

Area: Technical Education
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Degree: A.S. - Welding Technology
 Certificates: Gas Metal Arc, Flux Cored Arc Welding Plate
 Gas Tungsten Arc Plate & Pipe Welding
 Welding Equipment Maintenance and Blueprint Interpretation
 Shielded Metal Arc Plate and Pipe
 Welding Metallurgy and Inspection



American Welding Society
 Accredited Testing Facility, 2001

The ARC Program

The American Welding Society (AWS) nationally accredits American River College's welding program. ARC has met all the requirements of the AWS QC4 Standards for Accreditation of Test Facilities for their Certified Welder Program. AWS certification is recognized by the welding industry as an important step in professional development.

Welding Technology Degree

The Welding Technology degree provides skills and knowledge in manual and semi-automatic welding processes used in the metal fabrication and construction industries. Instruction covers materials, equipment, procedures, testing techniques, as well as, safety and blueprint reading. Competencies include techniques of joining ferrous and non-ferrous metals by the use of Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten Arc Welding (GTAW), and welding procedures.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Select the correct electrode classification and parameters for various thickness of material and welding positions on ferrous and nonferrous metals.
- Define principles of gas metal arc welding.
- Interpret GMA electrode and classification and specification.
- Describe gas metal arc (GMA) welding operations of various joint designs using selected electrodes on different positions.
- Describe shielded metal arc welding operations of various positions using selected electrodes on different joint designs.
- Define principles of arc welding.
- Select correct electrode amperage settings for the job application.
- Identify gas tungsten arc (GTA) welding principles and safe welding practices.
- Define GTA applications and limitations.
- Explain the reason for the formation of each discontinuity type, and distinguish different discontinuities.
- Interpret fabrication blueprints using a systematic process.
- Interpret graphic welding symbols.
- Relate the requirements for welding ferrous and nonferrous metals.

- Select the appropriate setting and application methods.
- List the methods used for discontinuity prevention and identify surface defects in welds.

Career Opportunities

Welding certification is recognized by the welding industry as an important step in the profession. The American Welding Society (AWS) nationally accredits American River College's welding program. The ARC welding program has met all the requirements of the AWS QC4 standards for Accreditation of Test Facilities for their Certified Welder Program.

Graduating students may find positions in oil refineries, nuclear power plants, aerospace, structural buildings, bridge construction, auto industry, and small commercial fabricating shops.

Requirements for Degree		37 Units
WELD 102	Introduction to Welding Metallurgy	3
WELD 116	Welding Inspection	2
WELD 130	Gas Tungsten Arc Welding	3
WELD 133	Gas Metal Arc Welding, Semi-Automatic Processes	3
WELD 134	Gas Metal Arc Welding of Non-Ferrous Metals	2
WELD 140	Mathematics for Welding Technicians	3
WELD 300	Introduction to Welding	3
WELD 320	Shielded Metal Arc Welding (Stick Electrode Welding)	3
WELD 321	Shielded Metal Arc Welding (Stick Electrode Welding)	3
WELD 322	Advanced Pipe Welding in Shielded Metal Arc	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3
WELD 335	Flux Cored Arc Welding.....	3
WELD 342	Symbol Reading, Layout and Fabrication	3

Associate Degree Requirements: The Welding Technology Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Gas Metal Arc, Flux Cored Arc Welding Plate (252 hours) Certificate

The Gas Metal Arc Welding certificate promotes competence in welding with different types of metal transfer, constant voltage power sources, different types of shielding gases, and electrode selection on various joint designs. Instruction is provided in gas metal and flux cored arc welding on fillet and groove welds to specific structural and pipe standards.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Select the correct electrode classification and parameters for various thicknesses of material and welding positions on ferrous and nonferrous metals
- Define principles of gas metal arc welding
- Interpret electrode classification and specification
- Analyze gas metal arc welding operations on various joint designs using selected electrodes for different welding positions

Requirements for Certificate		11 Units
WELD 133	Gas Metal Arc Welding, Semi-Automatic Processes	3
WELD 134	Gas Metal Arc Welding of Non-Ferrous Metals	2
WELD 300	Introduction to Welding	3
WELD 335	Flux Cored Arc Welding	3

Gas Tungsten Arc Plate and Pipe Welding (180 hours) Certificate

The Gas Tungsten Arc Welding certificate promotes competence in welding ferrous and nonferrous materials. Emphasis is on proper use of gas tungsten arc welding (GTA) equipment setup requirements, process variables, material requirements, and welding procedures that are in compliance with industry standards.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Identify GTA principles and safe practices.
- Define GTA applications and limitations.
- Weld mild steel, stainless steel, and aluminum alloys using GTA procedures in all positions.
- Evaluate and demonstrate procedures for a given welding project or application.
- Relate the requirements of welding ferrous and nonferrous materials.
- Select the appropriate settings and applications methods of GTA process.

Requirements for Certificate		9 Units
WELD 130	Gas Tungsten Arc Welding	3
WELD 300	Introduction to Welding	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3

Welding Equipment Maintenance and Blueprint Interpretation (234 hours) Certificate

This certificate promotes competence in solving equipment, mathematical and manufacturing problems that apply to the welding trade. It emphasizes metal placement, measurement, and layout of tools used in construction, as well as the fundamentals of blueprint reading and welding equipment repair.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Evaluate algebraic expressions by substituting given numbers for letter values
- Solve formulas by substituting numbers for letters, analyzing word statements and diagram values
- Compute the area, radius, and diameter of a circle
- Compute area, radius, and central angles of a sector
- Measure angles in degrees, minutes, and seconds

- Identify and demonstrate the proper use of common power tools and accessories used in the welding trade
- Interpret fabrication blueprints using a systematic process
- Interpret graphic welding symbols
- Interpret electrical and electronically controlled circuits
- Evaluate testing equipment used for welding maintenance repair

Requirements for Certificate		12 Units
WELD 107	Welding Equipment Maintenance	3
WELD 140	Mathematics for Welding Technicians	3
WELD 300	Introduction to Welding	3
WELD 342	Symbol Reading, Layout and Fabrication	3

Shielded Metal Arc Plate and Pipe (270 hours) Certificate

The Shielded Metal Arc Welding plate and pipe certificate promotes competence in plate and pipe welding. Emphasis is on power sources, electrode selection on various joint designs, techniques, and positions in welding. Instruction includes safety and proper procedures in making fillet and groove welds that are in compliance with structural and pipe welding codes.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Interpret electrode classification and specification
- Select correct amperage setting for the job application
- Define principles of arc welding
- Certify and perform SMA operations in various positions using selected electrodes on different joint designs

Requirements for Certificate		12 Units
WELD 300	Introduction to Welding	3
WELD 320	Shielded Metal Arc Welding (Stick Electrode Welding)	3
WELD 321	Shielded Metal Arc Welding (Stick Electrode Welding)	3
WELD 322	Advanced Pipe Welding in Shielded Metal Arc	3

Welding Metallurgy and Inspection (270 hours) Certificate

The Welding Metallurgy and Inspection certificate provides the science of metallurgy and weld inspection. Emphasis is on the identification and selection of irons and steel, mechanical and physical properties of metals and crystal structures of metals, rules and regulations of the welding construction industry, and principles, requirements and methods of inspection.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Describe the mechanical properties of different types of metals
- Interpret and explain the Nondestructive Testing (NDT) procedures of codes and specifications relating to welding
- Evaluate and explain in simple terms the reason for the formation of discontinuity in each of the welding processes
- Explain different methods used for the prevention of weld discontinuities
- Describe the crystalline structures of metals and explain how grain forms in metal
- Explain the problems hydrogen causes when welding steel
- Analyze phase diagrams of carbon and stainless steels

Requirements for Certificate		14 Units
WELD 102	Introduction to Welding Metallurgy	3
WELD 116	Welding Inspection	2
WELD 117	Ultrasonic Testing Level One	3
WELD 118	Ultrasonic Testing Level Two	3
WELD 300	Introduction to Welding	3

WELD 101 Introduction to Welding and Cutting **1 Unit**

Prerequisite: Acceptance into a registered apprenticeship program.

Hours: 9 hours LEC; 27 hours LAB

This course is an introduction to welding processes for apprentices. Shielded metal arc, oxyacetylene cutting on joint designs, and positions used in industry are taught. Safety in arc welding and oxyacetylene cutting is also covered.

WELD 102 Introduction to Welding Metallurgy **3 Units**

Prerequisite: WELD 300 with a grade of "C" or better

Hours: 54 hours LEC; 36 hours LAB

This course covers the production of iron and steel used in industry. The focus is on the identification and selection of irons and steels, the mechanical and physical properties of metals, and the crystal structure of metals. It also covers metallurgical failure of welds, deformation, and the heat treatment of steels.

WELD 103 Gas Metal Arc Welding of Sheet Steel **1.5 Units**

Hours: 18 hours LEC; 27 hours LAB

This course covers technique application and joint design used in the auto body repair and sheet steel manufacturing industries. Sheet steel applications in the areas of steel decks, panels, storage racks, and joint framing members are presented using Gas Metal Arc Short Circuit Transfer process. Proper safety welding techniques are also covered.

WELD 104 Introduction to Metal Fabrication and Sculpture **.5-3 Units**

Same As: ART 120

Hours: 0-36 hours LEC; 27-54 hours LAB

This course covers metal sculpture techniques, design principles and materials used for sculpture, functional and nonfunctional art forms, on ferrous and non-ferrous metals. Techniques on the major welding processes such as shielded metal arc, gas metal arc, gas tungsten arc and oxy-acetylene are an integral part of the course as well as related safety issues. Different artists and topics are covered each semester. ART 120 and /or WELD 104 may be taken 4 times for a total of 6 units.

WELD 107 Welding Equipment Maintenance **3 Units**

Hours: 36 hours LEC; 54 hours LAB

This course covers the basics of welding equipment maintenance, trouble-shooting and repair. Electrical and electronically controlled circuits are discussed and tested. Overall theory of operation and safety are presented, as well as maintenance scheduling and the use of electronic test equipment and other measuring devices. A field trip is required.

WELD 115 Code Welding **2 Units**

Prerequisite: WELD 300 with a grade of "C" or better.

Hours: 18 hours LEC; 54 hours LAB

This course provides individualized training for welder performance qualification. Welders select the code, metal, process, and position to be used. Code and test requirements are presented. This course may be taken four times for credit using a different code, metal, process, or position.

WELD 116 Welding Inspection **2 Units**

Prerequisite: WELD 300.

Hours: 36 hours LEC

This course covers the welding requirements for any type of welded structure made from commonly used carbon and low-alloy steel construction. It includes the rules and regulations for the welding construction industry and the principles, requirements, and methods of inspection. Weld measurement and discontinuities for evaluation acceptance using a variety of tools are taught.

WELD 117 Ultrasonic Testing Level One **3 Units**

Hours: 45 hours LEC; 27 hours LAB

This course covers the theory, technique application, and evaluation techniques used in the material processing, welding, and inspection industries. Ultrasonic testing as applied to industry practices such as building construction, aeronautics, shipbuilding, materials fabrication, and many others are covered. Proper safety techniques are also covered. Successful completion of this course certifies that the requirements of ASNT TCI-A for UT level 1 are met.

WELD 118 Ultrasonic Testing Level Two **3 Units**

Prerequisite: WELD 117 with a grade of "C" or better.

Hours: 45 hours LEC; 27 hours LAB

This course covers advanced theory, technique application, and evaluation techniques used in the material processing, welding, and inspection industries. Advanced ultrasonic testing as applied to industry practices such as building construction, aeronautics, shipbuilding, materials fabrication and many others are covered. Proper safety techniques are also covered. Successful completion of this course certifies that the requirements of ASNT TCI-A for UT level II are met.

WELD 123 Welding Certification to D1.5 Bridge Code **1 Unit**

Prerequisite: WELD 320 with a grade of "C" or better.

Hours: 9 hours LEC; 27 hours LAB

This course covers the welding requirements of the American Association of State Highway and Transportation Officials (AASHTO) for welded highway bridges made from carbon and low-alloy construction steels. It includes the general requirements for welder certification under this code. This course provides welding procedures for certification in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code, an American National Standard.

WELD 130 Gas Tungsten Arc Welding **3 Units**

Prerequisite: WELD 300 with a grade of "C" or better

Hours: 36 hours LEC; 54 hours LAB

This course covers tungsten inert gas welding of aluminum, stainless steel, and other metals used in industry. Certification and procedure qualification using Gas Tungsten Arc Welding (GTAW) are also covered.

WELD 133 Gas Metal Arc Welding, Semi-Automatic Processes **3 Units**

Hours: 36 hours LEC; 54 hours LAB

This course covers semi-automatic wire feed welding with micro wires on steel plate of varying thickness. Joint design, gas variations and all welding positions are covered.

WELD 134 Gas Metal Arc Welding: Ferrous and Non-Ferrous Metals 2 Units

Hours: 18 hours LEC; 54 hours LAB

This course covers semiautomatic wire feed welding including fine through heavy wire welding on aluminum and stainless steel plate of varying thickness. Joint design, gas variations and all welding positions are covered. The emphasis of this course is on code welding aluminum and stainless steels. This course content is relevant to the performance qualification test of the American Welding Society (AWS) D1.2 and D1.6.

WELD 140 Mathematics for Welding Technicians 3 Units

General Education: AA/AS Area II(b)

Hours: 54 hours LEC

This course covers the application of mathematics in technical and trade work. It applies mathematic principles to the welding trade. Areas covered are common fractions, fraction/decimal conversion, percentages, practical algebra, rectangles, triangles, metric measurement, measuring instruments, strength of materials and essentials of trigonometry. Problems involving labor and cost of material are also covered.

WELD 150 Employability Skills for Technical Careers 2 Units

Same As: AT 107 and ET 250

General Education: AA/AS Area III(b)

Hours: 36 hours LEC

This course provides the opportunity of exploring technical careers while developing valuable work and life skills. It is an introduction to a variety of technically-related occupations. Emphasis is placed on exploring technical careers in the Sacramento area. Activities are designed to enhance personal development, employability skills, and self esteem through leadership, citizenship, and character development. Not open to students who have completed AT 107 or ET 250.

WELD 290 Advanced Student Projects 2 Units

Prerequisite: WELD 300 with a grade of "C" or better.

Hours: 108 hours LAB

This course provides an opportunity to pursue advanced projects selected by the welding department. This course may be taken twice for credit.

WELD 294 Topics in Welding .5-5 Units

Hours: 9 hours LEC; 27-270 hours LAB

This course provides an opportunity to study current topics in welding technology that are not included in existing courses. It may be taken four times for a maximum of six units, providing there is no duplication of topics.

WELD 300 Introduction to Welding 3 Units

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course is an introduction to welding processes: shielded metal arc, gas metal arc, flux-cored gas shield and self shield, gas tungsten arc, oxyacetylene cutting and welding on joint designs and positions used in industry. Safety in arc, oxyacetylene welding and cutting is also covered.

WELD 320 Shielded Metal Arc Welding (Stick Electrode Welding) 3 Units

Prerequisite: WELD 300 with a grade of "C" or better

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course covers pre-employment training for welding technicians. Emphasis is on developing manipulative proficiency in the use of Shielded Metal Arc Welding (SMAW) in the flat, horizontal, verti-

cal and overhead positions on light and heavy gage material. Groove welding of plates, with limited and unlimited thickness in accordance with D1.1 Structural Welding Code, is also covered.

WELD 321 Shielded Metal Arc Welding (Stick Electrode Welding) 3 Units

Prerequisite: WELD 320 with a grade of "C" or better

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course provides training in shielded metal arc welding skills, using low, medium, and high carbon steels. Topics include all position welding on fillet and groove welds to code specifications. It also provides technical instruction on filler materials, base metals, and arc welding safety.

WELD 322 Advanced Pipe Welding in Shielded Metal Arc 3 Units

Prerequisite: WELD 321 with a grade of "C" or better.

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

The course covers the application of an electric welding process: shielded metal arc is used to join low-pressure piping systems that carry water, residential natural gas, non-corrosive and non-combustible piping systems. High pressure critical piping systems such as steam pipe, pipe lines, boilers, offshore oil-rigs and other critical heavy duty application of piping systems are covered.

WELD 332 Gas Tungsten Arc Welding (Pipe) 3 Units

Prerequisite: WELD 130 with a grade of "C" or better.

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course covers the application of low-pressure and high-pressure critical piping systems such as in oil, gas, nuclear, and chemical industries.

WELD 335 Flux Core Arc Welding 3 Units

Prerequisite: WELD 300 with a grade of "C" or better

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course provides training to develop semi-automatic welding skills on carbon steels. Topics include small and large diameter flux cored electrodes, with and without external shielding gas, in all positions on fillet and groove welds. It also provides a thorough technical understanding of the flux core arc welding process, and arc welding safety.

WELD 342 Symbol Reading, Layout and Fabrication 3 Units

Corequisite: WELD 300

Course Transferable to CSU

Hours: 36 hours LEC; 54 hours LAB

This course covers blueprint and welding symbol interpretation. It includes metal layout, measurement, marking and layout tools used in construction, and techniques of fabrication and assembly methods. It also covers fundamentals of blueprint reading, including basic lines and views, dimensions, notes and specification, structural shapes, sections, detail, and assembly.