

# Welding Technology 1

## COURSE OUTLINE - UC

### **DESCRIPTION:**

Welding Technology 1 equips students with the skills necessary to perform basic quality welding that meets industry standards. It is the first course in the Welding and Materials Joining Pathway and therefore places emphasis on measurements, the math used in the design process, workshop safety procedures and practices, as well as the proper use of common power tools and welding equipment. Students will be introduced to Gas Metal Arc Welding (GMAW), Shielded Metal Arc Welding (SMAW), Oxy-Fuel Gas Cutting (OFC-A) and Plasma Arc Cutting through hands-on, project-based and work-based learning activities that 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: Algebra 1 (Required); Geometry (Recommended)

LENGTH: One Year

SECTOR: Manufacturing and Product Development

PATHWAY: Welding and Materials Joining

ARTICULATED: Yes (after completion of Welding Tech. 2)

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

51-4124.00 Welders, Cutters, Solderers, and Brazers

<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, the ROP Student Rules of Conduct, and any operational guidelines.</li> <li>D. Review instructor/student expectations.</li> <li>E. Explain enrollment and attendance requirements and procedures.</li> <li>F. Review grading and student evaluation procedures.</li> <li>G. Discuss the community classroom 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 strategies for working effectively with each type.</li> <li>F. Practice business and social etiquette skills appropriate to the occupation.</li> <li>G. Discuss the role of business and personal ethics in the decision-making process.</li> <li>H. Evaluate various job-related scenarios and justify decisions based on ethics.</li> <li>I. Demonstrate flexibility and adaptability in working with others.</li> <li>J. 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 forms.
- C. Demonstrate interviewing techniques using appropriate tone and body language.
- D. Demonstrate appropriate dress and grooming standards in seeking employment and for the workplace.
- E. Identify strategies for employment retention.
- F. Analyze the impact of social networking on employability.
- G. Identify the need for continuing education, professional development, and professional growth in chosen field.
- H. Identify appropriate procedures for leaving a job.
- I. Identify sources of job information, including electronic sources.
- J. 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. Use a variety of means to positively impact the direction and actions of a team or organization.
- G. 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 the case of emergencies.
- B. Discuss 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. Describe the procedure for reporting a work-related hazard or injury.
- F. Recognize the effects of substance abuse in the workplace.
- G. Recognize good housekeeping as a safety issue.
- H. Identify safety hazards commonly found in the workplace environment.
- I. Explain the importance of CAL-OSHA.
- J. Define and discuss ergonomics in relation to the working environment.
- K. Identify the electrical hazards of working with electronic equipment.

<b>6. Welding Industry</b>
<ul style="list-style-type: none"> <li>A. Describe the welding trade and industry.</li> <li>B. Describe the work environment.</li> <li>C. Research emerging welding systems and their effect on the standard hand and machine industry.</li> </ul>
<b>7. Career Awareness</b>
<ul style="list-style-type: none"> <li>A. Explore different careers requiring basic welding skills.</li> <li>B. Describe personal traits for successful employment in the welding industry.</li> <li>C. Identify related career fields where welding skills are utilized.</li> <li>D. Describe education requirements for entry-level welding careers.</li> <li>E. Research job outlook and entry-level wages.</li> <li>F. Prepare a portfolio reflecting employability and professionalism in the welding profession.</li> </ul>
<b>8. 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. Describe CAL-OSHA and AWS standards.</li> <li>J. Demonstrate first aid skills for burns.</li> <li>K. Correctly store all equipment.</li> <li>L. Pass a safety test.</li> </ul>
<b>9. 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> </ul>

- E. Practice math conversions between decimals, percentages, fractions, inches, and the English-Metric system.
- F. Calculate perimeters, areas, circumferences, and the mid-point of a given distance.
- G. Identify basic geometric figures.

## 10. Blueprint Reading

- A. Introduce AWS welding symbols and codes.
- B. Describe how to interpret welding blueprints.
- C. Describe mathematics related to print reading.
- D. Draw basic elements of a blueprint.

## 11. Cutting Techniques and Welding Effects

- A. Describe how the effects of heat, metal thickness and metal length influence welding techniques.
- B. Model and practice appropriate flame cutting procedures.
- C. Describe how metal length and thickness affect cutting techniques.

## 12. Oxy-Fuel Gas Cutting (OFC-A)

- A. Distinguish between a well-cut surface and a poorly cut surface, and adjust as needed to perform a good cut.
- B. Demonstrate how to safely test oxygen fuel cutting (OFC) equipment.
- C. Demonstrate how to use OFC equipment, such as gas cylinder, regulator, hoses, and welding torch tips.
- D. Select proper cutting tip and working pressures for cutting in specific jobs and materials.
- E. Demonstrate proper procedure for setting up and shutting down the torch.
- F. Identify the function of each component of the outfit.

## 13. Plasma Arc Cutting

- A. List appropriate industrial uses of plasma cutting.
- B. Identify the advantages of plasma cutting in the welding industry.
- C. Describe safety rules and proper operation for plasma cutting equipment.
- D. Name materials suitable for plasma cutting.

## 14. Shielded Metal Arc Welding (SMAW) of Plate

- A. Produce a flat weld proficiently based on visual testing using 6010 rod.

- B. Produce a flat weld proficiently based on visual testing using 7018 rod.
- C. Produce a horizontal weld proficiently based on visual testing using 6010 rod.
- D. Produce a horizontal weld proficiently based on visual testing using 7018 rod.
- E. Run a continuous bead with ability to restart a weld using 6010 rod.
- F. Run a continuous bead with ability to restart a weld using 7018 rod.
- G. Identify the five common joints and their appropriate application, including butt, lap, corner, edge, tee and vee joints.
- H. Identify shapes of metal such as angle, I beam, channel, H beam, plate and gauge.
- I. Identify American Welding Society codes on welding rods and the materials with which they are compatible.
- J. Identify the power sources, electrode lead and terminals, work piece lead and terminals (polarities), and electrode holder and ground as parts of the arc-welding machine.
- K. Recognize the importance of high and low current settings, electrode size and heat, arc length, and electrode angle when making a weld.
- L. Produce a flat weld proficiently based on visual testing using 7024 rod.
- M. Produce a horizontal weld proficiently based on visual testing using 7024 (fillet) rod.
- N. Run a continuous bead with ability to restart a weld using 7024 rod.
- O. Apply industrial math in the use of measuring equipment.

## 15. Gas Metal Arc Welding (GMAW)

- A. Describe GMAW welding terminology and processes.
- B. Identify, set up, and safely use GMAW equipment.
- C. Identify and use appropriate gas with a variety of metals (straight carbon dioxide or combination of argon and carbon dioxide gas mix).
- D. Differentiate between GMAW and SMAW welding processes.
- E. Produce a flat weld proficiently based on visual testing using micro-wire.
- F. Produce a horizontal weld proficiently based on visual testing using micro-wire.
- G. Produce a vertical weld proficiently based on visual testing using micro-wire.
- H. Produce an overhead weld proficiently based on visual testing using micro-wire.
- I. Identify five basic welding joints.
- J. Evaluate and identify basic weld defects.
- K. Correct basic weld defects
- L. Visually inspect finished weld
- M. Identify and use appropriate polarity with ferrous and non-ferrous metals and filler wire.

## 21. Professional & Portfolio Skills

- A. Demonstrate diversity awareness, positive interpersonal, leadership, and citizenship skills through teamwork on projects.
- B. Create a professional digital portfolio reflecting employability skills in the relevant industry to include an "About Me" page.
- C. Collect original works and documents that demonstrate technical skills and knowledge in the industry.

- D. Demonstrate knowledge of competencies by accompanying each selected document or work with a journal entry or summary.
- E. Write a brief resume and cover letter to be included in portfolio.
- F. Develop interviewing techniques using portfolio materials.
- G. Display portfolio materials for critique by a professional panel (industry partners and classmates).
- H. Gather feedback and update portfolio.

## Key Assignments

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
1. Students will participate in mock interviews that represent current industry practices (e.g., skills demonstrations, resumes, applications, portfolios, personal websites, etc.).	1A, B, D 3B, C, D, I, J 6A-C 16A	2 3	2 3		LS 11-12.6 SLS 11-12.2
2. Students will explore in detail a welding career of their choice. The paper will be 3-5 pages in length, double-spaced. Students will incorporate online research, results from informal assessments, and information gathered through industry and post-secondary tours. Each paper will be organized into six parts as follows: <ul style="list-style-type: none"> <li>Part 1: Introduction - Personal Assessment</li> <li>Part 2: Requirements for entry into the career</li> <li>Part 3: Describing the job</li> <li>Part 4: Describing the profession today</li> <li>Part 5: Outlining the steps to go from here to there</li> <li>Part 6: Works cited</li> </ul>	7A-F	2	2		WS 11-12.6 WS 11-12.7
3. Pass a safety test and practice technical writing by writing an Instruction Manual or guide with an accompanying video on how to use a piece of welding gear safely. Students will explain welding vernacular in terms easy to understand by 8th grade visitors who know nothing about welding and are interested in learning more about the welding pathway.	8A-L	2 4	2 4		WS 11-12.6 WS 11-12.7
4. Students will write 250-word essays on the following prompts throughout the year: <ul style="list-style-type: none"> <li>What is the importance of a professional looking project?</li> <li>What math skills are needed to excel as a welder?</li> <li>Why must a welder know about the nature and properties of metal being used for the project?</li> </ul>	1B 5D-F, H 9A-G	1 4 5 10	5 6 10 11	C1.0 C2.0 C5.0 C8.0	CC 6 ETS 1.A G-CO-12 RLST 11-12.4



Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
5. Luminary project – Students will design a sketch that meets basic blueprint requirements before creating the project. Students will then create a luminary project consisting of two plates welded together, using linear and piercing cuts for the thickness of plate selected.	10A-D 11A-C 12A-F				
6. Students will use a manual or CNC plasma cutter to create a personal project of their choice, approved by the teacher.	13A-D				
7. Students will create and weld a 90 degree open corner joint. Students will also design and create a cube which is square on all axes (X, Y, Z) maintaining 90 degree angles to a +/- 2 degree angular tolerance with a dimensional tolerance to +/- 1/8 inch on all axes (linear dimension).	1B 5D- F, H 14A-O	1 2 4 5 10	5 6 7 10 11	C2.0 C6.0 C8.0	ETS 1.A, 1.B, 1.C RLST 11-12.4 RLST 11-12.3 SEP 1 SLS 11-12.1 WS 11-12.7
8. Students will weld two 11 gauge plates together in T-joint configuration that shall pass a bend test and meet AWS specifications.	15A-M				ETS 1.A, 1.B, 1.C RLST 11-12.3,12.4 SEP 1; SLS 11-12.1 WS 11-12.7
9. Reflection journal for class projects -Students will increase self-awareness and responsibility for their learning by documenting their thoughts and feelings about what they are learning. These journal entries will serve as a resource for students to review their learning and how it interrelates with their goals, how far they have progressed, and reflect on their personal work ethics, attitudes, beliefs, interpersonal skills and leadership style.	16	2 5	2 5		WS 11-12.6 WS 11-12.7

## 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 ([or 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