CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Manufacturing

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	Welding Technology III	Course Details	Credit = 1.0- 2.0 Prerequisite: Welding Technology II CTE Credential: CTE Manufacturing
		Course = 0.50 Carnegie Unit Credit	
Course Description	In this course the student will build upon their prior learning in Level II and can expect to engage in more advanced welding processes. These processes include advanced TIG welding including alloys such as aluminum and stainless steel, advanced blueprint reading, drawing and design, specifications, billing of materials, and Welding Procedure Specifications (WPS). Students will engage in advanced layout and fabrication processes to create projects for the community as well as private individuals.		
Note:	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 #	13207	Schedule calculation based on 60 calendar days of a 90-day semester. 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 **https://www.cde.state.co.us/standardsandinstruction/essentialskills**

Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Career Development		Describe employment opportunities in the construction and manufacturing industries related to the welding pathway. Describe employer expectations and identify basic employee responsibilities and appropriate work ethics.	Demonstrate career readiness, employability, and career development skills. Student is expected to: (A) describe employment opportunities, including potential earnings, employee benefits, job availability, working conditions, educational requirements, required technology skills,	Investigate local employment and work-based learning opportunities. Analyze the requirements and qualifications for various welding job postings identified. Gather information from multiple sources, such as sample resumes, interviews with advanced manufacturing professionals, and job boards, to determine effective strategies for realizing career goals. Create a personal resume modeled after elements based on the findings above, then	SkillsUSA Welding Fabrication and Individual Welding Competitions SkillsUSA Personal and Employability Skills Framework

			and continuing education/training; (B) discuss the guidelines for developing a proper résumé; (C) demonstrate completing job applications; (D) describe basic employee responsibilities and appropriate work ethics; (E) compare and contrast employment responsibilities and expectations to local school and program policies and expectations; and (F) define effective relationship skills and workplace issues including, but not limited to, sexual harassment, stress, and substance abuse.	complete an authentic job application as part of a career search or work-based learning experience. Evaluate student career and academic plan for alignment with industry-requirements for training and experience. Review and update student ICAP to reflect training and education pursuits following exit from secondary program. Pursue the industry certification exam (e.g., American Welding Society SMAW module) using the shielded metal arc welding (SMAW) process. Demonstrate how to make multiple-pass open-butt groove welds on plain carbon steel in all feasible positions (e.g., horizontal, flat, vertical, overhead) conforming to American Welding Society quality standards. In preparation for industry certification exams (e.g., American Welding Society GMAW, FCAW, and GTAW modules), complete assigned team projects that incorporate the following welding processes in order to design, fabricate, evaluate,	

				and test products made in this course. For each project, produce a technical report documenting illustrations, findings, and justifications for project solutions. Compile photographs of each project, along with technical documentation, into a portfolio of work. a. Using the gas metal arc welding (GMAW) process and various metal transfer methods (e.g., short-circuit, pulse-arc, and spray transfer), demonstrate how to make a complete joint penetration weld on plain carbon steel in all feasible positions (e.g., horizontal, flat, vertical, overhead) conforming to American Welding Society quality standards. b. Using the flux cored arc welding (FCAW) process, demonstrate how to make a complete joint penetration weld on plain carbon steel in all feasible positions (e.g., horizontal, flat, vertical, overhead) conforming to American Welding Society quality standards. c. Using electrodes and the gas tungsten arc welding (GTAW) process, demonstrate how to	

				complete joint penetration welds on plain carbon steel, stainless steel, and aluminum in all feasible positions (e.g., horizontal, flat, vertical, overhead) conforming to American Welding Society quality standards.	
Workplace Regulations, Safety & Compliance		Apply knowledge of using and maintaining professional welding equipment. Identify regulations and safety standards that are implemented within the welding profession. Identify materials and resources commonly used and recycled in welding. Understand the AWS certification requirements.	The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to: A) operate welding equipment according to safety standards; B) identify and properly dispose of environmentally hazardous materials used in welding; C) explain the importance of recycling materials used in welding; D) choose appropriate personal protective equipment; E) evaluate skills related to health and safety in the workplace as	Accurately read, interpret, and demonstrate adherence to safety rules, including rules published by the Occupational Safety and Health Administration (OSHA) guidelines, American Society for Testing Materials; ANSI Z49.1: Safety and Welding, Cutting, and Allied Processes, And state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. Complete safety test with 100 percent accuracy. Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, store, and maintain safe operating procedures with tools and equipment.	

			specified by appropriate governmental regulations; and F) understand the AWS certification process.	Locate and assess the American Welding Society website and analyze its structure, policies, and requirements for the AWS Entry Welder qualification and certification. Explain a welder certification document, what steps are required to obtain the certification, and how to prepare for the examination.	
Welding Efficiency		Differentiate and apply various types of welding assembly processes. Demonstrate increasing proficiency with welding processes and procedures. Identify industry resources to create welding efficiencies for either skill development or for seeking information. Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.	Use welding tools such as OFW, SMAW, GMAW, FCAW, GTAW, forge, and furnace and the equipment and assembly processes appropriate to the design criteria of a specific product to result in a finished part or product that meets the standards of the AWS or similar industry welding standards. The student is expected to: (A) observe safe operating practices; (B) apply safe handling of compressed gases; and (C) perform cutting processes according to	Analyze and differentiate among various types of elements that can directly impact welding efficiency. Create a table or other graphic organizer that lists the following types of elements and details how their purposes and characteristics can directly affect efficiency: a. Arc time b. Operating Factor c. Deposition Rate (wire feed speed) d. Electrode Efficiency e. Travel Speed f. Weld Size g. Poor Fit h. Defects/Repairs Research and explore how wire feed speed and weld size	

			accepted welding standards. The student performs shielded metal arc welding on metals. The student is expected to: (A) employ safe operating practices; and (B) demonstrate skills required to make welds in all positions according to industry-accepted welding standards. The student performs flux cored metal arc welding. The student is expected to: (A) use safe operating practices; (B) perform fillet and groove welds; and (C) perform welds in all appropriate positions according to industry-accepted welding standards. The student performs gas tungsten arc welding on	influences efficiency. Demonstrate the consequences of using different variables in relation to wire feed speed and weld size. Upon completion of the work, write and explanation and justify observations identifying different methods used and their final impact on efficiency. Research and evaluate the differences between Fillet and Groove Welds. Drawing on evidence from textbooks and other resources, create a table or other graphic organizer that details their purposes and characteristics, the costs associated with each weld, and a calculation of how long it would take a welder to successfully create each type.	

			metals. The student is expected to: (A) employ safe operating practices; (B) perform fillet and groove welds in all positions; and (C) perform welds on metals such as carbon steel, stainless steel, pipe, and aluminum according to industry-accepted welding standards. Understand finishing processes and the differences between various types of finishing materials used in the manufacture of welded parts and products.		
Quality Control		Understand and defend the purposes and processes of inspection and quality control in welding manufacturing processes. Apply quality control processes and procedures to welding tasks.	The student analyzes the concepts and intricacies of inspections related to welding codes. The student is expected to: (A) inspect the welding projects of team members;	Measure and visually inspect welded products for acceptability to American Welding Society QC-10 standards. Record discontinuities and defects and compare data to given project specifications using class-defined analysis methods. Interpret and communicate results both	

			(B) select codes for weld inspections; and (C) analyze and identify the steps to check for distortion, joint misalignment, and poor fit-up before and after welding; (D) perform continuous online quality control inspections of welded parts; and (E) evaluate and know how to troubleshoot performance problems of welding systems.	written and verbally. If necessary, recommend changes that will reduce the number of product defects during the manufacturing process. Drawing upon multiple resources, research nondestructive testing beyond visual inspection, such as penetrant inspection, magnetic particle inspection, radiographic inspection, and ultrasonic inspection. Describe how these tests are applied as quality control techniques to prevent manufacturing defects in welding. Compare and contrast these techniques and provide specific examples for when they are most appropriately used. Cite evidence to justify the examples. Demonstrate the proper use of the magnetic particle and penetrant inspection tests on weldment samples of gas metal arc welding (GMAW), flux cored arc welding (FCAW), and gas tungsten arc welding (GTAW) processes. Describe and distinguish between the guided-bend test and the free-bend test.	

				Explain when it is most appropriate to apply each test. Demonstrate the use of each test and properly document results on a mock qualification test record form conforming to the American Welding Society (AWS) requirements. For example, perform root- and face-guided bend tests on a butt joint weld coupon.	
Blueprint Reading		Read, analyze, and understand components of a blueprint.	Demonstrate advanced proficiency in understanding and applying blueprints, specifications, and drawings. Student is expected to: (A) recognize and identify terms, components, and symbols commonly used on blueprints; (B) relate information on drawings to actual locations on the print; (C) recognize different types of drawing; (D) interpret and use drawing dimensions; (E) interpret welding symbols from a blueprint; (F) examine a welding detail drawing;	Demonstrate ability to interpret scaled welding blueprints; gather design and materials information; perform calculations; and use the detail to plan, lay out, and produce parts or finished products.	

			(G) interpret elements of a welding detail drawing; and (H) demonstrate how to sketch or draw basic welding drawings.		