



**ORGANIZING THEME/TOPIC**

**FOCUS STANDARDS & SKILLS**

<p><b>Unit 1: Design Process</b></p> <ul style="list-style-type: none"><li>• Design Process</li><li>• Brainstorming</li><li>• Prototype testing and Scientific method</li><li>• Principles and Elements of Design</li><li>• Portfolio Development</li></ul> <p>Time Frame: 3 weeks</p>	<p>Implement the design process used by professional engineers to create innovative solutions.</p> <ul style="list-style-type: none"><li>• KS 21006.02.01 Explain the steps of the design process.</li><li>• KS 21006.02.02 Assess the value of working as a team and benefits of collaboration.</li><li>• KS 21006.02.03 Investigate the principles and elements of design and demonstrate their use in the design process.</li><li>• KS 21006.02.04 Identify career opportunities in design engineering and their job functions.</li><li>• KS 21006.02.05 Express understanding of the principles and elements of design utilized in products, print media, and art forms.</li><li>• KS 21006.03.04 Develop a portfolio to organize and display evidence of their work.</li><li>• KS 21006.06.01 Apply the creative thinking process</li></ul>
<p><b>Unit 2: Sketching and Visualization</b></p> <ul style="list-style-type: none"><li>• Techniques</li><li>• Pictorial</li><li>• Annotated Sketches</li></ul> <p>Time Frame: 2 weeks</p>	<p>Create various technical representations used in visualization, communicating and documenting design ideas.</p> <ul style="list-style-type: none"><li>• KS 21006.04.01 Integrate proper sketching techniques and styles in the creation of sketches.</li><li>• KS 21006.04.02 Demonstrate the ability to produce two-dimensional geometric figures.</li><li>• KS 21006.04.04 Formulate pictorial sketches to develop ideas, solve problems, and understand relationships during the design process.</li><li>• KS 21006.04.06 Select a sketching method that is efficient in its use of color, form, and symbols representing abstract data.</li><li>• KS 21006.04.08 Evaluate and select the necessary views to graphically communicate design solutions.</li><li>• KS 21006.04.10 Integrate annotated sketches in presentations, portfolio, and documentation processes.</li><li>• KS 21006.04.11 Develop properly annotated sketches to accurately convey data in design solution.</li></ul>

<p><b>Unit 3: Measurement and Statistics:</b></p> <ul style="list-style-type: none"> <li>• US Customary units</li> <li>• Metric units</li> <li>• Unit Conversion</li> <li>• Precision and accuracy</li> <li>• Linear dimensions</li> <li>• Statistical analysis with spreadsheets</li> <li>Statistics and quality</li> </ul> <p>Time Frame: 3 weeks</p>	<p>Utilize precise measurement and accurate statistical analysis in the application of the design process.</p> <ul style="list-style-type: none"> <li>• KS 21006.02.01 Apply the steps of the design process. <ul style="list-style-type: none"> <li>○ Construct a testable prototype of a problem solution.</li> <li>○ Analyze the performance of a design during testing and judge the solution as viable or non-viable with respect to meeting the design requirements.</li> <li>○ Use statistics to quantify information, support design decisions and justify problem solutions.</li> <li>○ Use a spreadsheet problem to store and manipulate raw data and perform calculations using formulas.</li> </ul> </li> <li>• KS 21006.08.15 Set up and integrate the use of a customized common dimensioning standard.</li> <li>• KS 21004.13.02 Design and create tables, charts, and graphs to illustrate data collected.</li> </ul>
<p><b>Unit 4: Modeling Skills</b></p> <ul style="list-style-type: none"> <li>• Conceptual models</li> <li>• Graphical models</li> <li>• 3D Computer Models</li> <li>• Physical models</li> <li>• Mathematical models</li> </ul> <p>Time Frame: 4 weeks</p>	<p>Apply a variety of modeling methods and formats to represent systems, components, and processes.</p> <ul style="list-style-type: none"> <li>• KS 21006.06.04 Communicate their idea through written and verbal formats.</li> <li>• KS 21006.06.06 Select and utilize the appropriate graphical format to a problem.</li> <li>• KS 21006.06.07 Analyze and develop graphical representation of given data.</li> <li>• KS 21006.06.08 Demonstrate an understanding of the different physical modeling techniques.</li> <li>• KS 21006.06.09 Present a model with its correct proportions.</li> <li>• KS 21006.06.11 Evaluate a problem using mathematical formulas.</li> <li>• KS 21006.06.12 Analyze a solution to a problem using the correct format of analysis.</li> <li>• KS 21006.06.13 Interpret a sketch using a CAD package.</li> <li>• KS 21006.06.14 Explain the difference between parametric and adaptive designs and be able to specify their uses.</li> <li>• KS 21006.06.15 Draw a two-dimensional sketch using CAD package.</li> <li>• KS 21006.06.17 Demonstrate the ability to generate a three-dimensional model.</li> <li>• KS 21006.06.18 Demonstrate the use of work features and how they are applied while constructing a solid model.</li> <li>• KS 21006.06.19 Recognize the use and need of work planes, axes, and points in the development of a computer model.</li> </ul>

<p><b>Unit 5: Geometry of Design</b></p> <ul style="list-style-type: none"> <li>• Forms and Shapes</li> <li>• Geometric Constraints</li> <li>• Cartesian Coordinate System</li> <li>• Parametric Design</li> </ul> <p>Time Frame: 3 weeks</p>	<p>Apply 2 and 3-dimensional geometric concepts and skills to problem solving and engineering design.</p> <ul style="list-style-type: none"> <li>• KS 21006.05.01 Define and contrast points, lines and line segments.</li> <li>• KS 21006.05.02 Identify major geometric shapes.</li> <li>• KS 21006.05.03 Using a compass, ruler and triangle, construct geometric shapes.</li> <li>• KS 21006.05.04 Define terminology associated with arcs and circles.</li> <li>• KS 21006.05.06 Distinguish and define geometric constraints.</li> <li>• KS 21006.05.07 Identify geometric constraints in given three dimensional models.</li> <li>• KS 21006.05.08 Apply the right hand rule to identify the X, Y, and Z axes of the Cartesian Coordinate System.</li> <li>• KS 21006.05.09 Apply a combination of absolute, relative, and polar coordinates to construct a three-dimensional model.</li> <li>• KS 21006.05.10 Define the origin planes in the Coordinate System.</li> <li>• KS 21006.06.16 Apply geometrical and dimensional constraints to a sketch.</li> </ul>
<p><b>Unit 6 Reverse Engineering</b></p> <ul style="list-style-type: none"> <li>• Visual, functional and structural aspects of design</li> <li>• Functional analysis</li> <li>• Strengths and weaknesses of product and manufacturing process</li> </ul> <p>Time Frame: 3 weeks</p>	<p>Disassemble and analyze a product or system in order to understand and document the visual, functional, and/or structural aspects of its design.</p> <ul style="list-style-type: none"> <li>• KS 21006.08.01 Students will demonstrate how to extract data from solid models. <ul style="list-style-type: none"> <li>○ Evaluate and compare the impact of materials and fastener choices on product design cost, performance, marketability, environment and service life.</li> <li>○ Accurately measure linear distances and mass.</li> <li>○ Create sketches and orthographic projections of an object to fully detail parts.</li> <li>○ Generate CAD multi-view technical drawings, including orthographic projections, sections view(s), detail view(s), auxiliary view(s) and pictorial views.</li> </ul> </li> </ul>
<p><b>Unit 7 Documentation</b></p> <ul style="list-style-type: none"> <li>• Working Drawings</li> <li>• Dimensioning</li> <li>• Annotation</li> <li>• Dimensional tolerances</li> <li>• 3D Computer models</li> </ul> <p>Time Frame: 5 weeks</p>	<p>Create engineering working drawings that document measurements collected during reverse engineering process and to propose new designs.</p> <ul style="list-style-type: none"> <li>• KS 21006.08.02 Evaluate the accuracy of mass properties calculations.</li> <li>• KS 21006.08.03 Describe how analysis data can be used to update parametric models.</li> <li>• KS 21006.08.04 Generate an isometric view from orthographic drawing views.</li> <li>• KS 21006.08.05 Determine the correct application for the various section views.</li> <li>• KS 21006.08.07 Create the appropriate section view for a specified view.</li> <li>• KS 21006.08.08 Create a detail view that corresponds to appropriate orthographic view.</li> <li>• KS 21006.08.09 Create an auxiliary view to show the detail on an inclined surface.</li> <li>• KS 21006.08.11 Apply common dimensioning systems, rules and practices.</li> <li>• KS 21006.08.13 Apply size and location dimensions to annotated drawings.</li> <li>• KS 21006.08.17 Solve tolerance problems.</li> <li>• KS 21006.08.19 Formulate general and proprietary specifications to further communicate information relating to product design.</li> </ul>

<p><b>Unit 8: Advanced Computer Modeling</b></p> <ul style="list-style-type: none"> <li>• Adding Components</li> <li>• Assembly Constraints</li> <li>• Part Libraries</li> <li>• Sub-Assemblies</li> <li>• Driving Constraints</li> <li>• Adaptive Design</li> <li>• Mass Properties</li> <li>• Mathematical functions</li> </ul> <p>Time Frame: 3 weeks</p>	<p>Utilize 3D computer modeling skills to create exploded and animated assembly views of multi-part products.</p> <ul style="list-style-type: none"> <li>• KS 21006.07.01 Demonstrate assembly modeling skills to solve design problems.</li> <li>• KS 21006.07.03 Create components effectively in the assembly modeling environment.</li> <li>• KS 21006.07.05 Replace components with modified external parts.</li> <li>• KS 21006.07.06 Perform part manipulation during the creation of an assembly model.</li> <li>• KS 21006.07.07 Demonstrate assembly modeling skills to solve design problems.</li> <li>• KS 21006.07.09 Apply assembly constraints to successfully construct a multi-part object.</li> <li>• KS 21006.07.10 Utilize part libraries effectively during the assembly modeling process.</li> <li>• KS 21006.07.12 Employ sub-assemblies during the production of assemblies.</li> <li>• KS 21006.07.14 Apply drive constraints to simulate the motion of parts in assemblies.</li> <li>• KS 21006.07.16 Apply adaptive design concepts during development of sketches, features, parts and assemblies.</li> </ul>
<p><b>Unit 9: Design Team and Design Challenge</b></p> <ul style="list-style-type: none"> <li>• Collaborative teamwork</li> <li>• Virtual communication</li> <li>• Shared decision-making</li> <li>• Ethical responsibilities</li> <li>• Diversity and cultural competence.</li> <li>• Societal and environmental impacts</li> <li>• Engineering design process</li> <li>• Scientific method</li> <li>• Mathematical models</li> </ul> <p>Time Frame: 9 weeks</p>	<p>Apply the concepts and skills of engineering to create and test a solution for a real-world problem.</p> <ul style="list-style-type: none"> <li>• KS 140101.13.09 Develop and use mathematical models to represent and justify mathematical relationships found in a variety of situations.</li> <li>• KS 140101.04 Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.</li> <li>• KS 140101.18 Apply leadership, teamwork and effective communication to achieve a common goal. <ul style="list-style-type: none"> <li>○ Apply appropriate technology to support collaboration in the design process.</li> <li>○ Develop and utilize a decision matrix based on accepted outcome criteria and constraints.</li> <li>○ Justify and validate a selected solution path.</li> <li>○ Document design process using technical drawings and design journal.</li> <li>○ Incorporate visual elements and principles of design in the engineered product.</li> <li>○ Justify and present problem solution.</li> </ul> </li> </ul>