

Advanced Manufacturing Welding Technology							
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Principles of Welding Technology

7110

Principles of Welding Technology includes classroom and laboratory experiences that develop a variety of skills in oxy-fuel cutting and basic welding. This course is designed for individuals who intend to make a career as a Welder, Technician, Designer, Researcher, or Engineer. Emphasis is placed on safety at all times. OSHA standards and guidelines endorsed by the American Welding Society (AWS) are used. Instructional activities emphasize properties of metals, safety issues, blueprint reading, electrical principles, welding symbols, and mechanical drawing through projects and exercises that teach students how to weld and be prepared for postsecondary and career success.

- Prerequisite/Co-Requisite: none
- Credits: 2 semester course, 2 semesters required, 1 credit per semester, 2 credits maximum

Postsecondary Alignment:

- ITCC: WELD 100
- VU: WELD 107

Key Competencies:

- Understand and identify welding symbols and blueprints.
- Discuss the need for workplace safety and workplace safety training programs as covered by the OSHA 10 hour program
- Demonstrate basic welding techniques using virtual welding simulator.
- Learn proper AWS Standard Welding Terms and Definitions.
- Effectively analyze and apply Metallurgy fundamentals to welding processes.
- Identify the five basic welding joints.
- Understand and identify welding defects and discontinuities.
- Understand how to interpret Weld Procedure Specifications (WPSs) and their purpose.
- Demonstrate the use of oxy fuel welding and cutting.
- Demonstrate the use of plasma arc cutting.

- Discuss the current trends and opportunities in the welding field.
- Attain readiness to take OSHA 10 Hour General Industry Certification exam
- Demonstrate ability to read and interpret technical documents. Apply that knowledge to steel fabrication.
- Utilize welding symbols to make appropriate welds according to code.
- Understand the basic concepts of sketching and drawing blueprints.
- Understand and apply welding symbol terminology and theory to industry applications
- Demonstrate ability to use various types of software applicable to course.

Shielded Metal Arc Welding

7111

This course involves the theory and application of the Shielded Metal Arc Welding process. Process theory will include basic electricity, power sources, electrode selection, and all aspects pertaining to equipment operation and maintenance. Laboratory welds will be performed in basic weld joints with a variety of electrodes in the flat, horizontal and vertical positions. Emphasis will be placed on developing the basic skills necessary to comply with AWS industry standards.

- Prerequisite/Co-Requisite: Principles of Welding Technology
- Credits: 2 semester course, 2 semesters required, 1 credit per semester, 2 credits maximum

Postsecondary Alignment:

- ITCC: WELD 108, WELD 206
- VU: WELD 102

Key Competencies:

- Demonstrate electric welding equipment safety.
- Understand and apply all shielded metal arc welding safety rules.
- Identify the five basic welding joints.
- Identify heat input and metal distortion.
- Describe the capabilities of electric welding equipment.
- Weld with A.C. and D.C. current.
- Prepare and tack weld coupons.
- Make single and multi-pass welds.
- Weld in the flat, horizontal, vertical, and the overhead position.
- Identify SMAW electrodes and AWS electrode classification.
- Describe D.C. straight and reverse polarity.
- Describe proper electrode manipulation for each type of electrode.
- Describe proper correct technique for each welding position and electrode type.
- Demonstrate ability to read and interpret technical documents.
- Demonstrate ability to use various types of software applicable to course.

- Describe differences in currents and polarities; AC, DC Reverse and DC Straight.
- Explain how to safely use SMAW equipment.
- Describe the AWS electrode identification system for SMA process.
- Perform fillet welds on 1" plate (21-bead Multi-pass) in horizontal, vertical and overhead positions.
- Describe how to control magnetic arc blow in DC welding of groove welds.
- Prepare and tack groove welds as to AWS D1.1 Structural Steel Code.
- Perform 3/8" and 1" groove welds as per AWS and ASME Code, in all positions.
- Perform air carbon arc gouging on steel groove welds.
- Describe heat input and metal warpage and distortion.
- Describe methods of destructive and non-destructive testing.
- Attain readiness to take American Welding Society certification exam
- Demonstrate ability to read and interpret technical documents.
- Demonstrate ability to use various types of software applicable to course.

Gas Welding Processes

7101

A course designed to cover the operation of Gas Metal Arc Welding (MIG) equipment. This will include all settings, adjustments and maintenance needed to weld with a wire feed system. Instruction on both short-arc and spray-arc transfer methods will be covered. Tee, lap, and open groove joints will be done in all positions with solid, fluxcore, and aluminum wire. Test plates will be made for progress evaluation. Schools will have the option to introduce students to both MIG and TIG welding rather than focusing solely on MIG welding.

- Prerequisite/Co-Requisite: Principles of Welding Technology
- Credits: 2 semester course, 2 semesters required, 1 credit per semester, 2 credits maximum

Postsecondary Alignment:

- ITCC: WELD 207, WELD 272
- VU: WELD 103

Key Competencies:

- Employ safety practices involved in gas metal arc welding.
- Describe constant voltage and wire feed welding processes.
- Weld with hard wire using short circuit and spray method welding.
- Weld with flux-core tubular wires.
- Weld aluminum with spray.
- Identify the gases used in gas metal arc welding.
- Perform routine maintenance on gas metal arc welding equipment.
- Identify and weld five (5) basic types of joints.
- Demonstrate ability to read and interpret technical documents.
- Demonstrate ability to use various types of software applicable to course.

- Demonstrate the proper safety procedures in Gas Metal Arc welding.
- Learn proper AWS Standard Welding Terms and Definition.
- Perform weld restarts that are smooth and even with GMAW using short circuiting transfer equipment on mild steel.
- Perform lap, and tee joint welds with GMAW using short circuiting transfer equipment on mild steel in the vertical up, vertical down and overhead position.
- Perform square groove welds with GMAW using short circuiting transfer equipment on mild steel in the vertical up, vertical down and overhead position.
- Perform lap, and tee joint welds with GMAW using spray equipment on thick mild steel in the flat and horizontal position.
- Perform V-Groove welds with GMAW using spray equipment on thick mild steel in the flat position.
- Perform lap, tee and groove welds with GMAW equipment on aluminum.
- Understand welding procedure specifications (WPS) and be able to follow them.
- Understand the basic metallurgical properties of steel and aluminum and how they are affected by welding.
- Understand the significance of the suffix in GMAW electrode selection.
- Prepare to create a workmanship sample weldment for GMAW following the AWS provided prints.
- Gain insight into the Certification for AWS welders
- Attain readiness to take American Welding Society certification exam
- Demonstrate ability to read and interpret technical documents.
- Demonstrate ability to use various types of software applicable to course.

Welding Technology Capstone

The Welding Technology Capstone course builds upon the knowledge and skills developed in Welding Fundamentals, Shielded Metal Arc Welding, and Gas Metal Arc Welding by developing advanced welding skills in Gas Tungsten Arc Welding (TIG), Pipe Welding, and Fabrication. As a capstone course, students should have the opportunity to apply their knowledge and use skills through an intensive work-based learning experience.

- Prerequisite/Co-Requisite: Shielded Metal Arc Welding, Gas Arc Welding
- Credits: 2 semester course, 2 semesters required, 1-3 credits per semester, 6 credits maximum

Postsecondary Alignment:

- ITCC: WELD 208, WELD 273, WELD 203, WELD 210, Elective
- VU: WELD 104, WELD 105, WELD 106, WELD 108

Key Competencies:

Domain: Gas Tungsten Arc Welding (TIG)

- Interpret welding symbols and demonstrate how they apply to shop drawings.
- Identify the various joint configurations and explain how they affect weld strength.
- Employ and practice safety procedures and practices used in the welding industry.
- Identify and describe the function of each component of a GTAW station.
- Identify and specify GTAW electrodes using the AWS electrode classification system.
- Identify and specify GTAW filler metals using the AWS filler metal classification system.
- Explain the effects of DCEN, DCEP, and AC current on electrode life, surface cleaning, and weld characteristics.
- Describe the shielding gases used for GTAW, describe their characteristics and their uses.
- Select the proper power source, current type, shielding gas, flow rate, electrode type and diameter, nozzle size, and filler metal.
- Properly assemble and adjust all variables required to produce acceptable GTA welds.
- Properly prepare tungsten electrodes for welding with AC or DC current.
- Demonstrate the use of square wave and pulse welding technology and how it applies to GTAW.
- Properly prepare metals for welding.
- Identify different types of weld defects and describe steps to prevent them.
- Describe welding characteristics for Mild Steel, Stainless Steel, and Aluminum and other weldable metals.
- Demonstrate welding on various types of metals.
- Demonstrate the proper safety procedures in Gas Tungsten Arc welding.
- Learn proper AWS Standard Welding Terms and Definition.
- Setup and shut down of a Gas Tungsten Arc station properly and safely.
- Select and determine the proper electrode and nozzle size for a job.
- Understand welding procedure specifications (WPS) and be able to follow them.
- Perform destruction testing with appropriate welds.
- Perform proper techniques of preparation of tungsten electrodes.
- Perform balling of tungsten electrodes in preparation for aluminum welding.
- Gain insight into the Certification for AWS welders.
- Practice welding, following WPS and instructors guidelines.
- Lap/T/Square groove/w/wire on 10ga. steel.
- Lap/T/Square groove on 10ga. Stainless Steel.
- Lap/T on 10ga. Aluminum.
- Workmanship sample prints; steel, stainless steel, aluminum.
- Attain readiness to take American Welding Society certification exam.
- Demonstrate ability to read and interpret technical documents.

Domain: Pipe Welding

- Understand and apply all shielded metal arc pipe welding and gas tungsten arc welding safety rules.
- Apply American Welding Society D1.1 code welding criteria to guided bend tests.
- Utilize and apply shielded metal arc pipe welding process and gas tungsten arc welding fundamentals to pass AWS welding certifications.
- Apply all appropriate equipment settings and adjustments.
- Understand and apply the basic principles and terminology involved in destructive weld testing.
- Employ safety procedures in preparation of and welding of pipe.

- Perform the proper technique for preparing the pipe for welding.
 - Tack pipe in 2G and 5G position.
 - Weld pipe in the 2G position with the stringer bead method.
 - Weld pipe in the 5G position with the stringer or weave bead method.
 - Prepare pipe for weld test.
 - Demonstrate ability to inspect weld joint before, during and after welding.
 - Demonstrate ability to read and interpret technical documents.
- Domain: Fabrication***
- Describe equipment used in basic metal fabrication.
 - Use measuring equipment.
 - Prepare a bill of materials from a print chosen for project.
 - Prepare a list of fabrication steps necessary to fabricate this project.
 - Layout the various tolerances, fits and allowances related to this project.
 - Layout the assigned project.
 - Fabricate the assigned project.
 - Perform visual inspection of project.
 - Produce a detailed drawing of project with welding symbols.
 - Demonstrate ability to read and interpret technical documents.
- Domain: Plasma Arc Cutting***
- Understand and apply learned skills to be able to operate CNC plasma cutting equipment
 - Use CAD software to design parts
 - Perform basic maintenance on all required equipment
 - Utilize equipment to its full capability
 - Use proper terminology as it applies to Plasma Arc Cutting
 - Show they understand safe work practices
 - Apply learned skills to cut and fabricate a project