

**Pacing Guide and Essential Standards - EA 21.47200**  
**Engineering Applications**

<p><b>CTAE Basics</b></p>	<p><b>STEM-EA-1</b>  The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.</p> <p><b>Standard:</b>  <b>Demonstrate employability skills required by business and industry.</b>  <b>The following elements should be integrated throughout the content of this course.</b></p>	<p>This standard is integrated into each lesson for 18 weeks.</p>
<p><b>CTSO TSA</b></p>	<p><b>STEM-EA-12</b>  Critique and synthesize how related career and technology student organizations are integral parts of career and technology education courses. Students will develop leadership, interpersonal, and problem-solving skills through participation in co-curricular activities associated with the Technology Student Association (TSA).</p>	<p>TSA is combined with each class.</p>
<p><b>Unit 1: Time keeps on ticking</b></p>	<p><b>STEM-EA-5</b>  Employ planning and time management skills and tools to enhance results and complete work tasks.  <b>5.1</b> Develop goals and objectives to complete a technological problem.  <b>5.2</b> Prioritize tasks to be completed during a STEM project.  <b>5.3</b> Develop project timelines using time management knowledge and skills.  <b>5.4</b> Use project-management skills to improve workflow of a STEM project.</p>	<p><b>½ week</b> (Goals are a part of life...Students will always be setting goals.)</p>
<p><b>Unit 2: Safety</b></p>	<p><b>STEM-EA-2</b>  Demonstrate and follow safety, health, and environmental standards related to the STEM workplace and apply specific engineering tools, machines, materials and processes in a safe and orderly manner to formulate, analyze, and verify engineering practices and solutions.  <b>2.1</b> Implement workplace and product safety standards such as Implement workplace and product safety standards such as Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), International Organization for</p>	<p><b>½ week</b> (At this point we review what we know from previous courses and we practice safety every day!)</p>

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	<p>Standardization (ISO), Good Manufacturing Practice (GMP), American Disabilities Association (ADA), and Underwriters Laboratories (UL).</p> <p><b>2.2</b> Demonstrate and incorporate safe laboratory procedures in the classroom, lab, and field environments.</p> <p><b>2.3</b> Explain the impact of safety standards such as Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), International Organization for Standardization (ISO), Good Manufacturing Practice (GMP), American Disabilities Association (ADA), and Underwriters Laboratories (UL) related to engineering fields.</p> <p><b>2.4</b> Understand the environmental impact of engineering designs and processes.</p> <p><b>2.5</b> Explain the criteria for selection of appropriate materials, tools, and processes.</p> <p><b>2.6</b> Safely and effectively manipulate materials, tools, and processes.</p> <p><b>2.7</b> Apply appropriate care and maintenance in the use of tools and machines.</p>	
<p><b>Unit 3: What are we going to do today?</b></p>	<p><b>STEM-EA-4</b> Apply knowledge of the engineering design process to solve engineering/ technological problems in the STEM workplace.</p> <p><b>4.1</b> Identify, define, and research a technological problem.</p> <p><b>4.2</b> Utilize planning, time management, and leadership skills to organize an engineering project.</p> <p><b>4.3</b> Research, select, and safely apply engineering concepts, machines, and tools for completion of the project.</p> <p><b>4.4</b> Develop alternative solutions to a technological problem.</p>	<p><b>3 weeks</b> (This is when they begin their capstone project of choice. This standard has followed them through the entire catalog. Now they put it to work again!)</p>
<p><b>Unit 4: Public Speaking is(not) scary(if you're prepared)</b></p>	<p><b>STEM-EA-6</b> Apply oral, written, and visual communication skills to obtain, interpret, and present information to and from intended audiences.</p> <p><b>6.1</b> Apply the ability to read, interpret, and analyze STEM materials discerning the information and concepts.</p> <p><b>6.2</b> Use appropriate listening skills to obtain and interpret messages or information provided to clarify issues, ideas, plans, projects, or processes.</p> <p><b>6.3</b> Demonstrate understanding by responding to and/or restating information that will clarify STEM techniques to be used and/or information to be applied to projects, plans, or processes.</p>	<p><b>3 weeks</b> (also integrated into daily work in the lab)</p>

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	<p><b>6.4</b> Use effective oral, written, and visual methods to communicate concepts of STEM to an audience.</p> <p><b>6.5</b> Utilize an engineering design notebook and/or portfolios to collect, organize, and document the design process.</p>	
<p><b>Unit 5: PLAN!!!!</b></p>	<p><b>STEM-EA-7</b>          Develop and apply detailed plans to solutions for design problems using mathematical and scientific concepts.</p> <p><b>7.1</b> Analysis of design problems will be conducted and include flow charts, timelines, milestones, models, and other information to complete solutions.</p> <p><b>7.2</b> Prove optimal solutions through the application of mathematical models and calculations necessary to complete predictive analysis.</p> <p><b>7.3</b> Modify design plans and schedules that are informed directly by data collected and analyzed using graphical and algebraic solutions.</p> <p><b>7.4</b> Critique the effectiveness and accuracy of design plans for each possible solution.</p> <p><b>7.5</b> Implement failure analysis techniques to a design solution to enhance future solutions for a design problem.</p> <p><b>7.6</b> Evaluate design solutions using the standards required to maintain a system in a condition of static equilibrium with respect to gravitational forces and normal operating conditions.</p>	<p><b>3 weeks</b></p>
<p><b>Unit 6: Engineering Design Process</b></p>	<p><b>STEM-EA-8</b>          Develop appropriate models.</p> <p><b>8.1</b> Understand the concept of model as it relates to engineering design.</p> <p><b>8.2</b> Understand the concept of scale as it relates to models.</p> <p><b>8.3</b> Prepare mock-up and scale models.</p> <p><b>8.4</b> Create 3D models using appropriate software and technologies.</p>	<p><b>2-½ weeks</b>          (Students will spend much more time learning how to model using modern technology.)</p>
<p><b>Unit 7: Prototype (Capstone Project)</b></p>	<p><b>STEM-EA-9</b>          Design and construct a testable prototype.</p> <p><b>9.1</b> Understand the concept of prototype as it relates to engineering design.</p> <p><b>9.2</b> Select and apply appropriate materials, tools, and processes for prototype development.</p> <p><b>9.3</b> Consider end user experience and interface in prototype development.</p> <p><b>9.4</b> Test prototype for performance, usability, and durability.</p> <p><b>9.5</b> Assess and evaluate prototype testing data to recommend design improvements,</p>	<p><b>3 weeks</b></p>

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	optimization, or re-design of prototype.	
<b>Unit 8: Creating an impact: Good or bad?</b>	<p><b>STEM-EA-10</b> Understand engineering impacts of social, economic, design and environmental issues.</p> <p><b>10.1</b> Apply knowledge of external issues such as time constraints, budget, supply chain and available technology that strain the engineering design process to optimize a solution to a STEM problem.</p> <p><b>10.2</b> Analyze and connect the impacts of events in the global marketplace to understand the importance of national standards, supply chains, and timelines.</p> <p><b>10.3</b> Analyze the sustainability and life cycle of an engineered product and their applications on a worldwide scale.</p> <p><b>10.4</b> Connect cultural diversity to possible impacts on creating solutions to engineering design problems.</p>	<b>1 week</b>
<b>Unit 9: How will you make money?</b>	<p><b>STEM-EA-11</b> Explain the impact of business and marketing on engineering design.</p> <p><b>11.1</b> Gather and synthesize information using social media and the internet.</p> <p><b>11.2</b> Research the global nature of engineering design in multinational corporations.</p> <p><b>11.3</b> Demonstrate an understanding of the design timeline, time to market, and the impact of a rapidly changing consumer market.</p> <p><b>11.4</b> Generate and analyze market research in terms of consumer requirements, competitive landscape, and market opportunity.</p>	<b>1 week</b>
<b>Unit 10: Careers</b>	<p><b>STEM-EA-3</b> Identify and explore career opportunities in one or more engineering career pathways to build an understanding of the opportunities available in the STEM workplace.</p> <p><b>3.1</b> Locate and identify career opportunities that appeal to personal career goals.</p> <p><b>3.2</b> Match personal interests and aptitudes to selected careers.</p> <p><b>3.3</b> Participate in career related field trips and/or career related presentations by professionals in STEM.</p>	<b>½ week</b>