



# Scope and Sequence

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<b>Cluster:</b>	Manufacturing
<b>Course Name:</b>	Welding (One to Two Credits)
<b>Course Description:</b>	Rapid advances in technology have created new career opportunities and demands in many industries. Welding provides the knowledge, skills, and technologies required for employment in metal technology systems. Students develop knowledge and skills related to this system in order to apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer their knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.
<b>Course Requirements:</b>	This course is recommended for students in Grades 10-12. Recommended prerequisite: Algebra 1.

Units of Study	Knowledge and Skills	Student Expectations	Resources
1. Basic Shop/Welding Safety -	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	D. identify characteristics of good leaders;  E. identify employers' work expectations;	NCCER Core Contren Learning Series - Ch. 1 Module 00101-04; Welding Level 1 - Ch.1 - Module 29101-03; Modern Welding - Part 1 Chapter 1

Units of Study	Knowledge and Skills	Student Expectations	Resources
	<p>2. The student explores the employability characteristics of a successful worker in the global economy.</p>	<p>F. discuss Equal Employment Opportunity law in the workplace;</p> <p>A. explore academic knowledge and skills required for postsecondary education;</p> <p>B. identify employers' expectations to foster positive customer satisfaction;</p> <p>C. demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;</p> <p>D. evaluate personal career goals;</p> <p>E. communicate effectively with others in the workplace to clarify objectives; and</p> <p>F. demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.</p>	
	<p>3. The student applies academic skills to the requirements of welding.</p>	<p>A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;</p>	
	<p>4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.</p>	<p>A. use welding equipment according to safety standards;</p> <p>B. properly dispose of environmentally hazardous materials used in welding; and</p> <p>C. use appropriate personal protective equipment as needed to follow safety measures.</p>	

<b>Units of Study</b>	<b>Knowledge and Skills</b>	<b>Student Expectations</b>	<b>Resources</b>
2. Oxyfuel Cutting	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	A. describe how teams function;  B. use teamwork to solve problems; C. distinguish team roles such as team leaders and team members; D. identify characteristics of good leaders; E. identify employers' work expectations;  H. describe how teams measure results; and	NCCER Welding Level One - Contren Learning Series - Ch.2 Module 29102-03; Modern Welding - Part 5 Chapter 12-17
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers; E. accurately use an appropriate tool to make measurements;	
	4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.	A. use welding equipment according to safety standards;  C. use appropriate personal protective equipment as needed to follow safety measures.	
	8. The student performs oxy-fuel processes on carbon steels.	A. observe safe operating practices;  B. perform safe handling of compressed gases; C. identify components of oxy-fuel gas cutting; D. demonstrate proper set-up procedures for oxy-fuel process;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		E. distinguish factors affecting base metals; F. demonstrate proper cutting techniques such as piercing, straight line, and bevel;  G. perform welding and brazing; and H. identify acceptable cuts.	
3. Plasma Cutting	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	E. identify employers' work expectations;	Modern Welding - Part 4 Chapter 10-11
	2. The student explores the employability characteristics of a successful worker in the global economy.	B. identify employers' expectations to foster positive customer satisfaction;	
	3. The student applies academic skills to the requirements of welding.	D. apply accurate readings of measuring devices, both U.S. customary and metric;  E. accurately use an appropriate tool to make measurements; F. compute measurements such as area, surface area, volume, and perimeter;  G. determine how changes in dimension affect geometric figures; H. calculate problems using whole numbers, fractions, mixed numbers, and decimals; I. use a calculator to perform computations; J. perform conversions between fractions and decimals; K. understand the functions of angles; L. apply right triangle relationships using the Pythagorean Theorem; M. understand the parts of a circle;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		<p>N. identify the most reasonable mathematical solution using estimation;</p> <p>O. use cross-sections of three-dimensional figures to relate to plane figures;</p> <p>P. describe orthographic views of three-dimensional figures; and</p> <p>Q. describe isometric views of three-dimensional figures.</p>	
	<p>4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.</p>	<p>C. use appropriate personal protective equipment as needed to follow safety measures.</p>	
	<p>9. The student performs plasma arc cutting on metals.</p>	<p>A. observe safe operating practices;</p> <p>B. demonstrate knowledge of the theories of plasma arc cutting;</p> <p>C. apply safe handling of compressed air supply;</p> <p>D. identify components of plasma arc cutting;</p> <p>E. demonstrate correct set-up procedure for plasma arc cutting;</p> <p>F. define cutting terms; and</p> <p>G. perform shape cutting.</p>	
<p>4. Construction Math/ Math for Welders</p>	<p>2. The student explores the employability characteristics of a successful worker in the global economy.</p>	<p>A. explore academic knowledge and skills required for postsecondary education;</p> <p>C. demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;</p>	<p>NCCER Core Content Learning Series; Math for Welders - Nino Marion</p>

Units of Study	Knowledge and Skills	Student Expectations	Resources
	<p>3. The student applies academic skills to the requirements of welding.</p>	<p>A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;</p> <p>B. demonstrate mathematical skills to estimate costs;</p> <p>D. apply accurate readings of measuring devices, both U.S. customary and metric;</p> <p>E. accurately use an appropriate tool to make measurements;</p> <p>F. compute measurements such as area, surface area, volume, and perimeter;</p> <p>G. determine how changes in dimension affect geometric figures;</p> <p>H. calculate problems using whole numbers, fractions, mixed numbers, and decimals;</p> <p>I. use a calculator to perform computations;</p> <p>J. perform conversions between fractions and decimals;</p> <p>K. understand the functions of angles;</p> <p>L. apply right triangle relationships using the Pythagorean Theorem;</p> <p>M. understand the parts of a circle;</p> <p>N. identify the most reasonable mathematical solution using estimation;</p> <p>O. use cross-sections of three-dimensional figures to relate to plane figures;</p> <p>P. describe orthographic views of three-dimensional figures; and</p> <p>Q. describe isometric views of three-dimensional figures.</p>	

<b>Units of Study</b>	<b>Knowledge and Skills</b>	<b>Student Expectations</b>	<b>Resources</b>
5. Hand/Power Tools	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	E. identify employers' work expectations;  I. develop a method to reward team performance.	NCCER Core Contren Learning Series
	2. The student explores the employability characteristics of a successful worker in the global economy.	B. identify employers' expectations to foster positive customer satisfaction;  F. demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers; B. demonstrate mathematical skills to estimate costs; C. demonstrate technical writing skills related to work orders; D. apply accurate readings of measuring devices, both U.S. customary and metric;  E. accurately use an appropriate tool to make measurements; F. compute measurements such as area, surface area, volume, and perimeter;  G. determine how changes in dimension affect geometric figures; H. calculate problems using whole numbers, fractions, mixed numbers, and decimals; I. use a calculator to perform computations;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		J. perform conversions between fractions and decimals; K. understand the functions of angles; L. apply right triangle relationships using the Pythagorean Theorem; O. use cross-sections of three-dimensional figures to relate to plane figures; P. describe orthographic views of three-dimensional figures; and Q. describe isometric views of three-dimensional figures.	
6. Electrodes and How to Select Them	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	E. identify employers' work expectations;	NCCER Welding Level One - Contren Learning Series ; Modern Welding - Part 2 Chapter 5, Part 3 Chapter 7, Part
	2. The student explores the employability characteristics of a successful worker in the global economy.	F. demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	
7. Proper Metal Preparation	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	A. describe how teams function;  B. use teamwork to solve problems; C. distinguish team roles such as team leaders and team members; D. identify characteristics of good leaders;	NCCER Welding Level One - Contren Learning Series



Units of Study	Knowledge and Skills	Student Expectations	Resources
		E. identify employers' work expectations;  G. use time-management techniques to develop work schedules; H. describe how teams measure results; and I. develop a method to reward team performance.	
	2. The student explores the employability characteristics of a successful worker in the global economy.	B. identify employers' expectations to foster positive customer satisfaction;  E. communicate effectively with others in the workplace to clarify objectives; and	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	
	4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.	A. use welding equipment according to safety standards;  B. properly dispose of environmentally hazardous materials used in welding; and  C. use appropriate personal protective equipment as needed to follow safety measures.	
8. Proper Welding Equipment and Setup	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	E. identify employers' work expectations;	NCCER Welding Level One - Contren Learning Series; Welding: Principles and Applications - Section 2 Chapter3, Section 4 Chapter 10,

Units of Study	Knowledge and Skills	Student Expectations	Resources
	2. The student explores the employability characteristics of a successful worker in the global economy.	B. identify employers' expectations to foster positive customer satisfaction;  F. demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
	4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.	A. use welding equipment according to safety standards;  B. properly dispose of environmentally hazardous materials used in welding; and  C. use appropriate personal protective equipment as needed to follow safety measures.	
	6. The student applies the concepts and skills of welding to simulate actual work situations.	D. troubleshoot equipment.	
9. Beads and Fillet Welds Using the Following Processes - SMAW, GMAW , and GTAW	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	E. identify employers' work expectations;	NCCER Welding Level One - Contren Learning Series
	2. The student explores the employability characteristics of a successful worker in the global economy.	B. identify employers' expectations to foster positive customer satisfaction;  E. communicate effectively with others in the workplace to clarify objectives; and	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;  C. demonstrate technical writing skills related to work orders;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		E. accurately use an appropriate tool to make measurements;	
	4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.	A. use welding equipment according to safety standards;  B. properly dispose of environmentally hazardous materials used in welding; and  C. use appropriate personal protective equipment as needed to follow safety measures.	
	5. The student understands welding joint design, symbols, and welds	A. demonstrate knowledge of a welding blueprint; C. analyze components of the welding symbol; D. analyze types of welding joints; E. analyze positions of welding; and F. identify types of welds such as fillet, groove, spot, plug, and flanged.	
	6. The student applies the concepts and skills of welding to simulate actual work situations.	C. work collaboratively with other students to complete a relevant project; and D. troubleshoot equipment.	
	10. The student performs shielded metal arc welding principles and practices on metals.	A. use safe operating practices;  B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity; C. apply shielded metal arc welding principles; D. demonstrate proper set-up procedure for shielded metal arc welding;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		E. determine appropriate filler for base metal in shielded metal arc welding; F. perform welds such as fillet and groove; G. perform passes such as root, hot, filler, and cover; H. perform plate preparation; and I. perform heating process such as pre-heating and post-heating.	
	11. The student performs gas metal arc welding principles and practices.	A. use safe operating practices; B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity; C. apply gas metal arc welding principles; D. demonstrate proper set-up procedure for gas metal arc welding; E. determine appropriate filler for base metal in gas metal arc welding; and F. perform fillet welds.	
	12. The student performs flux cored arc welding principles and practices on metals.	A. use safe operating practices; B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity; C. apply flux cored arc welding principles; D. demonstrate proper set-up procedure for flux cored arc welding; E. determine appropriate filler for base metal in flux cored arc welding; F. perform fillet welds; and	

Units of Study	Knowledge and Skills	Student Expectations	Resources
	13. The student performs gas tungsten arc welding on metals.	<p>G. perform welds in all appropriate positions.</p> <p>A. use safe operating practices;</p> <p>B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity;</p> <p>C. determine the common types of tungsten and filler materials;</p> <p>D. demonstrate proper set-up procedure for gas tungsten arc welding;</p> <p>E. perform fillet welds;</p> <p>F. perform welds in all appropriate positions; and</p> <p>G. perform welds on carbon steel.</p>	
10. Weld Quality	<p>1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.</p> <p>2. The student explores the employability characteristics of a successful worker in the global economy.</p>	<p>B. use teamwork to solve problems;</p> <p>E. identify employers' work expectations;</p> <p>H. describe how teams measure results; and</p> <p>A. explore academic knowledge and skills required for postsecondary education;</p> <p>B. identify employers' expectations to foster positive customer satisfaction;</p> <p>D. evaluate personal career goals;</p>	<p>NCCER Welding Level One - Contren Learning Series; Modern Welding - Part 9 Chapters 30-31; Welding Principles and Applications Section 7 Chapter 20</p>

Units of Study	Knowledge and Skills	Student Expectations	Resources
		E. communicate effectively with others in the workplace to clarify objectives; and	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	
	4. The student knows the function and application of the tools, equipment, technologies, and materials used in welding.	A. use welding equipment according to safety standards;  C. use appropriate personal protective equipment as needed to follow safety measures.	
	5. The student understands welding joint design, symbols, and welds	D. analyze types of welding joints;  E. analyze positions of welding; and F. identify types of welds such as fillet, groove, spot, plug, and flanged.	
	6. The student applies the concepts and skills of welding to simulate actual work situations.	A. explore careers in welding;  B. work independently to fabricate a welded project with minimal assistance; C. work collaboratively with other students to complete a relevant project; D. troubleshoot equipment.	
	7. The student knows the concepts and intricacies of inspections and related codes.	A. evaluate weld inspection processes; and  B. analyze welding codes.	
	10. The student performs shielded metal arc welding principles and practices on metals.	A. use safe operating practices;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		<p>B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity;</p> <p>C. apply shielded metal arc welding principles;</p> <p>D. demonstrate proper set-up procedure for shielded metal arc welding;</p> <p>E. determine appropriate filler for base metal in shielded metal arc welding;</p> <p>F. perform welds such as fillet and groove;</p> <p>G. perform passes such as root, hot, filler, and cover;</p> <p>H. perform plate preparation; and</p> <p>I. perform heating process such as pre-heating and post-heating.</p>	
	<p>11. The student performs gas metal arc welding principles and practices.</p>	<p>A. use safe operating practices;</p> <p>B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity;</p> <p>C. apply gas metal arc welding principles;</p> <p>D. demonstrate proper set-up procedure for gas metal arc welding;</p> <p>E. determine appropriate filler for base metal in gas metal arc welding; and</p> <p>F. perform fillet welds.</p>	
	<p>12. The student performs flux cored arc welding principles and practices on metals.</p>	<p>A. use safe operating practices;</p>	

Units of Study	Knowledge and Skills	Student Expectations	Resources
		<p>B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity;</p> <p>C. apply flux cored arc welding principles;</p> <p>D. demonstrate proper set-up procedure for flux cored arc welding;</p> <p>E. determine appropriate filler for base metal in flux cored arc welding;</p> <p>F. perform fillet welds; and</p> <p>G. perform welds in all appropriate positions.</p>	
	<p>13. The student performs gas tungsten arc welding on metals.</p>	<p>A. use safe operating practices;</p> <p>B. demonstrate knowledge of the theories of electrical relationships such as alternating current and direct current, heat transfer, and polarity;</p> <p>C. determine the common types of tungsten and filler materials;</p> <p>D. demonstrate proper set-up procedure for gas tungsten arc welding;</p> <p>E. perform fillet welds;</p> <p>F. perform welds in all appropriate positions; and</p> <p>G. perform welds on carbon steel.</p>	
<p>11. Reading Blueprints</p>	<p>1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.</p> <p>2. The student explores the employability characteristics of a successful worker in the global economy.</p>	<p>E. identify employers' work expectations;</p> <p>A. explore academic knowledge and skills required for postsecondary education;</p> <p>B. identify employers' expectations to foster positive customer satisfaction;</p>	<p>NCCER Core Contren Learning Series Modern Welding - Part 1 Chapters 2-3</p>



Units of Study	Knowledge and Skills	Student Expectations	Resources
	3. The student applies academic skills to the requirements of welding.	C. demonstrate technical writing skills related to work orders; D. apply accurate readings of measuring devices, both U.S. customary and metric;  E. accurately use an appropriate tool to make measurements; F. compute measurements such as area, surface area, volume, and perimeter;  G. determine how changes in dimension affect geometric figures; H. calculate problems using whole numbers, fractions, mixed numbers, and decimals; I. use a calculator to perform computations; J. perform conversions between fractions and decimals; K. understand the functions of angles; L. apply right triangle relationships using the Pythagorean Theorem; M. understand the parts of a circle; N. identify the most reasonable mathematical solution using estimation; O. use cross-sections of three-dimensional figures to relate to plane figures; P. describe orthographic views of three-dimensional figures; and Q. describe isometric views of three-dimensional figures.	
	5. The student understands welding joint design, symbols, and welds	A. demonstrate knowledge of a welding blueprint; B. interpret blueprints, drawings, charts, and diagrams;	

<b>Units of Study</b>	<b>Knowledge and Skills</b>	<b>Student Expectations</b>	<b>Resources</b>
12. Communication Skills	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	<p>A. describe how teams function;</p> <p>B. use teamwork to solve problems;</p> <p>C. distinguish team roles such as team leaders and team members;</p> <p>D. identify characteristics of good leaders;</p> <p>E. identify employers' work expectations;</p> <p>F. discuss Equal Employment Opportunity law in the workplace;</p> <p>G. use time-management techniques to develop work schedules;</p> <p>H. describe how teams measure results; and</p> <p>I. develop a method to reward team performance.</p>	NCCER Core Contren Learning Series
	2. The student explores the employability characteristics of a successful worker in the global economy.	<p>B. identify employers' expectations to foster positive customer satisfaction;</p> <p>C. demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;</p> <p>D. evaluate personal career goals;</p> <p>E. communicate effectively with others in the workplace to clarify objectives; and</p>	
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	

Units of Study	Knowledge and Skills	Student Expectations	Resources
	6. The student applies the concepts and skills of welding to simulate actual work situations.	A. explore careers in welding;  C. work collaboratively with other students to complete a relevant project; and	
13. Employability Skills	1. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.	D. identify characteristics of good leaders;  E. identify employers' work expectations;  F. discuss Equal Employment Opportunity law in the workplace;	NCCER Core Contren Learning Series; Modern Welding - Part 9 Chapters 30-34
	2. The student explores the employability characteristics of a successful worker in the global economy.	A. explore academic knowledge and skills required for postsecondary education;  B. identify employers' expectations to foster positive customer satisfaction; C. demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation; D. evaluate personal career goals; E. communicate effectively with others in the workplace to clarify objectives; and  F. demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	

Units of Study	Knowledge and Skills	Student Expectations	Resources
	3. The student applies academic skills to the requirements of welding.	A. demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers; C. demonstrate technical writing skills related to work orders;	
	6. The student applies the concepts and skills of welding to simulate actual work situations.	A. explore careers in welding;  B. work independently to fabricate a welded project with minimal assistance; C. work collaboratively with other students to complete a relevant project; and	
<p>Textbooks: NCCER National Center for Construction Education and Research. Textbooks are not State adopted Texts</p> <p>NCCER - Contren Learning Series - Core Curriculum NCCER - Contren Learning Series - Welding Level 1</p> <p>1566379873 Goodheart/Wilcox. Modern Welding, 10E Revised Edition</p> <p>1401810462 Thomson-Delmar Learning. Welding Principles and Applications, 5E</p> <p>Math for Welders - Nino Marion (not state adopted)</p>		<p>Required Shop Equipment: SMAW Stick. Welding Machine</p> <p>GMAW Mig/Flux Core. Welding Machine</p> <p>GTAW Tig. Welding Machine</p> <p>Electrodes</p> <p>Heating Ovens for Electrodes</p> <p>Bench Grinder Bandsaw or Porta-Band</p> <p>Oxyacetylene Cutting Rig Drill Press</p> <p>Plasma Cutter</p>	

<b>Units of Study</b>	<b>Knowledge and Skills</b>	<b>Student Expectations</b>	<b>Resources</b>
		Vices Safety Equipment - Goggles, Gloves, Welding Hoods Proper Measuring Tools Assorted Gases	