



El Camino College  
COURSE OUTLINE OF RECORD – Official

<b>Course Acronym:</b>	WELD
<b>Course Number:</b>	1B
<b>Descriptive Title:</b>	Advanced Welding for Manufacturing
<b>Division:</b>	Industry and Technology
<b>Department:</b>	Welding
<b>Course Disciplines:</b>	Welding
<b>Catalog Description:</b>	This course continues the development of students' theory and practice of their manual and semiautomatic welding skills, joining ferrous and non-ferrous metals for manufacturing technology. Welding processes include Gas Tungsten Arc Welding (GTAW), aluminum Gas Metal Arc Welding (GMAW), Dual-Shield Flux Core Arc welding (FCAW-G) and Shielded Metal Arc welding (SMAW). The course is an in-depth study into advanced manufacturing processes, work procedure specifications, occupational safety and calculations of material cost and sizes. Additional topics include fractional, decimal and metric conversions.
<b>Prerequisite:</b>	Welding 1A or Welding 10A with a minimum grade of C in prerequisite or equivalent
<b>Co-requisite:</b>	
<b>Recommended Preparation:</b>	
<b>Enrollment Limitation:</b>	
<b>Hours Lecture (per week):</b>	2.50
<b>Hours Laboratory (per week):</b>	5
<b>Outside Study Hours:</b>	5
<b>Total Course Hours:</b>	135
<b>Course Units:</b>	4
<b>Grading Method:</b>	Letter Grade and Pass/No Pass
<b>Credit Status:</b>	Credit, degree applicable
<b>Transfer CSU:</b>	Yes
<b>Effective Date:</b>	Proposed
<b>Transfer UC:</b>	No
<b>Effective Date:</b>	
<b>General Education:</b> ECC	
<b>Term:</b>	
<b>Other:</b>	

<b>CSU GE:</b>	
<b>Term:</b>	
<b>Other:</b>	
<b>IGETC:</b>	
<b>Term:</b>	
<b>Other:</b>	
<b>Student Learning Outcomes:</b>	<p><b>SLO #1</b></p> <p>Demonstrate troubleshooting skills, problem, and critical thinking by adjusting machine or weld parameters for corrective action.</p> <p><b>SLO #2</b></p> <p>Demonstrate knowledge of multiple processes: constant current and constant voltage power supplies.</p> <p><b>SLO #3</b></p> <p>Demonstrate proper safety procedure.</p>
<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Demonstrate proper welding safety procedures.</li> <li>2. Demonstrate knowledge of multiple processes: constant current and constant voltage power supplies.</li> <li>3. Demonstrate troubleshooting skills, problem solving, and critical thinking by adjusting machine settings or weld parameters for corrective action.</li> <li>4. Distinguish between ferrous and nonferrous metals.</li> <li>5. Understand when to use direct current polarity instead of alternating current when welding nonferrous materials.</li> </ol>
<b>Major Topics:</b>	<p><b>I. PHYSICAL LAWS (10.5 hours, lecture)</b></p> <p>A. Predicting effects of welding variables</p> <p>B. Understanding process variables - constant voltage and constant current</p> <p><b>II. PHYSICAL LAWS (18 hours, lab)</b></p> <p>A. Predicting effects of welding variables</p> <p>B. Understanding process variables - constant voltage and constant current</p> <p><b>III. ARC HEAT GENERATION (2.0 hours, lecture)</b></p> <p>A. Electrical welding</p> <p>B. Resistance to flow of electrons</p> <p><b>IV. RESISTANCE WELDING (2 hours, lecture)</b></p>

A. Equipment details

B. Power supplies and tooling

**V. HEAT AFFECTED ZONE (HAZ) PHENOMENA (5 hours, lecture)**

A. Fusion and solid-state welds

B. Weld solidification

C. Weld defects

**VI. BASE METALS (12 hours, lecture)**

A. Ferrous metals

B. Non-ferrous metals

C. Atmospheric exposure

D. Characteristics

**VII. JOINT FIT UP and POSITION OF WELDING (10 hours, lecture)**

A. Work angle

B. Push or drag angle

C. Optimal weld process

D. Discontinuities

**VIII. OUT OF POSITION WELDS (20 hours, lab)**

A. Fillet

B. Grooves

**IX. POWER SOURCES (30 hours, lab)**

A. Thin gage

B. Joint configuration

**X. VISUAL EXAMS (2 hours, lab)**

A. Root

B. Intermediate passes

C. Cover passes

	<p><b>XI. FORMING (20 hours, lab)</b></p> <p>A. Ferrous metals</p> <p>B. Non-ferrous metals</p> <p><b>XII. CORRECTING DISCONTINUITIES (3.5 hours, lecture)</b></p> <p>A. Recognizing what causes defects</p> <p>B. Troubleshooting to correct</p> <p>C. Weldability of metal</p>
<b>Total Lecture Hours:</b>	45
<b>Total Laboratory Hours:</b>	90
<b>Total Hours:</b>	135
<b>Primary Method of Evaluation:</b>	3) Skills demonstration
<b>Typical Assignment Using Primary Method of Evaluation:</b>	Perform multiple operations on a weldment using various welding processes, demonstrating an ability to maintain proper torch angle, Contact to Work Distance (CTWD) / arc length, torch manipulation and travel speed. Submit weldment to the instructor.
<b>Critical Thinking Assignment 1:</b>	Implement correct settings for various weld machines to troubleshoot discontinuities. Consult the instructor for evaluation.
<b>Critical Thinking Assignment 2:</b>	Perform a welding process according to a Welding Procedure Specification (WPS). Identify correct process needed, fit-up and filler materials. Submit weldment to the instructor.
<b>Other Evaluation Methods:</b>	Class Performance Matching Items Multiple Choice Performance Exams Quizzes
<b>Instructional Methods:</b>	Demonstration Discussion Lab Lecture Multimedia presentations
<b>If other:</b>	
<b>Work Outside of Class:</b>	Problem solving activity Required reading Study
<b>If Other:</b>	
<b>Up-To-Date Representative Textbooks:</b>	Andrew Althouse, Carl Turnquist, William Bowditch, <u>Modern Welding</u> , 13th edition, Goodheart-Wilcox, 2024
<b>Alternative Textbooks:</b>	

<b>Required Supplementary Readings:</b>	Canvas assisted content
<b>Other Required Materials:</b>	Welding helmet Leather gloves Safety glasses Chipping hammer Wire brush
<b>Requisite:</b>	Prerequisite
<b>Category:</b>	sequential
<b>Requisite course(s): List both prerequisites and corequisites in this box.</b>	Welding 1A  Welding 10A
<b>Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).</b>	<b>Experience in multi-process welding.</b>  WELD 1A - Safely operate various welding equipment for SMAW, GMAW, and GTAW.  WELD 10A - Safely operate SMAW equipment.
<b>Requisite Skill:</b>	or equivalent
<b>Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable</b>	If a student has taken Welding 1A or Welding 10A at another college or has experience in GMAW or GTAW or FCAW welding processes, the student will be prepared to enroll in this course. Students must have welding experience to succeed in this course.
<b>Requisite course:</b>	
<b>Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).</b>	
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<b>Enrollment Limitations and Category:</b>	
<b>Enrollment Limitations Impact:</b>	
<b>Course Created by:</b>	Renee Newell

<b>Date:</b>	10/10/2017
<b>Original Board Approval Date:</b>	12/18/2017
<b>Last Reviewed and/or Revised by:</b>	Renee Newell
<b>Date:</b>	03/14/2022
<b>Last Board Approval Date:</b>	06/17/2024 effective FA 2025