Aldine ISD

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***Curriculum Guide* – 2018-2019**
Grades* 11- 12/Days: *MWF

Advanced Engineering Design & Presentation

First Nine Weeks Scope and Sequence

Unit 1: Engineering Notebooks
Unit 2: Careers in Engineering
Unit 3: Technical Drafting
Unit 4: Engineering Design Process
Unit 5: Fusion 360
Unit 6: 3D Printing and its processes
Unit 7: Traditional Manufacturing
Unit 8: Final Project: Pen Base & Pen Holder

Unit 1 Vocabulary

Calculations	Class Notes	Designs Drawings	Engineering Design	Ideas
Interactions	Meeting Notes	Observations	Patents	

Unit 1: Engineering Notebooks

TEKS	Standard Clarifiers	Guiding Questions
§130.410 (c) (7) The student uses engineering design methodologies. The student is expected to: **(A) demonstrate an understanding of and discuss principles of ideation;** **(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions;** **(C) use rational thinking to develop or improve a product;** **(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 and portfolio to record the final design, construction, and manipulation of finished projects.**	**Students must know:** 1. **How to use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process.** 2. **How to use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects.** **Students must be able to:** 1. **Setup and document lesson notes in their engineering notebook.** 2. **Use rational thinking to develop or improve a product.** **Misconceptions: The importance of an Engineering Notebook.**	**Essential Question** 1. **What are two factors why using Engineering notebook are important?** 2. **Identify what makes a good Engineering Notebook** **Guiding Questions** 1. **Can you understand why the notebook is important?** 2. **What is a patent?**

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Unit 2 Vocabulary

Aerospace Engineer	Architect Engineer	Drafting and Design Engineer	Software Engineer		
Agricultural Engineer	Civil Engineer	Geological Engineer	Marine Engineer		
Automotive Engineer	Computer Engineer	Petroleum Engineer			

Unit 2: Careers in Engineering

TEKS	Standard Clarifiers	Question
§130.402. (c) (2) The student investigates the components of engineering and technology systems. The student is expected to: **(A) investigate and report on the history of engineering science;** **(B) identify the inputs, processes, and outputs associated with technological systems;** **(C) describe the difference between open and closed systems;** **(D) describe how technological systems interact to achieve common goals;** **(E) compare and contrast engineering, science, and technology careers;** **(F) conduct and present research on emerging and innovative technology; and** **(G) Demonstrate proficiency of the engineering design process.**	**Students must know**: 1. How to identify the traits of leadership. 2. Describe what to expect when entering the world of work. **Students must be able to**: 1. Identify many career possibilities related to the fields of engineering. 2. Identify sources of information about careers in engineering. **Misconceptions:** Understanding what engineers really do. http://educatingengineers.com/career-specialties	**Essential Question** 1. What are some things you already know about Engineers? **Guiding Questions** 1. List 3 sites you can utilize to obtain career and college information pertaining to engineering. 2. Can you identify sources of information about careers in Engineering?

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Unit 3 Vocabulary

Architect's scale	Border line	Break lines	Centerlines	Construction lines	Cutting-plane lines
Dimension lines	Engineer's scale	Erasing shield	Extension lines	Guidelines	Hidden lines
Line conventions	Mechanical drafters scale	Metric scale	Object line	Phantom lines	Scale
Scale clip	Section lines	Symmetry centerlines	Visible lines		

Unit 3: Technical Drafting

TEKS	Standard Clarifiers	Questions
130.42 (c) (10) The student demonstrates a knowledge of drafting by completing a series of drawings that will be published by various media. The student is expected to: (A) set up, create, and modify drawings; (B) store and retrieve geometry; (C) demonstrate an understanding of the use of line-types in engineering drawings; (D) draw 2-D single view objects; (E) create multi-view working drawings using orthographic projection; (F) dimension objects using current American National Standards Institute (ANSI) standards; (G) draw single line 2-D pictorial representations; (H) create working drawings that include section views; and (I) demonstrate a knowledge of screw thread design per ANSI standards by drawing a hex head bolt with standard, square, and acme threads.	**Students must know**: 1. Display mandala renderings at the beginning of the next class session or at the established deadline. **Students must be able to**: Use basic drafting skills and techniques when solving drawing **Misconceptions:** Identifying common sheet size formats for drafting.	**Essential Question** 1. *True or False?* Line conventions are the physical characteristics of lines and their different standards for use. 2. *True or False?* Object lines, cutting-plane lines, and centerlines are all drawn to the same line weight. 3. **Guiding Questions** 1. Why do you think there are different drafting techniques?

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Unit 4 Vocabulary

Constraints	Creativity	Criteria	Data	Design	Distribution
Experiment	Invention	Marketing	Problem solving	Product	Process
System	systematic	Technology	Engineering Design Process (EDP)		

Unit 4: Engineering Design Process

TEKS	Standard Clarifiers	Questions
130.410 (c) (7) The student uses engineering design methodologies. The student is expected to: (A) demonstrate an understanding of and discuss principles of ideation; (B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions; (C) use rational thinking to develop or improve a product; (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 and portfolio to record the final design, construction, and manipulation of finished projects.	**Students must know**: 1. Define terms associated with the lesson. 2. Understand the Engineering Design Process. **Students must be able to**: 1. Name the steps of the Engineering Design Process. 2. Apply the engineering design process steps. **Misconceptions: The Engineering Design Process is the same thing as the Scientific Method.** http://teachers.egfi-k12.org/lesson-engineering-design-process/	**Essential Question** 1. Choose one idea. On the back of this page, draw a detailed picture of the solution you chose. Label the drawing to explain what each part is made out of, how the parts fit together, and how it will work. **Guiding Questions** 1. Where do you think you will run into problems with your solution? Where do you think the weak parts in your creation will be?

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Unit 5 Vocabulary

planar	Planar material	Teamwork	Craftsmanship		
Assemblies	Browser Menu	Constraints	Rendering	CAM	
Animate	Computer Aided Design (CAD)	Degrees' of Freedom	Views	STL files	

Unit 5: Fusion 360

TEKS	Standard Clarifiers	Questions
§130.410. (c) (6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to: (E) use advanced construction techniques; (F) prepare and revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards; (G) demonstrate knowledge of effective file structure and management; (H) use advanced dimensioning techniques; (I) construct and use basic 3D parametric drawings; and (J) Develop and use prototype drawings for presentation. (7) The student uses engineering design methodologies. The student is expected to:(A) demonstrate an understanding of and discuss principles of ideation; demonstrate critical thinking, identify the system constraints, and make fact-based decisions; (B) demonstrate critical thinking, identify	**Students must know**: 1. Understand how to use Fusion 360. 2. Demonstrate the use of the Fusion 360 user interface. **Students must be able to**: 1. Understand the nature of Fusion and demonstrate effective use of design from idea to prototype. 1. **Misconceptions:** Understanding the difference between Autodesk Inventor and Autodesk Fusion 360.	**Essential Question** 1. Write a (2) paragraph paper describing one fact that you have learned about the nature Fusion 360 and two strategies you have observed that demonstrated an effective use to the design process. **Guiding Questions** 1. Give a list of real world products that we use today designed using a CAD software. 2. Describe how to create a drawings and renderings.

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Unit 6 Vocabulary

Mockup	Model	Production fixture	Prototype	Surface model	Solid model
wireframe	Stl file	ABS	Build platform	CAD	CNC
Curing	FDM	Hardening	OBJ	Photopolymer	SLA

Unit 6: 3D Printing and its Processes

TEKS	Standard Clarifiers	Questions
130.410 (c) (10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to: (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 using a variety of media.	**Students must know**: 1. Describe tension and compression forces. 2. Understand the nature of a given material and demonstrate effective use of that material **Students must be able to**: 1. Evaluate the capabilities of a material by analyzing different configurations. 2. Compare and contrast structures using different materials. **Misconceptions:** The limitations of 3D printing. http://3dprintingforbeginners.com/glossary/	**Essential Question** 1. Explain why industry uses models, mockups, and prototypes. 2. Discuss how 3D printing is evolving. **Guiding Questions** 1. Discuss the strengths of the design. 2. Discuss the weaknesses of 3D printing. 3. Construct simple models.

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Unit 7 Vocabulary

Additive manufacturing	Blanking	Broach	Casting	Composite	Compression molding
CNC	Direct casting	direct shell	Production casting	Drilling	Forming
Fused deposition modeling	Grinding	Injection molding	Just-in-time (JIT) manufacturing	Lathe	Manufacturing machine tool

Unit 7: Traditional Manufacturing

TEKS	Standard Clarifiers	Questions
130.412 (c) (8(8) 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) 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	**Students must know**: 1. What is fused deposition modeling? 2. Explain the different methods of molding plastics. **Students must be able to**: 1. Identify and describe basic manufacturing processes. 2. Name and describe the different types of modern machine tolls used to manufacture products. **Misconceptions:** The entire manufacturing process as a whole.	**Essential Question** 1. What differentiates a basic CNC milling machine from a machining center? **Guiding Questions** 1. Briefly describe the difference between the sterolithogrpahpy and selective laser melting (SLM) processes.

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Unit 8 Vocabulary

Additive manufacturing	Blanking	Broach	Casting	Composite	Compression molding
CNC	Direct casting	direct shell	Production casting	Drilling	Forming
Fused deposition modeling	Grinding	Injection molding	Just-in-time (JIT) manufacturing	Lathe	Manufacturing machine tool

Unit 8: Project: Pen Base & Pen Holder

TEKS	Standard Clarifiers	Questions
§130.410. (c) (6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to: (E) use advanced construction techniques; (F) prepare and revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards; (C) improve a system design to meet a specified need, including properties of materials selected; (c) (10) (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 using a	**Students must know**: 1. Use CAD software to design. 2. Recognize key engineering design and manufacturing terminology. **Students must be able to**: 1. Complete a final project using skills and knowledge obtained over the semester. 2. 3D print final design. **Misconceptions:** The Engineering Design Process	**Essential Question** 1. Pick five to ten of the key terms that you learned in this chapter. **Guiding Questions** 1. What issues did you encounter while working on your final project? 2. What steps did you take to find solutions?

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