between temperature and absolute temperature. ES 14(E) The student will calculate values in a pneumatic system using the ideal gas laws. ES 14(F) The student will calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system.		