

# Welding Technology 2

## COURSE OUTLINE - UC

### **DESCRIPTION:**

Welding Technology 2 is a capstone course in the Welding and Materials Joining pathway which builds on the knowledge and skills acquired in Welding Technology 1 and prepares students for entry-level jobs and post-secondary education in welding. This course provides structure and precision in welding of ferrous and non-ferrous materials, wire feeding, and advanced techniques in Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Core Arc Welding (FCAW), and Carbon Arc Cutting. In addition, students will continue to practice and demonstrate an exemplary understanding of workplace safety, blueprint reading, measurements, and quality welds that meet various industry standards and certifications. Hands-on, project and work based learning activities connect students to industry and the local community. Students must successfully complete Welding Technology 1 and Welding Technology 2 for pathway completion and/or articulation.

### **INFORMATION:**

PRE-REQUISITE:	Welding Technology 1
LENGTH:	One Year
SECTOR:	Manufacturing and Product Development
PATHWAY:	Welding and Materials Joining
ARTICULATED:	Yes
UC A-G APPROVAL:	Yes: College-Preparatory Elective (G) – Interdisciplinary Requirement

### **O\*NET SOC CODES:**

47-2211.00	Sheet Metal Workers
51-2041.00	Structural Metal Fabricators and Fitters
51-4121.00	Welders, Cutters, Solderers, and Brazers
51-4122.00	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders

<b>Orientation</b>
<ul style="list-style-type: none"><li>A. Introduce the course and facilities.</li><li>B. Discuss the syllabus and major objectives.</li><li>C. Explain applicable classroom management procedures, and any operational guidelines.</li><li>D. Review instructor/student expectations.</li><li>E. Explain attendance requirements and procedures.</li><li>F. Review grading and student evaluation procedures.</li><li>G. Discuss the work-based learning aspect of the program, if applicable.</li><li>H. Discuss the “next steps” related to additional education, training, and employment.</li><li>I. Review classroom safety, emergency and disaster procedures.</li></ul>
<b>1. Communication Skills</b>
<ul style="list-style-type: none"><li>A. Demonstrate positive verbal communication skills using appropriate vocabulary, demeanor, and vocal tone in the classroom and/or worksite.</li><li>B. Read and interpret written information and directions.</li><li>C. Practice various forms of written communication appropriate to the occupation.</li><li>D. Practice positive body language skills.</li><li>E. Practice professional verbal skills for resolving a conflict.</li><li>F. Demonstrate active listening skills including techniques for checking for understanding, and for obtaining clarification of directions.</li></ul>
<b>2. Interpersonal Skills</b>
<ul style="list-style-type: none"><li>A. Demonstrate positive teamwork skills by contributing to a group effort.</li><li>B. Practice the importance of diversity awareness and sensitivity in the workplace.</li><li>C. Define sexual harassment in the workplace and identify the employee’s role and responsibility.</li><li>D. Practice participation skills.</li><li>E. Identify different personality types and demonstrate flexibility and adaptability working with diverse individuals.</li><li>F. Practice business and social etiquette skills appropriate to the occupation.</li><li>G. Evaluate and discuss the role of business and personal ethics in decision making based on various job-related scenarios.</li><li>H. Demonstrate the use of time management skills.</li></ul>

**3. Employability Skills**

- A. Demonstrate appropriate attendance and punctuality practices for the classroom (and worksite, if applicable).
- B. Prepare a resume, cover letter, and job application.
- C. Demonstrate interviewing techniques in seeking employment, using appropriate tone, body language and professional dress and grooming standards.
- D. Identify strategies for employment retention.
- E. Identify and analyze sources of job information, including electronic sources and the impact of social networking on employability.
- F. Identify the need for continuing education, professional development, and professional growth in chosen field.
- G. Identify appropriate procedures for leaving a job.
- H. Review company policies and current trends in employee compatibility screening, drug screening, and background checks.

**4. Leadership**

- A. Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- B. Work with peers to promote divergent and creative perspectives.
- C. Demonstrate how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.
- D. Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- E. Employ ethical behaviors and actions that positively influence others.
- F. Analyze the short-term and long-term effects a leader's actions and attitudes can have on productivity, morale, and organizational culture.

**5. Personal and Occupational Safety**

- A. Demonstrate procedures to be followed in case of emergencies.
- B. Describe and discuss the procedure for reporting a work-related hazard or injury (worker's comp), including ways to report a potential safety hazard to a supervisor.
- C. Identify and discuss cyber ethics, cyber safety, and cyber security.
- D. Apply personal safety practices to and from the job.
- E. Recognize the effects of substance abuse in the workplace.
- F. Explain the importance of CAL-OSHA in the industry.
- G. Recognize good housekeeping as a safety issue.
- H. Identify safety hazards commonly found in the workplace environment.
- I. Define and discuss ergonomics in relation to the working environment.
- J. Identify the electrical hazards of working with electronic equipment.

<b>6. Career Awareness</b>
<ul style="list-style-type: none"><li>A. Explore employment opportunities, wages and job outlook.</li><li>B. Examine education and training requirements.</li><li>C. Identify and visit training and apprenticeship programs.</li><li>D. Participate in work-based learning programs.</li><li>E. Describe licensure and certifications in the industry.</li><li>F. Update portfolio to include skills, talents, awards, experiences and job search documents.</li></ul>
<b>7. Workshop Safety</b>
<ul style="list-style-type: none"><li>A. Describe safety practices for different types of welding.</li><li>B. List factors for maintaining a clean and safe work area.</li><li>C. Properly wear and use personal protective clothing and equipment such as safety glasses, ear protection, face shields and gloves.</li><li>D. Follow safety procedures while working with equipment in a group setting.</li><li>E. Locate and demonstrate knowledge of material safety data sheets (MSDS).</li><li>F. Demonstrate safety procedures for flammable materials, gases, fire, hazardous materials and disaster.</li><li>G. Use hand brush, slag hammer, grinder, and power cup brush and other power tools safely and appropriately to the job.</li><li>H. Adhere to rules for avoiding electric shock.</li><li>I. Apply CAL-OSHA and AWS standards.</li><li>J. Recognize how to provide proper ventilation in shop.</li><li>K. Correctly store all equipment.</li><li>L. Pass a safety test.</li></ul>
<b>8. Measurements and Math</b>
<ul style="list-style-type: none"><li>A. Read and explain the use of measurement tools such as tape measure, compass, and ruler.</li><li>B. Make accurate measurements, draw lines and objects.</li><li>C. Review basic math concepts used in welding.</li><li>D. Accurately add, subtract, multiply, and divide whole numbers, decimals, and fractions.</li><li>E. Practice math conversions between decimals, percentages, fractions, inches, and the English-Metric system.</li><li>F. Calculate perimeters, areas, circumferences, and the mid-point of a given distance.</li><li>G. Identify basic geometric figures.</li></ul>
<b>9. Blueprint Reading</b>
<ul style="list-style-type: none"><li>A. Interpret AWS welding symbols and codes.</li><li>B. Describe blueprint nomenclatures</li><li>C. Interpret welding blueprints.</li></ul>

- D. Apply mathematics related to print reading
- E. Draw elements of a blueprint.

## 10. Oxy-Acetylene Gas Welding Process for Ferrous and Non-Ferrous Materials

- A. Distinguish between a well-cut surface and a poorly cut surface, and adjust as needed to perform a good cut.
- B. Safely test oxygen fuel cutting (OFC) equipment.
- C. Identify the correct brazing applications in welding ferrous and non-ferrous metals.
- D. Identify the correct silver soldering in welding ferrous and non-ferrous metals.

## 11. Advanced Plasma Arc Cutting

- A. Describe, review, practice, and demonstrate plasma arc cutting.
- B. Identify the descriptive difference between a well-cut metal surface and a poorly cut metal surface using Plasma Arc Cutting procedures.

## 12. Shielded Metal Arc Welding (SMAW)

- A. Describe safety rules and proper technique for SMAW.
- B. Produce a vertical weld proficiently based on visual testing using 6010 rod.
- C. Produce a vertical weld proficiently based on visual testing using 7018 rod.
- D. Produce an overhead weld proficiently based on visual testing using 6010 rod.
- E. Produce an overhead weld proficiently based on visual testing using 7018 rod.
- F. Perform welds using the (SMAW) process in various applications and positions.
- G. Identify five basic welding joints; identify and correct basic weld defects.
- H. Recognize the importance of high and low current settings, electrode size and heat, arc length, and electrode angle when making a weld.
- I. Produce welds that meet American Welding Society standards.
- J. Apply industrial math in the use of measuring equipment.

## 13. Wire Feeding Welding

- A. Demonstrate competency in wire feed welding.
- B. Interpret the principles of and set-up for wire feed welding.
- C. Review, practice, and demonstrate metal preparation for wire feed welding.
- D. Evaluate, review, practice, and demonstrate tacking techniques using wire feed welding.
- E. Describe, review, practice, and demonstrate flaw identification and repair.
- F. Produce a flat weld proficiently based on visual testing using micro-wire.
- G. Produce a horizontal weld proficiently based on visual testing using micro-wire.
- H. Produce a vertical weld proficiently based on visual testing using micro-wire.

- I. Produce an overhead weld proficiently based on visual testing using micro-wire.

#### 14. Flux Core Arc Welding (FCAW)

- A. Describe FCAW welding terminology and processes.
- B. Identify, set up, and safely use FCAW equipment.
- C. Identify techniques related to FCAW.
- D. Perform welds using the FCAW process in various applications and positions.
- E. Identify five basic welding joints.
- F. Evaluate and identify basic weld defects.
- G. Correct basic weld defects.
- H. Visually inspect finished weld.

#### 15. Carbon Arc Operations

- A. Describe principles and techniques of arc welding.
- B. Determine the quality of a weld.
- C. Demonstrate Carbon Arc Cut (CAC-A).
- D. Safely and properly operate carbon arc torch.
- E. Identify sufficient vs. insufficient amperage and air pressure for the weld.
- F. Explain and identify rod size and air polarity.
- G. Remove welds with minimal damage to the plates.

#### 16. Advanced Oxygen/Acetylene Torch Welding Techniques

- A. Evaluate theory of oxygen/acetylene torch.
- B. Demonstrate proper procedure for setting up and shutting down the torch.
- C. Use torch to make difficult cuts.

#### 17. Gas Metal Arc Welding (GMAW)

- A. Identify appropriate accessories for GTAW applications, such as gas cylinder, flow meter, power source, and torch (hand-held or foot pedal for remote control).
- B. Identify and safely use equipment, such as gas cylinder, regulator, hoses, and welding torch tips.
- C. Produce a flat weld proficiently based on visual testing.
- D. Produce a horizontal weld proficiently based on visual testing.
- E. Produce a vertical weld proficiently based on visual testing.

F. Produce an overhead weld proficiently based on visual testing.

## 18. Project Planning

- A. Discuss and demonstrate how to measure and lay out a project.
- B. Identify and use common AWS welding symbols used in blueprint.
- C. Draw and label measurements for cuts and bends.
- D. Develop plans with dimensions.
- E. Design and create a small project.

## 19. Certification

- A. Demonstrate proper preparation, fabrication, and welding techniques that meet performance weldments for American Welding Society (AWS) qualification testing.
- B. Demonstrate proper preparation, fabrication, and welding techniques that meet performance weldments for D9.1 1G Certification.
- C. Demonstrate proper preparation, fabrication, and welding techniques that meet performance weldments for D1.1 Certification (3G and 4G SMAW) limited and unlimited thickness.

## 20. Portfolio Design

- A. Develop personal marketing and computer skills by refining your digital portfolio for post-secondary and employment acceptance.
- B. Compile best samples of original works and documents for a variety of purposes, which shows a progression in the acquisition of knowledge and/or skills.
- C. Demonstrate knowledge of competencies through journaling or summary of selected works or documents.
- D. Revise professional resume and cover letter to align with skills and objective statements of the relevant industry.
- E. Dress professionally and practice interviewing techniques using portfolio materials.
- F. Assemble industry and employability documents (resume, cover letter, certifications, recommendation letters, etc.).
- G. Create a "leave behind" book or folder.
- H. Display portfolio materials during a fair, community event, competition, or professional panel review.
- I. Evaluate and utilize feedback to improve portfolio.

## Key Assignments

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p>1. Students will participate in mock interviews that represent current industry practices (e.g., skills demonstrations, resumes, applications, portfolios, personal websites, etc.).</p>	<p>1A-D 2D-H 3A-C, E, F, H 4A, D-F 5C, E, F, I, J 6A-F 20A-I</p>	<p>1 2 3 4 5 6 7 10 11</p>	<p>2 3 4 5 6 7 10</p>		<p>LS 11-12.6 SLS 11-12.2 WS 11-12.6 WS 11-12.7</p>
<p>2. Students will write a 500-word essay on the following prompt and present to classmates: Identify a potential shop hazard that can occur when protective equipment is not effectively utilized, and the steps a welder must take to prevent injury from occurring to them and/or others. Students will pass a safety test.</p>	<p>1A-C 2D, H 3A 5A, B, D, F-J 7A-L</p>	<p>1 2 4 5 6 7 8 11 12</p>	<p>2 5 6 7 8 10</p>	<p>C1.0 C2.0 C6.0 C8.0</p>	<p>LS 11-12.6 WS 11-12.6 WS 11-12.7</p>
<p>3. Students will lay out and cut a ¼” to 3/8” thick plate using plasma arc cutting process (PAC).</p>	<p>1A-C 2D, H 3A 4B-E 5D 8A-G 11A-B</p>	<p>1 2 5 6 7 9 10 11 12</p>	<p>2 5 6 7 9 10</p>	<p>C1.0 C2.0</p>	<p>RLST 11-12.4 A-CED-1 G-CO-12 SEP 4</p>

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p>4. Students will build a personal project following blueprint conventions, project design revisions and appropriate welding skills.</p>	1A-C 2D, H 3A 4B-E 5D 9A-E	1 2 5 6 10 11 12	2 4 5 6 10	C1.0 C2.0 C4.0 C6.0 C8.0	LS 11-12.6 RLST 11-12.4 RSIT 11-12.7 WS 11-12.6 WS 11-12.7 CC 3 ETS 1 G-CO-5
<p>5. Students will braze/braze weld sheet metal together using the correct brazing rod.</p>	1A-C 2D, H 3A 4B-E 5D 10A-D	1 2 4 5 6 7 9 10 11 12	2 5 6 7 9 10	C2.0 C3.0	RLST 11-12.3 RLST 11-12.4 PS 1.A
<p>6. Students will work on a project to show mastery of welding skills by successfully welding a test plate to: A.W.S. D.1.1 limited, all position specifications and to A.W.S. D.1.1 unlimited, all position skills. Students will be able to differentiate between a weld which will pass code and not pass code.</p>	1A-C 2D, H 3A 4B-E 5D 12A-J 14A-H	1 2 4 5 6 7 9 10	2 4 5 6 7 9 10	C2.0 C4.0 C8.0	RLST 11-12.4 RLST 11-12.3 PS 1.A

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
	18A-E 19A, C	11			
7. Students will create a 2 FT joint. Students will weld two 11 gauge plates together in T-joint configuration that shall pass a bend or break test and meet AWS specifications.	1A-C 2D, H 3A 4B-E 5D 13A-I	1 2 6 7 9 10 11 12	2 5 6 7 9 10	C1.0 C2.0 C6.0 C8.0	RLST11-12.4 A-CED-1 G-CO-12 SEP 4
8. Accurately use carbon arc cutting to gouge out a bad/damaged weld.	1A-C 2D, H 3A 4B-E 5D 15A-G	1 2 6 7 9 10 11 12	2 6 7 9 10	C1.0 C2.0 C6.0 C8.0	RLST11-12.4 A-CED-1 G-CO-12 SEP 4
9. Students will lay out and cut a 1/4" to 3/8" thick plate using the oxy-fuel cutting process (OFC).	1A-C 2D, H 3A 4B-E 5D 16A-C	1 2 5 6 10 11	2 5 6 10	C1.0 C2.0 C6.0 C8.0	RLST11-12.4 A-CED-1 G-CO-12 SEP 4
10. Students will work on a project to show mastery of welding skills by successfully welding a test plate to A.W.S. D.9.1. Flat and/or all position specifications. Students will be able to differentiate between a weld which will pass code and not pass code.	1A-C 2D, H	3 4	2 3	C2.0 C4.0 C8.0	RLST 11-12.4 RLST 11-12.3 PS 1.A

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
	3A 4B-E 5D 17A-F 18A-E 19A-C	6 10 11 12	4 6 10		

## Standards Assessed in this Program

### Career Ready Practices

1. Apply appropriate technical skills and academic knowledge.
2. Communicate clearly, effectively, and with reason.
3. Develop an education and career plan aligned to personal goals.
4. Apply technology to enhance productivity.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
6. Practice personal health and understand financial well-being.
7. Act as a responsible citizen in the workplace and the community.
8. Model integrity, ethical leadership, and effective management.
9. Work productively in teams while integrating cultural/global competence.
10. Demonstrate creativity and innovation.
11. Employ valid and reliable research strategies.
12. Understand the environmental, social, and economic impacts of decisions.

### Anchor Standards

#### 2.0 Communications

- Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

#### 3.0 Career Planning and Management

- Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

#### 4.0 Technology

- Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the sector workplace environment.

#### 5.0 Problem Solving and Critical Thinking

- Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

#### 6.0 Health and Safety

- Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.

#### 7.0 Responsibility and Flexibility

- Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.

#### 8.0 Ethics and Legal Responsibilities

- Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

## 9.0 Leadership and Teamwork

- Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.

## 10.0 Technical Knowledge and Skills

- Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.

## Pathway Standards

### Manufacturing and Product Development - Welding and Materials Joining Pathway

**C1.0** Interpret and demonstrate the planning and layout operations used in the welding processes.

**C2.0** Understand and demonstrate how materials can be processed through the use of welding tools and equipment.

**C3.0** Differentiate and apply various types of welding assembly processes.

**C4.0** Understand finishing processes and the differences between various types of finishing materials used in the manufacture of welded parts and products.

**C5.0** Understand and defend the purposes and processes of inspection and quality control in welding manufacturing processes.

**C6.0** Explore and understand various welding systems that require standard hand and machine tools.

**C7.0** Understand various automated welding systems, welding design for manufacturing, flexible manufacturing systems, and materials resource planning.

**C8.0** Understand various joining or combining processes, including welding processes used in manufacturing, maintenance, and repair.

## Common Core State Standards

### ENGLISH LANGUAGE ARTS

#### Language Standards

**LS 11-12.6:** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the (career and college) readiness level, demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

#### Reading Standards for Information Text

**RSIT 11-12.7:** Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

## Reading Standards for Literacy in Science and Technical Subjects

- RLST 11-12.3:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- RLST 11-12.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- RLST 11-12.7:** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

## Speaking and Listening Standards

- SLS 11-12.2:** Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions, and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
- SLS 11-12.1:** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others ideas and expressing their own clearly and persuasively.
- SLS 11-12.1d:** Respond thoughtfully to diverse perspectives, synthesize comments, claims and evidence made on all sides of an issue, resolve contradictions when possible, and determine what additional information or research is required to deepen the investigation or complete the work.

## Writing Standards

- WS 11-12.6:** Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback including new arguments and information.
- WS 11-12.7:** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

## MATHEMATICS

### Algebra - Creating Equations

- A-CED-1** Create equations and inequalities in one variable including ones with absolute value and use them to solve problems in and out of context, including equations arising from linear functions.

### Geometry - Congruence

- G-CO-05:** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
- G-CO-12:** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

## **SCIENCE**

### **Crosscutting Concept**

**CC 1:** Patterns

**CC 3:** Scale, proportion, and quantity

**CC 6:** Scale, proportion, and quantity

### **Engineering, Technology, and the Applications of Science**

**ETS 1:** Engineering Design

**ETS 1.A:** Defining and Delimiting an Engineering Problem

**ETS 1.B:** Developing Possible Solutions

**ETS 1.C:** Optimizing the Design Solution

**ETS 2:** Links Among Engineering, Technology, Science, and Society

**ETS 2.B:** Influence of Engineering, Technology and Science on Society and the Natural World

### **Physical Sciences**

**PS 1.A:** Structure and Properties of Matter

### **Scientific and Engineering Practices**

**SEP 1:** Asking questions (for science) and defining problems (for engineering)

**SEP 2:** Developing and using models

**SEP 4:** Analyzing and interpreting data

**SEP 7:** Engaging in argument from evidence

**SEP 8:** Obtaining, evaluating, and communicating information