**MISSION VALLEY REGIONAL OCCUPATION PROGRAM**

**Welding and Metal Joinery**

**Course Outline**

**1. Course Title:** Welding and Metal Joinery

**2. CTE Career Sector and Pathway:**

Manufacturing and Product Development Sector (MAN), 213 Welding and Materials Joining

**3. CALPADS Number:** 8231

**4. Job Titles:** **O*NET Codes**

| | |
|---|---|
| Production Occupations | 51-0000 |
| Metal Workers and Plastic Workers | 51-4000 |
| Welding, Soldering and Brazing Workers | 51-4120 |
| Welders, Cutters, Solderers, and Brazers | 51-4121.00 |
| Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders | 51-4122.00 |

**5. Course Description:**

This course prepares students in core skills needed for the Welding and Metal Joining industry. This course is an introduction to welding and an exposure to metalworking basics. Students will learn proper safety practices associated with welding, perform basic welds using different types of welding equipment, and identify ferrous and nonferrous metals. Students will learn the use of hand tools and cutting & preparation techniques as they relate to welding and fabrication. Students will take part in group and individual projects throughout the semester.

Integrated throughout the course are Career Preparation Standards, which include Workplace Basic Skills and Behaviors, Career Technical Skills, and Job Employment Skills.

**6. Hours**: Students receive 360 hours of classroom and skills instruction.

**7. Articulation:** This course is articulated not articulated with any community college course

**8. UC/CSU A-G Eligibility:** This course does not meet the UC/CSU A-G requirement.

**9. Instructional Materials:**

- American Welding Society's *Fundamentals of Welding* Curriculum
- S/P2 curriculum and certification
- OSHA10 curriculum and certification
- Lab materials for hands-on training
- Necessary tools and equipment
- Personal Protective Equipment (PPE)

Date Revised: Aug 3, 2023 Date Approved by Advisory:

## Course Outline

Upon successful completion of this course, students will be able to demonstrate skills necessary for entry-level employment.

**CAREER PREPARATION STANDARDS**

**I. WORKPLACE BASIC SKILLS & BEHAVIORS**
(Necessary skills for any occupation – MVROP SLO #1)
Apply skills learned in class.
Analyze information and make decisions.
Communicate verbally and in writing.
Work independently and as a team member in a diverse workplace.
Work reliably, responsibly, and ethically.

**II. CAREER TECHNICAL SKILLS**
(Occupational competencies – MVROP SLO #2)
Use appropriate technology.
Understand and practice occupational safety standards.
Demonstrate an awareness of how a business or industry functions.

**III. JOB EMPLOYMENT SKILLS**
(Occupational competencies – MVROP SLO # 3)
Develop a plan to achieve career goals.
Use effective job search strategies
1. complete a professional resume
2. fill out a job application
3. practice industry written exam testing
4. prepare for oral board interviewing

Demonstrate an awareness of the importance of lifelong learning.

**IV. WELDING SAFETY**
This unit will focus on aspects of personal safety and clothing, fire safety, general machinery safety, proper ventilation, storing compressed gasses, lifting techniques, hazardous obstacles, hand and power tools, designated welding and cutting areas, welding on containers, and general material handling techniques. Instructional methods used in this unit include textbook, teacher-led demonstrations, student labs, S/P2, OSHA10 and AWS certification training.

**Unit Competencies/ Outcomes:**
Identify common hazards found in welding
Explain and identify proper personal protection used in welding
Describe how to avoid welding fumes
Explain some of the causes of accidents
Explain safety techniques for storing and handling cylinders
Explain how to avoid electric shock when welding
Describe proper material handling methods

**Unit Assessment:**
Successful completion of written safety test
Ability to demonstrate safe use of equipment in the lab

## V. MEASUREMENT

**Unit Description:** Functional mathematical and measurement skills are one of the many attributes expected of a skilled welder. Concepts such as dimensions, root fit up, tolerances and the ability to read and interpret blueprints and Welding Procedure Specifications (WPS). Students will focus on those basic measurement concepts centering on the use of a tape measure or equivalent measurement tool.

**Unit Competencies/ Outcomes:**
Students will be able to read a tape to measure. Students will be able to perform linear measurement using tape measure or similar device.

## VI. OXY-FUEL CUTTING

**Unit Description:** This unit will address aspects of oxyfuel cutting applications. Focus areas will include: general oxyfuel safety, cylinder storage and handling, assembling the torch kit, pressurizing the oxyfuel setup, safely checking for leaks, lighting/adjusting the flame and shutting down the kit. Students will perform oxyfuel gas cutting techniques, including preparing materials to cut, manual cutting (both freehand and guided) and operation of entry-level automated cutting machines.

**Unit Competencies/ Outcomes:**
Identify and explain the use of oxyfuel cutting equipment
Set up oxyfuel equipment.
Light and adjust an oxyfuel cutting torch
Properly shut down oxyfuel equipment
Safely change oxyfuel cylinders
Preform oxyfuel cutting practices: Straight line, square shapes, piercing, slot, bevel and wash
Operate a motorized, portable oxyfuel gas cutting machine.

**Unit Assessment**
Demonstrate proficiency in setup operation safe use and maintenance of oxyfuel equipment
Demonstrate proficiency in setup, operation, safe use and maintenance of oxyfuel equipment
Demonstrate proficiency in oxyfuel cutting practices

## VII. OXY-FUEL WELDING

**Unit Description:** This unit will address aspects of oxyfuel welding applications. Focus areas will include: general oxyfuel safety, cylinder storage and handling, assembling the torch kit, pressurizing the oxyfuel set up, safely checking for leaks, lighting/adjusting the flame and shutting down the kit. Students will perform oxyfuel gas welding techniques on a variety of steels, alloys, joints and positions.

**Unit Competencies/ Outcomes**
Identify and explain the use of oxyfuel welding equipment
Safely set up oxyfuel equipment.
Safely light and adjust an oxyfuel welding and cutting torch
Properly shut down oxyfuel equipment
Safely change oxyfuel cylinders
Perform satisfactory common weld joint configuration in all positions
Perform brazing and soldering on copper pipes and materials

**Unit Assessment**
Demonstrate proficiency in setup, operation, safe use and maintenance of oxyfuel welding equipment
Demonstrate proficiency in oxyfuel welding practices
Demonstrate brazing and soldering on copper pipes and materials.

## VIII. PLASMA ARC CUTTING (PAC)

**Unit Description:**

This unit will address aspects of Plasma Arc Cutting (PAC) applications. Focus areas include: Plasma Arc Cutting equipment, supplies, assembly, required personal protective equipment and related safety. Students will perform preparation to cut materials, plasma arc cutting, plasma arc gouging and hole piercing. Students will further explore the PAC process using various material thicknesses, including sheet metal and plate. Cut quality, kerf, dross and other aspects of the cut area will be examined for quality. Students will cut both ferrous and non ferrous materials to gain a deeper knowledge of cutting principles.

**Unit Competencies/ Outcomes**

Be able to explain safety and the plasma arc cutting process
Identify plasma arc cutting equipment
Prepare and set up plasma arc cutting equipment
Demonstrate proficient use of plasma arc cutting equipment to make various types of cuts on ferrous and non-ferrous materials.
Properly store equipment and clean the work area after use
Operate a motorized, portable plasma cutting machine.

**Unit Assessment**

Demonstrate proficiency and acceptable cut quality in PAC free-hand & guided cuts on a variety of ferrous and non-ferrous metals.
Demonstrate ability to safely operate PAC equipment

## IX. SHIELDED METAL ARC WELDING (SMAW)

**Unit Description:**
This unit will address aspects of the Shielding Metal Arc Welding (SMAW) process. Focus areas will include: preparing to weld, safety precautions, striking an arc, arc blow, performing a weld bead, welding positions, electrode selection, and electrode manipulation techniques, understanding the molten puddle, post-weld cleaning and weld defects. Instructional methods used in this unit include textbook, multimedia, teacher-led demonstrations and student labs with an emphasis on progression toward AWS D1.1 Structural Steel certification(s). Students will perform various SMAW materials joining techniques with appropriate filler material selections.

**Unit Competencies/ Outcomes**

Set up Shielded Metal Arc Welding (SMAW) equipment
Describe methods of striking an arc
Properly strike and maintain an arc
Describe causes of arc blow and methods to correct
Describe the relationship between joint fit up, proper amperage, travel speed and electrode manipulation technique
Safely make satisfactory stringer and weave beads on plate material
Safely make groove and fillet welds on plate materials in a variety of joints in all positions

**Unit Assessment**

Demonstrate proficiency in setup, troubleshooting and safe operation of SMAW equipment
Demonstrate proficiency in SMAW welding process
Make progress toward AWS Certification(s)

## X. WIRE FEED WELDING: GAS METAL ARC WELDING (GMAW) and FLUX CORE (FCAW)

**Unit Description:**

This unit will address aspects of the Gas Metal Arc Welding (GMAW) and FCAW (Flux Core) processes. Focus areas will include preparing to weld, safety precautions, methods of metal transfer, welding positions, equipment parts identification, gun angle, gun manipulation techniques, understanding the molten puddle, shielding gasses, equipment set up and troubleshooting techniques. Instructional methods used in this unit include textbook, multimedia, teacher-led demonstrations and student labs with an emphasis on AWS certification training or progress toward AWS certifications. Students will perform various GMAW and FCAW materials joining techniques using various transfer methods. Both sheet metal and plate welds will be performed in various positions and joints

**Unit Competencies/ Outcomes**

Describe the methods of metal transfer
Be able to name and describe the uses of key parts of the GMAW and FCAW equipment
Explain the variables in the process and how they relate to weld quality
Be able to set up GMAW and FCAW equipment
Set proper drive roll tension and describe steps for removing a bird's nest
Describe the relationship between gun angle and position, stick out, proper voltage, wire speed, manipulation techniques, shielding gas selection and how these relate to quality
Safely perform groove and fillet welds on sheet and plate materials

**Unit Assessment**

Demonstrate proficiency in setup, troubleshooting and operation of GMAW and FCAW equipment
Demonstrate safe operation proficiency in the GMAW and FCAW welding process
Make progress toward AWS Certification(s) in GMAW and FCAW processes

## XII. GAS TUNGSTEN ARC WELDING (GTAW)

**Unit Description:**

This unit will address aspects of the Gas Tungsten Arc Welding (GTAW) process. Focus areas will include preparing to weld, safety precautions, methods of metal transfer, welding positions, equipment parts identification, torch angle, torch manipulation techniques, understanding the molten puddle, shielding gasses, equipment set up and troubleshooting techniques. Instructional methods used in this unit include textbook, multimedia, teacher-led demonstrations and student labs with an emphasis on AWS certification training or progress toward AWS certifications.

**Unit Competencies/ Outcomes**

Describe the gas tungsten arc welding process.
Be able to name and describe the uses of key parts of the GTAW equipment
Explain the variables in the process and how they relate to weld quality
Be able to set up GTAW equipment
Identify the types of GTAW electrodes and electrode tip configurations,
Describe the relationship between gun angle and position, stick out, proper current settings, travel speed, manipulation techniques, shielding gas selection and how these relate to quality
Safely perform gas tungsten arc welding,

**Unit Assessment**

Demonstrate proficiency in setup, troubleshooting and operation of GTAW equipment
Demonstrate safe operation proficiency in the GTAW welding process
Make progress toward AWS Certification(s) in GTAW process

**Additional Items:**

**a. Instructional Strategies:**

- Lecture
- Group discussion
- Reading assignments
- Multimedia
- Hands-on practice
- Demonstration
- Guest Speakers
- Field Trips

**b. Certifications:** American Welding Society Certified Welder Certifications
S/P2 Safety Certifications, OSHA 10 certifications