

Colorado AFNR Course Scope and Sequence

Course Name	Advanced Welding Technology		Course Details	Level 3 course in the Power, Structure, & Technology pathway. This course aligns with the metal fabrication strand.		
			Course = 0.50 Carnegie Unit Credit			
<b>Course Description</b>	Advanced Welding Technology is an advanced course educating students in the advanced skills and knowledge in metal fabrication. Students will build on the skills and competencies presented in prerequisite courses. Students will learn cutting and welding applications of increasing complexity used in the manufacturing/metal fabrication industry. Student will be proficient in fundamental safety practices in welding, general industry-based metal fabrication skills, multiple welding processes, project management, quality control methods, and further advanced welding/metal fabrication technology and processes.					
<b>Note:</b>	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.					
SCED Identification #	18404	Schedule calculation based on 60% of a semester instructional time. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.				
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at <a href="https://www.cde.state.co.us/standardsandinstruction/essentialskills">https://www.cde.state.co.us/standardsandinstruction/essentialskills</a>						
Unit Number, Title and Brief Description	Suggested % of Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration	
<b>Unit 1: Lab &amp; Workplace Safety</b> <ul style="list-style-type: none"> <li>Review lab safety</li> <li>Expansion of Workplace safety expectations</li> </ul>	2%	<b>PST.01.</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	<b>PST.01.02.</b> Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations. <u>SCIENCE: SC.HS.1.6</u> <u>SC.HS.1.7</u> <u>SC.HS.1.9</u>	<b>PST.01.02.02.c</b> Devise and document processes to safely implement and evaluate the safe use of AFNR related tools, machinery, and equipment.		
<b>Unit 2: Welding Careers &amp; understanding welder qualification testing</b> <ul style="list-style-type: none"> <li>Entry level training necessary, post-secondary opportunities</li> </ul>	3%	<b>PST.01.</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	<b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g. SMAW, GMAW, GTAW, fuel-oxygen, and plasms arch torch, etc)	<b>PST 01.03.01.c.</b> Evaluate the quality of metal fabrication procedures (e.g. SMAW, GMAW, GTAW, fuel-oxygen, and plasma arc torch, etc)		

<ul style="list-style-type: none"> <li>Welder Qualification testing and common code awareness</li> <li>AWS (D1.1- Structural Steel)</li> <li>ASME (Section IV Pressure Vessel)</li> <li>API (1104- Cross Country Pipeline)</li> </ul>		<p><b>CRP.10.</b> Plan education and career path aligned to personal goals.</p>	<p><b>CRP.10.01</b> Identify career opportunities within a career cluster that match personal interests, talents, goals, and preferences.</p>	<p><b>CRP.10.01.02.a</b> Examine career clusters and identify potential career opportunities based on personal interests, talents, goals, and preferences.</p>	
<p><b>Unit 3: Review of process &amp; joins covered in Prin PSTS</b></p> <ul style="list-style-type: none"> <li>SMAW <ul style="list-style-type: none"> <li>- 6010 &amp; 7018</li> </ul> </li> <li>GMAW – short circuit <ul style="list-style-type: none"> <li>- .025 - .035</li> <li>- 75/25 or 100% CO2 gas</li> </ul> </li> <li>Flat position – lap, tee, edge, corner</li> <li>Material Type <ul style="list-style-type: none"> <li>- Various thickness of plate, tubing and/or angle</li> <li>- Filler materials &amp; gas selection review</li> </ul> </li> </ul>	7%	<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.</p>	<p><b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g. SMAW, GMAW, GTAW ,fuel-oxygen, and plasma arc torch, etc)</p>	<p><b>PST.01.03.01.b</b> Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.</p> <p><b>PST.01.03.02.b</b> Assess and select the proper electrode for use in various shielded metal arc welding situations.</p> <p><b>PST. 01.03.02.c</b> Construct and/or repair metal structures and equipment using metal fabrication procedures.</p>	
<p><b>Unit 4: Advanced Welding Positions</b></p> <ul style="list-style-type: none"> <li>SMAW – 6010 &amp; 7018 <ul style="list-style-type: none"> <li>- Horizontal</li> <li>- Vertical up &amp; down (7018 up only)</li> <li>- Overhead</li> </ul> </li> </ul>	26%	<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.</p>	<p><b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g. SMAW, GMAW, GTAW ,fuel-oxygen, and plasma arc torch, etc)</p>	<p><b>PST.01.03.01.b</b> Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.</p> <p><b>PST.01.03.02.b</b> Assess and select the proper electrode for use in</p>	

<ul style="list-style-type: none"> <li>• <b>GMAW – short circuit</b> <ul style="list-style-type: none"> <li>- Horizontal</li> <li>- Vertical up and down (down on thinner material only gauge through 3/16”</li> <li>- Overhead</li> </ul> </li> </ul>				<p>various shielded metal arc welding situations.</p> <p><b>PST. 01.03.02.c</b> Construct and/or repair metal structures and equipment using metal fabrication procedures.</p>	
<p><b>Unit 5: Mathematical Applications in Welding</b></p> <ul style="list-style-type: none"> <li>• Measuring &amp; Numeric understanding <ul style="list-style-type: none"> <li>- Understanding fractions and how they apply</li> <li>- Proper use and reading of a tape measure</li> </ul> </li> </ul>	2%	<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structure, and technical systems.</p>	<p><b>PST.01.02</b> Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situation.</p> <p><i>SCIENCE: SC.HS.1.6</i> <i>SC.HS.1.7</i> <i>SC.HS.1.9</i></p>	<p><b>PST.01.02.01.b</b> Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems.</p>	
<p><b>Unit 6: Blueprint reading and welding</b></p>	4%	<p><b>PSTS.04</b> Demonstrate skills in project completion on individual and group projects</p>	<p><b>PSTS.04.01</b> Utilize blueprints in completing an agricultural mechanics project.</p>	<p><b>PSTS.04.01.a</b> Students will identify blueprints, their components, and describe their purpose.</p> <p><b>PSTS.04.01.b</b> Read blueprints with accuracy</p>	
<p><b>Unit 7: Small project design &amp; construction</b></p> <ul style="list-style-type: none"> <li>• Individual choice or following a blueprint</li> </ul>	6%	<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.</p>	<p><b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g. SMAW, GMAW, GTAW, fuel-oxygen, and plasma arc torch, etc)</p>	<p><b>PST.01.03.01.b</b> Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.</p>	
<p><b>Unit 8: Groove Welds</b></p> <ul style="list-style-type: none"> <li>• Square Grooves and Bevel Grooves</li> </ul>	15%	<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and</p>	<p><b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting</p>	<p><b>PST.01.03.01.b</b> Analyze the situation and determine the best welding and cutting</p>	

<ul style="list-style-type: none"> <li>• Joint Preparation <ul style="list-style-type: none"> <li>- Based on material thickness and joint style</li> <li>- Bevel angle/groove angle</li> <li>- Root face</li> <li>- Root opening</li> <li>- Tacking</li> </ul> </li> <li>• Weld Sequence <ul style="list-style-type: none"> <li>- Root pass, hot pass (if appropriate), fill passes and cover passes</li> </ul> </li> <li>• Pipe Joints</li> </ul>		<p>improve performance in AFNR power, structural, and technical systems.</p>	<p>processes (e.g. SMAW, GMAW, GTAW, fuel-oxygen, and plasma arc torch, etc)</p>	<p>process to be used in metal fabrication.</p> <p><b>PST.01.03.02.b</b> Assess and select the proper electrode for use in various shielded metal arc welding situations.</p> <p><b>PST.01.03.02.c</b> Construction and/or repair metal structures and equipment using metal fabrication procedures.</p>	
<p><b>Unit 9: Supplemental Content</b></p> <ul style="list-style-type: none"> <li>• FCAW (Flux core)</li> <li>• GTAW (TIG)</li> <li>• GMAW – Spray Transfer</li> </ul>		<p><b>PST.01</b> Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.</p>	<p><b>PST.01.03</b> Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g. SMAW, GMAW, GTAW, fuel-oxygen, and plasma arc torch, etc)</p>	<p><b>PST.01.03.01.b</b> Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.</p> <p><b>PST.01.03.02.c</b> Construction and/or repair metal structures and equipment using metal fabrication procedures.</p>	

**CAS Academic Standards Alignment:** Online Version: <https://www.cde.state.co.us/apps/standards/>; Download version: <https://www.cde.state.co.us/apps/standards/>

### Science:

- SC.HS.1.6 – Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system.
- SC.HS.1.7 – Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
- SC.HS.1.9 – Although energy cannot be destroyed, it can be converted to less useful forms as it is captured, stored, and transferred.

### **Essential Skills:**

#### Problem Solver:

- **Critical Thinking and Analysis:** The ability to apply a deliberate process of identifying problems, gathering information, and weighing possible solutions, including: making choices rooted in understanding patterns, cause-and-effect relationships, and the impacts that a decision can have on the individual and others.
- **Creativity and innovation:** the ability to demonstrate curiosity and imagination through experimenting with new and emerging ideas.

#### Empowered Individual:

- **Self-Awareness:** the ability to understand one's own emotions, thoughts, and values, and how personal actions and emotions influence behavior across contexts, including: the capacity to recognize one's strength and limitations with a well-grounded sense of confidence and purpose.
- **Career Awareness:** The ability to apply the knowledge and understanding of how one's dreams, experiences, and interests translate into career fulfillment and lifelong pursuits in local, regional, national, and global career pathways and opportunities.