Curriculum Alignment with Texas Essential Knowledge and Skills (TEKS) for Fourth-Year Science Course "Engineering Design and Problem Solving"

ENGINEER YOUR WORLD

	Fall Semester					Spring Semester		
Unit Title	*Overview and Norms: Introduction to Engineering*	*Designing for Customeers: Customer Needs*	*Discovering Design: Pinhole Camera*	*Understanding Data: Designing Coffee*	*Designing with Data: Safer Buildings*	*Reverse Engineering: Product Redesign*	*Programming: Electronic Music*	*System Engineering: Aerial Imaging*
1. The student, for at least 40% of instructional time, conducts engineering field and laboratory activities using safe, environmentally appropriate, and ethical practices. The student is expected to:								
(A) demonstrate safe practices during engineering field and laboratory activities		+	+	+	+	+		+
(B) make informed choices in the use and conservation of resources, recycling of materials, and the safe and legal disposal of materials			+		+			+
2. The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:								
(A) apply scientific processes and concepts outlined in the Texas Essential Knowledge and Skills (TEKS) for Biology, Chemistry, or Physics relevant to engineering design problems			+	+	+			+
(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems			+		+		+	+
(C) select appropriate mathematical models to develop solutions to engineering design problems			+	+	+			+
(D) integrate advanced mathematics and science skills as necessary to develop solutions to engineering design problems				+	+			+
(E) judge the reasonableness of mathematical models and solutions			+	+	+			+
(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems				+	+			+
(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems		*				*	+	+
(H) describe the difference between open-loop and closed-loop control systems								+
(I) make measurements and specify tolerances with minimum necessary accuracy and precision			+	+	+	+		+
(J) use appropriate measurement systems, including customary and International System (SI) of units			+	+	+	+		+
(K) use conversions between measurement systems to solve real-world problems								+
3. The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:								
(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, but not limited to, graphs and tables		+	+	+	+	+		+
(E) evaluate the quality and relevance of sources and cite appropriately		+	+	+	+		+	+
(F) defend a design solution in a presentation								+
4. The student recognizes the history, development, and practices of the engineering professions. The student is expected to:								
(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 among engineers, scientists, and mathematicians				+				
(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			+					+
(E) discuss the history and importance of engineering innovation on the United States economy and quality of life		+	+					+
(F) describe the importance of patents and the protection of intellectual property rights						+		
5. The student creates justifiable solutions to open-ended 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) 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, but not limited to, 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			+		+	+		+
(F) test and evaluate proposed solutions using methods such as models, prototypes, mock-ups, simulations, 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					+	+	+	+
(H) predict performance, failure modes, and reliability of a design solution								+
(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process					+	+		+
6. The student manages an engineering design project. The student is expected to								
(A) participate in the design and implementation of a real or simulated engineering project			+	+	+	+		+
(B) develop a plan and timeline 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 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			+	+	+	+		+
(I) maintain an engineering notebook that chronicles work such as ideas, concepts, inventions, sketches, and experiments	+	+	+	+	+	+	+	+

Texas Essential Knowledge and Skills (TEKS)

** - These student expectations are met when a "system" is defined in a science (e.g. Biology, Chemistry, Physics) context.*