Welding is the most common way of permanently joining metal parts. Heat is applied to the pieces to be joined, the metal melts and fuses together to form a permanent bond. The resultant weld joint is as strong as if the two parts were one. Because of its strength, welding is used to construct and repair ships, automobiles, spacecraft and to join steel beams and reinforcing rods in buildings, bridges and highways.

There are three basic methods used to create the heat necessary to weld metals. The most frequently used process is called arc welding. It uses electricity to create heat as electrical current arcs between the tip of an electrode and the metal parts to be joined. In resistance (or spot) welding, heat is created by resistance to the flow of electrical current through the metal parts. In gas welding, the flame from the combustion of gases is used to melt the metal. It is the welder's responsibility to control the amount of heat and the size of the melted area and to add the proper amount of filler material so that the parts form a strong bond or joint. Welders must know how to use gas and electric welding equipment safely, and how to plan their work from drawings or specifications.

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. With multiple certifications, ARC will prepare students to work with welding industry codes, standards and specifications. The ARC welding program provides both classroom instruction and shop training for positions in most fields of welding. Competencies include techniques of joining ferrous and non-ferrous metals by use of Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Fluxed Core Arc Welding (FCAW) and Gas Tungsten Arc Welding (GTAW) welding processes. Competencies also include shop math, blueprint reading, welding symbol interpretation, oxy fuel gas cutting, plasma arc cutting, air arc gouging, welding metallurgy, welding inspection, and intensive training for welding certification.

Welding Technology

Requirements for Degree Major 37 units*

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<th>Course</th>
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<td>WELD 102</td>
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Recommended Electives

DESGN 100, MATH 100.

General Education Graduation Requirements: In addition to completing the degree requirements, students must also complete the general education graduation requirements for an A.A./A.S. degree. See ARC graduation requirements.

*Cannot be completed in one year.

Mathematics and Blueprint Interpretation (144 hours)

Requirements for Certificate 9 Units

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<th>Course</th>
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<td>WELD 140</td>
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<td>WELD 342</td>
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Gas Metal Arc Plate and Pipe (252 hours)

Requirements for Certificate 11 Units

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<tr>
<th>Course</th>
<th>Units</th>
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<tr>
<td>WELD 133</td>
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<td>WELD 135</td>
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<td>WELD 300</td>
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</tbody>
</table>
Gas Tungsten Arc Plate and Pipe Welding (180 hours)

Requirements for Certificate 9 Units
- WELD 130 3
- WELD 132 3
- WELD 300 3

Shielded Metal Arc Plate and Pipe (270 hours)

Requirements for Certificate 12 Units
- WELD 122 3
- WELD 300 3
- WELD 320 3
- WELD 321 3

Welding Metallurgy and Inspection (270 hours)

Requirements for Certificate 14 Units
- WELD 102 3
- WELD 116 2
- WELD 117 3
- WELD 118 3
- WELD 300 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
Formerly: WELD 54
Prerequisite: WELD 300.
Hours: 54 hours LEC, 36 hours LAB
This course introduces production of iron and the manufacture of iron and steel in shapes and forms used in industry. The focus is on identification and selection of irons and steels, mechanical and physical properties of metals, and crystal structure of metals. Additionally failure and deformation, the heat treating of steel, and the metallurgy of welds will be covered.

WELD 103 Gas Metal Arc Welding of Sheet Steel 1.5 Units
Prerequisite: None
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 (Same as ART 120) .5-3 Units
Formerly: WELD 67
Prerequisite: WELD 300 with a grade of "C" or better.
Hours: 0-36 hours LEC, 27-54 hours LAB
This course will cover metal sculpture techniques, design principles and materials used for sculpture, and functional and nonfunctional art forms, on ferrous and non-ferrous metals. Techniques on the major welding processes - gas welding, SMAW, MIG and TIG - will be an integral part of the course as well as related safety issues. This class may be taken 4 times for a maximum of 6 units. Not open to students who have completed ART 120.

WELD 106 Introduction to Ornamental Iron (Same as ART 122) .5-3 Units
Formerly: WELD 68
Prerequisite: WELD 300 with a grade of "C" or better.
Hours: 0-36 hours LEC, 27-54 hours LAB
This course will cover the hands-on basics of metal forming and welding techniques, design principles and materials used for sculpture, and functional art forms with emphasis on the use of the anvil and the gas forge. Techniques on the major welding processes - gas welding, SMAW, MIG and TIG - will be an integral part of the course as well as related safety issues. This class may be taken 4 times for a maximum of 6 units. Not open to students who have completed ART 122.

WELD 107 Welding Equipment Maintenance 2 Units
Prerequisite: None
Hours: 27 hours LEC, 27 hours LAB
This course covers the basics of welding equipment maintenance, troubleshooting 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
Prerequisite: None
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 122 Shielded Metal Arc Welding (Pipe) 3 Units
Formerly: WELD 62C
Prerequisite: WELD 321 with a grade of "C" or better.
Hours: 36 hours LEC, 54 hours LAB
This course will cover the areas of low-pressure piping systems used to carry water, residential natural gas, noncorrosive or noncombustible 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 will also be covered.

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 constructional steels. It includes the general requirements for welder certification under this code. This course provides welding procedures for certification in accordance with ANSI/AASHTO/ASD D1.5 Bridge Welding Code, an American National Standard.

**WELD 130 Gas Tungsten Arc Welding** 3 Units  
Formerly: WELD 64  
Prerequisite: None  
Corequisite: WELD 300.  
Hours: 36 hours LEC, 54 hours LAB  
This course covers tungsten inert gas welding of aluminum, stainless steel, and other metals used in industry.

**WELD 132 Gas Tungsten Arc Welding (Pipe)** 3 Units  
Formerly: WELD 64A  
Prerequisite: WELD 130 with a grade of “C” or better.  
Hours: 36 hours LEC, 54 hours LAB  
The course will cover the areas of low-pressure and high-pressure critical piping systems such as in oil, gas, nuclear, and chemical industries.

**WELD 133 Gas Metal Arc Welding, Semi-Automatic Processes** 3 Units  
Formerly: WELD 65A  
Prerequisite: None  
Corequisite: WELD 300.  
Hours: 36 hours LEC, 54 hours LAB  
This course will cover automatic wire feed welding covering fine through heavy wire welding on steel plate gauges of varying thickness. Joint design, gas variations and all welding positions are covered.

**WELD 134 Gas Metal Arc Welding of Non-Ferrous Metals** 2 Units  
Formerly: WELD 65B  
Prerequisite: WELD 133 with a grade of “C” or better.  
Hours: 18 hours LEC, 54 hours LAB  
This course will cover semiautomatic wire feed welding covering fine through heavy wire welding on non-ferrous steel plate gauge of varying thickness. Joint design, gas variations and all welding positions are covered. Emphasis is on aluminum, stainless steels, and mixtures of gases. Introduction to open groove plate and pipe of mild steel using Gas Metal Arc and Flux Cored Arc Welding processes. A performance qualification test is optional at end of course.

**WELD 135 Gas Metal Arc Welding (GMAW)-Pipe** 3 Units  
Formerly: WELD 65C  
Prerequisite: WELD 133.  
Hours: 36 hours LEC, 54 hours LAB  
The course will cover the areas of low-pressure heating, air-conditioning, refrigeration, and water supply as well as some gas and chemical systems. The short circuit metal transfer will be used on all gas metal arc welding (GMAW) pipe connection.

**WELD 140 Mathematics for Welding Technicians** 3 Units  
Formerly: WELD 66A  
Prerequisite: None  
Hours: 54 hours LEC  
This course covers practical mathematics as they are applied to technical and trade work. It involves applying mathematics principles to the welding trade. Areas covered are common fractions, decimal fractions, 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. AAAS/AA area D2.

**WELD 150 Employability Skills for Technical Careers (Same as AT 107 and ET 250)** 2 Units  
Formerly: WELD 118  
Prerequisite: None  
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. AA/AS area E2.

**WELD 290 Advanced Student Projects** 2 Units  
Formerly: WELD 83  
Prerequisite: Must have a “C” or better in the Welding major  
Hours: 54 hours LAB  
This course provides an opportunity for students 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  
Formerly: WELD 93  
Prerequisite: To be determined for each topic  
Hours: 90 hours LEC, 27-270 hours LAB  
Individualized course developed in cooperation with industry to meet specialized training needs. This course may be taken four times with different topics.

**WELD 300 Introduction to Welding** 3 Units  
Formerly: WELD 62A  
Prerequisite: None  
Course Transferrable 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  
Formerly: WELD 62B  
Prerequisite: WELD 300 with a grade of “C” or better.  
Course Transferrable to CSU  
Hours: 36 hours LEC; 54 hours LAB  
This course will cover pre-employment training for welding technicians. Emphasis on developing manipulative proficiency in the use of shielded metal-arc welding in the flat, horizontal, vertical and overhead positions on light and heavy gauge material. Emphasis will also be placed on groove welding of plate, limited and unlimited thickness in accordance with D1.1 Structural Welding Code. May be taken twice for credit.

**WELD 321 Shielded Metal Arc Welding (Stick Electrode Welding)** 3 Units  
Formerly: WELD 62C  
Prerequisite: WELD 320 with a grade of “C” or better.  
Course Transferrable to CSU  
Hours: 36 hours LEC; 54 hours LAB  
This is a continuation of skills and content begun in Welding 320. Emphasis will also be placed on pipe welding procedures and welding techniques. May be taken twice for credit.

**WELD 342 Symbol Reading, Layout and Fabrication** 3 Units  
Formerly: WELD 66B  
Prerequisite: None  
Corequisite: WELD 300.  
Course Transferrable to CSU  
Hours: 36 hours LEC; 54 hours LAB  
This course will cover blueprint and welding symbol interpretation. Metal layout, measurement, marking and layout tools used in construction; techniques of fabrication and assembly methods. Concentration on fundamentals of blueprint reading and topics as basic lines and views, dimensions, notes and specification, structural shapes, sections, detail and assembly.