Introduction to Engineering Design – IED
At-A-Glance - Lamar CISD

Ongoing Skills Imbedded All Year	**Professional Standards/Employability Skills/Technical Skills**		
	IED 1.1(A) The student will apply engineering notebook standards and protocols when documenting their work during the school year. IED 1.1(B) The student will identify and apply group brainstorming techniques and the rules associated with brainstorming.		
Ongoing Ways to Show	Engineering Notebook checks at grading periods. Utilize brainstorming techniques on various projects throughout the year; reflect on the rules and techniques as needed. Portfolio of Inventor work at the end of the year.		
Grading Period	**Unit Name**	**Estimated Time Frame**	**TEKS**
Grading Period 1 **29 Days**	**Engineering Notebook & Documentation**	**6 Days**	1.1A
	IED 1.1(A) The student will apply engineering notebook standards and protocols when documenting their work during the school year.		
	Disciplines of Engineering	**5 Days**	21st Century Skills
	PLTW does not have this on their out-of-date TEKS, but Career Exploration is part of 21st century skills and standard work for an intro level CTE course.		
	Sketching Techniques	**9 Days**	1.2A, 1.2B, 1.2C, 1.2G
	IED 1.2(A) The student will identify, sketch, and explain the function of points, construction lines, object lines, and hidden lines. IED 1.2(B) The student will plot points on grid paper to aid in the creation of sketches and drawings. IED 1.2(C) The student will explain the concepts of technical sketching and drawing. IED 1.2(G) The student will describe the concept of proportion as it relates to freehand sketching.		
	Design Process Overview	**9 Days**	1.1B, 1.1D, 1.1E
	IED 1.1(B) The student will identify and apply group brainstorming techniques and the rules associated with brainstorming. IED 1.1(D) The student will use online and published works to research aspects of design problems. IED 1.1(E) The student will identify the design process steps used in given scenarios and be able to list the steps, if any are missing.		
Grading Period 2 **26 Days**	**Pictorial Drawing**	**10 Days**	1.2D, 1.2E, 1.2F
	IED 1.2(D) The student will sketch an isometric view of simple geometric solids. IED 1.2(E) The student will explain how an oblique view of simple geometric solids differs from an isometric view. IED 1.2(F) The student will sketch one-point, two-point, and three-point perspectives of simple geometric solids.		
	Orthographic Drawing	**10 Days**	1.2H, 1.2I, 1.3B, 1.3D, 1.3E, 1.3F
	IED 1.2(H) The student will sketch multiview drawings of simple geometric solids. IED 1.2(I) The student will determine the front view for a given object. IED 1.3(B) The student will measure and record linear distances using a scale to a precision of 1/16 inch and 1 mm. IED 1.3(D) The student will add and subtract U.S. standard and metric linear measurements. IED 1.3(E) The student will convert linear distance measurements from inches to millimeters and vice versa. IED 1.3(F) The student will apply linear dimensions to a multiview drawing.		
	Introduction to 3D Modeling	**6 Days**	2.1A, 2.1B, 2.1C
	IED 2.1(A) The student will identify common geometric shapes and forms by name. IED 2.1(A) The student will identify and explain the various geometric relationships that exist between the elements of two-dimensional shapes and three-dimensional forms. IED 2.1(B) The student will identify and define the axes, planes, and sign conventions associated with the Cartesian coordinate system. IED 2.1(C) The student will apply geometric and numeric constraints to CAD sketches.		

Grading Period 3 25 Days	**Puzzle Cube Project**	**25 Days**	1.3C, 1.3G, 1.3H, 1.4B, 1.4C,1.4D, 1.4E, 1.4 F, 1.4G, 1.4H, 1.4I
	IED 1.3(C) The student will measure and record linear distances using a dial caliper to a precision of 0.001 inch. IED 1.4(A) The student will brainstorm and sketch possible solutions to an existing design problem. IED 1.3(G) The student will calculate the mean, mode, median, and range of a data set. IED 1.3(H) The student will create a histogram of recorded measurements showing data elements or class intervals, and frequency. IED 1.4(B) The student will select an approach that meets or satisfies the constraints given in a design brief. IED 1.4(C) The student will create simple extruded solid Computer Aided Design (CAD) models from dimensioned sketches. IED 1.4(D) The student will generate dimensioned multiview drawings from simple CAD models. IED 1.4(E) The student will measure and fabricate parts for a functional prototype from the CAD multiview drawings. IED 1.4(F) The student will assemble the product using the CAD modeling software. IED 1.4(G) The student will test and evaluate the prototype and record results. IED 1.4(H) The student will apply geometric and numeric constraints to CAD sketches. IED 1.4(I) The student will identify the purpose of packaging in the design of consumer products.		
Grading Period 4 32 Days	**Product Evolution**	**7 Days**	1.1C, 3.4D, 4.1A, 4.1B, 4.1C
	IED 1.1(C) The student will research a product's history, develop a PowerPoint presentation, list chronologically the major innovations to a product, and present findings to a group. IED 3.4(D) The student will explain the difference between invention and innovation. IED 4.1(A) The student will create a brainstorming list of different products made from common materials that are used daily. IED 4.1(B) The student will research and construct a product impact timeline presentation of a product from the brainstorming list and present how the product may be recycled and used to make other products after its lifecycle is complete. IED 4.1(C) The student will identify the five steps of a product's lifecycle and investigate and propose recyclable uses for the material once the lifecycle of the product is complete.		
	Advanced Modeling Techniques	**25 Days**	2.1A, 2.1D, 2.1E, 2.2A, 2.2B, 2.2C, 2.2D, 2.2E, 2.2F
	IED 2.1(A) The student will calculate the area of simple geometric shapes. IED 2.1(A) The student will calculate the surface area and volume of simple geometric forms. IED 2.1(D) The student will utilize sketch-based, work reference, and placed features to develop solid CAD models from dimensioned drawings. IED 2.1(E) The student will explain how a given object's geometry is the result of sequential additive and subtractive processes. IED 2.2(A) The student will explain the differences between size and location dimensions. IED 2.2(B) The student will differentiate between datum dimensioning and chain dimensioning. IED 2.2(C) The student will identify and dimension fillets, rounds, diameters, chamfers, holes, slots, and screw threads in orthographic projection drawings. IED 2.2(D) The student will explain the rules that are associated with the application of dimensions to multiview drawings. IED 2.2(E) The student will identify, sketch, and explain the difference between general tolerances, limit dimensions, unilateral, and bilateral tolerances. IED 2.2(F) The student will differentiate between clearance and interference fits.		
Grading Period 5 32 Days	**Advanced Modeling Techniques Pt 2**	**16 Days**	2.3 A, 2.3B, 2.3C, 2.3D, 2.3E, 2.3F, 2.3G, 2.3H, 2.3I, 2.3J
	IED 2.3(A) The student will sketch and model an auxiliary view of a given object to communicate the true size and shape of its inclined surface. IED 2.3(B) The student will describe the purpose and demonstrate the application of section lines and cutting plane lines in a section view drawing. IED 2.3(C) The student will sketch a full and half section view of a given object to communicate its interior features. IED 2.3(D) The student will identify algebraic relationships between the dimensional values of a given object. IED 2.3(E) The student will apply assembly constraints to individual CAD models to create mechanical systems. IED 2.3(F) The student will perform part manipulation during the creation of an assembly model. IED 2.3(G) The student will explain how assembly constraints are used to systematically remove the degrees of freedom for a set of components in a given assembly. IED 2.3(H) The student will create an exploded model of a given assembly. IED 2.3(I) The student will determine ratios and apply algebraic formulas to animate multiple parts within an assembly model. IED 2.3(J) The student will create and describe the purpose of the following items: exploded isometric assembly view, balloons, and parts list.		

	Reverse Engineering – Team Norms & CAD Work	**16 Days**	2.4A, 2.4B, 2.4C, 2.4D, 2.4E, 2.4F, 2.4G, 2.4H, 2.4I, 3.3F, 3.3G, 3.4A, 3.4B, 3.4C, 4.2A, 4.2B, 4.2C, 4.2D, 4.2E, 4.2F
	IED 2.4(A) The student will brainstorm and sketch possible solutions to an existing design problem. IED 2.4(B) The student will create a decision-making matrix. IED 2.4(C) The student will select an approach that meets or satisfies the constraints given in a design brief. IED 2.4(D) The student will create solid computer-aided design (CAD) models of each part from dimensioned sketches using a variety of methods. IED 2.4(E) The student will apply geometric numeric and parametric constraints to form CAD modeled parts. IED 2.4(F) The student will generate dimensioned multiview drawings from simple CAD modeled parts. IED 2.4(G) The student will assemble the product using the CAD modeling software. IED 2.4(H) The student will explain what constraints are and why they are included in a design brief. IED 2.4(I) The student will create a three-fold brochure marketing the designed solution for the chosen problem, such as a consumer product, a dispensing system, a new form of control system, or extend a product design to meet a new requirement. IED 3.3(F) The student will assign a density value to a material and apply it to a given solid CAD model. IED 3.3(G) The student will perform computer analysis to determine mass, volume, and surface area of a given object. IED 3.4(A) The student will write design briefs that focus on product innovation. IED 3.4(B) The student will identify group brainstorming techniques and the rules associated with brainstorming. IED 3.4(C) The student will use decision matrices to make design decisions. IED 4.2(A) The student will explain why teams of people are used to solve problems. IED 4.2(B) The student will identify group norms that allow a virtual design team to function efficiently. IED 4.2(C) The student will establish file management and file revision protocols to ensure the integrity of current information. IED 4.2(D) The student will use internet resources, such as email, to communicate with a virtual design team member throughout a design challenge. IED 4.2(E) The student will identify strategies for addressing and solving conflicts that occur between team members. IED 4.2(F) The student will create a Gantt chart to manage the various phases of their design challenge.		
Grading Period 6 **29 Days**	**Reverse Engineering – Visual, Functional, and Structural Analysis**	**19 Days**	3.1A, 3.1B, 3.1C, 3.1D, 3.1E, 3.1F, 3.2A, 3.2B, 3.3A, 3.3B, 3.3C, 3.3D, 3.3E
	IED 3.1(A) The student will identify visual design elements within a given object. IED 3.1(B) The student will explain how visual design principles were used to manipulate design elements within a given object. IED 3.1(C) The student will explain what aesthetics is, and how it contributes to a design's commercial success. IED 3.1(D) The student will identify the purpose of packaging in the design of consumer products. IED 3.1(E) The student will identify visual design principles and elements that are present within marketing ads. IED 3.1(F) The student will identify the intent of a given marketing ad and demographics of the target consumer group for which it was intended. IED 3.2(A) The student will identify the reasons why engineers perform reverse engineering on products. IED 3.2(B) The student will describe the function of a given manufactured object as a sequence of operations through visual analysis and inspection (prior to dissection). IED 3.3(A) The student will describe the differences between joinery, fasteners, and adhesives. IED 3.3(B) The student will identify the types of structural connections that exist in a given object. IED 3.3(C) The student will use dial calipers to precisely measure outside and inside diameter, hole depth, and object thickness. IED 3.3(D) The student will identify a given object's material type. IED 3.3(E) The student will identify material processing methods that are used to manufacture the components of a given commercial product.		
	Presentations, EOC Review, & Testing	**10 Days**	Process
	• Student presentations of the Reverse Engineering Projects. • PLTW EOC Review and Testing.		