Welding Technology
Mississippi Curriculum Framework

Program CIP: 48.0508 – Welding Technology/Welder

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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

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CONTENTS

RESEARCH ABSTRACT

The curriculum framework in this document reflects changes in the workplace and a number of other factors that impact local vocational–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

The last validated and approved revision of this curriculum took place in 2014. In the fall of 2018, the Office of Curriculum and Instruction (OCI) met with different industry/program visits. An industry questionnaire was used to gather feedback concerning the trends and needs, both current and future, of their field. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends.

ADOPTION OF NATIONAL CERTIFICATION STANDARDS

The **National Center for Construction Education and Research (NCCER)** is a not-for-profit 501(c)(3) education foundation created in 1996. It was developed with the support of more than 125 construction CEOs and various association and academic leaders who united to revolutionize training for the construction industry. Sharing the common goal of developing a safe and productive workforce, these companies created a standardized training and credentialing program for the industry. This progressive program has evolved into curricula for more than 70 craft areas and a complete series of more than 70 assessments offered in over 4,000 NCCER-accredited training and assessment locations across the United States.

NCCER develops standardized construction and maintenance curricula and assessments with portable credentials. These credentials are tracked through NCCER's National Registry which allows organizations and companies to track the qualifications of their craft professionals and/or check the qualifications of possible new hires. The National Registry also assists craft professionals by maintaining their records in a secure database.

NCCER's process of accreditation, instructor certification, standardized curriculum, national registry, assessment, and certification is a key component in the industry's workforce development efforts. NCCER also drives multiple initiatives to enhance career development and recruitment efforts for the industry. NCCER is headquartered in Alachua, Fl., and is affiliated with the University of Florida's M.E. Rinker, Sr. School of Building Construction.

As the accrediting body for the industry, NCCER establishes the benchmark for quality training and assessments. By partnering with industry and academia, NCCER has developed a system for program accreditation that is similar to those found in institutions of higher learning. This process fosters national unity among the construction industry while providing a defined career path with industry-recognized credentials.

NCCER's accreditation process assures that students and craft professionals receive quality training based on uniform standards and criteria. These standards are outlined in the NCCER Accreditation Guidelines and must be adhered to by all NCCER Accredited Training Sponsors and Accredited Assessment Centers.

For more information related to implementing NCCER at your local campus, please visit http://www.nccer.org/welding.

Permission was granted by the National Center for Construction Education and Research to include the competencies and objectives in this curriculum. This content is the copyrighted intellectual property of NCCER and is reprinted with permission from Core Curriculum: Introductory Craft Skills 5th edition, by NCCER 2015, Pearson Education, Inc., New York, NY. More information can be found at:

http://www.nccer.org/about-us

The **American Welding Society (AWS) Foundation** was established by the American Welding Society on September 13, 1989, to support programs that ensure the growth and development of the welding industry through strengthening research and educational opportunities in welding and related industries.

From giving children their first glimmer of excitement in learning about the natural sciences, to providing funding for welding engineering undergraduates and fellowships for welding research, the AWS Foundation supports the welding industry. Led by a volunteer Board of Trustees, the Foundation is organized as a not-for-profit 501(c)(3) charitable organization. Administration, including program development, fundraising, public relations, marketing and financial management, is provided by a small development staff of the American Welding Society. Its operations are conducted from the Society's offices in Miami, Florida.

As the accrediting body for the industry, AWS establishes the benchmark for quality training and assessments. By partnering with industry and academia AWS has developed a system for program accreditation that is similar to

those found in institutions of higher learning. This process fosters national unity among the construction industry while providing a defined career path with industry-recognized credentials.

AWS's accreditation process assures that students and craft professionals receive quality training based on uniform standards and criteria. These standards are outlined in the AWS Accreditation Guidelines and must be adhered to by all AWS Accredited Training Sponsors and Accredited Assessment Centers.

The welding competencies required in this curriculum were developed to coincide with the Guide for the Training and Qualification of Welding Personnel:

- Entry-Level Welders (AWS EG2.0-2017)
- Specification for Qualification & Certification for Entry-Level Welders (AWS QC 10-2017)

Industry standards are based on the American Welding Society Standards EG2.0-2017.

For more information related to implementing AWS at your local campus, please visit www.aws.org.

Permission was granted by the American Welding Society to include the competencies and objectives in this curriculum.

More information can be found at:

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INDUSTRY JOB PROJECTION DATA

Welders, cutters, solderers, brazers, operators, and tenders occupations require an education level of a long term on the job training and moderate term on-the-job training. There is a .15% increase in occupational demand at the regional level and state level. Median annual income for welders, cutters, solderers, brazers, operators, and tenders is $41,985 at the state and regional level. A summary of occupational data from the National Strategic Planning and Analysis Research Center (nSPARC) is displayed below:

Table 1: Education Level

Program Occupations	Education Level
Welders, cutters, solderers, and brazers	Long-Term on-the-job training
Welding, soldering, and brazing machine setters, operators, and tenders	Moderate-term on-the-job training

Table 2: Occupational Overview

	Region	State	United States
2016 Occupational Jobs	7,275	7,275	422,947
2026 Occupational Jobs	7,286	7,286	428,715
Total Change	11	11	5,768
Total % Change	0.15%	0.15%	1.36%
2016 Median Hourly Earnings	$20.19	$20.19	$18.55
2016 Median Annual Earnings	$41,985	$41,985	$38,591
Annual Openings	1	1	50,200

Table 3: Occupational Breakdown

Description	2016 Jobs	2026 Jobs	Annual Openings	2016 Hourly Earnings	2016 Annual Earnings 2,080 Work Hours
Welders, cutters, solderers, and brazers	6,577	6,589	1	$20.77	$43,202
Welding, soldering, and brazing machine setters, operators, and tenders	698	697	0	$17.26	$35,901
Total	7,275	7,286	1	$20.19	$41,995

Table 4: Occupational Change

Description	Regional Change	Regional % Change	State % Change	National % Change
Welders, cutters, solderers, and brazers	12	0.18%	0.18%	1.68%
Welding, soldering, and brazing machine setters, operators, and tenders	-1	-0.14%	-0.14%	-1.25%

ARTICULATION

Articulation credit from Secondary Career Pathway programs to Postsecondary Maritime Pipefitting is available. Secondary students who have completed the articulated the Secondary Career Pathway Courses listed below may be awarded articulated college credit according to Mississippi Community College Board (MCCB) guidelines (http://www.mccb.edu/pdfs/ct/StatewideArtManual201213.pdf).

Articulated Secondary Course	Articulated Postsecondary Course	PS Courses
CIP 48.0508 Welding Technology	Welding & Cutting Technology (CIP 48.0508)	WLT 1173 Introduction to Welding and Safety
	Industrial Maintenance Trades (CIP 47.0303)	IMM 1734 Maintenance Welding and Metals
	Commercial/Residential Maintenance (CIP 46.0401) Bldg Prop Maint & Mgt	CRM 1713 Welding

TECHNICAL SKILLS ASSESSMENT

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment:

NCCER Core Assessment
NCCER Welding Level 1 and 2 Credential

OR

NCCER NCCT Welding Level 1

OR

AWS Sense Level 1 (program certification fee - one-time fee; student fee)

ONLINE AND BLENDED LEARNING OPPORTUNITIES

Course content includes lecture and laboratory semester credit hours. Faculty members are encouraged to present lecture related content to students in an online or blended learning environment. Training related to online and blended learning will be available to faculty members through the MS Community College Board.

CREDIT BY EXAMINATION

The following NCCER modules are aligned to courses listed below. Each module will serve as the state recommended exam to reward credit for prior learning experiences. Colleges have the local autonomy to create a college-level exam when awarding credit.

Course Number and Name	**NCCER Credential and Module**
WLT 1173 Introduction to Welding Safety	NCCER Core Curriculum Module 00101-15—Basic Safety Module 00102-15—Introduction to Construction Math Module 00103-15—Introduction to Hand Tools Module 00104-15—Introduction to Power Tools Module 00105-15—Introduction to Construction Drawing Module 00106-15—Basic Rigging Module 00107-15—Basic Communication Skills Module 00108-15—Basic Employability Skills Module 00109-15—Introduction to Materials Handling NCCER Welding Level 1 Module 29101-15—Welding Safety OR AWS Sense Level 1 Module 1: Occupational Orientation Module 2: Safety and Health of Welders
WLT 1115 Shielded Metal Arc Welding I	NCCER Welding Level 1 Module 29105-15—Base Metal Preparation Module 29107-15—SMAW-Equipment and Setup Module 29108-15—Shielded Metal Arc Welding-Electrodes Module 29109-15—SMAW-Beads and Fillet Welds Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 4: Shielded Metal Arc Welding (SMAW) Module 9: Welding Inspection And Testing Key Indicators
WLT 1225 Shielded Metal Arc Welding II	NCCER Welding Level 1 Module 29110-15—Joint Fit-Up and Alignment Module 29111-15—SMAW- Groove Welds with Backing Module 29112-15—Open V-Groove Welds Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 4: Shielded Metal Arc Welding (SMAW) *(Continued from WLT 1115)* MODULE 9: WELDING INSPECTION AND TESTING KEY INDICATORS

WLT 1313 Cutting Processes	NCCER Welding Level 1 Module 29102-15—Oxyfuel Cutting Module 29103-15—Plasma Arc Cutting Module 29104-15—Air Carbon Arc Cutting and Gouging Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 8: Thermal Cutting Processes Module 9: Welding Inspection and Testing Key Indicators
WLT 1124 Gas Metal Arc Welding (GMAW)	NCCER Welding Level 2 *(Only GMAW components)* Module 29205-15—GMAW and FCAW: Equipment and Filler Metals Module 29206-15—GMAW and FCAW: Plate NCCER Welding Level 1 Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 5: Gas Metal Arc Welding (GMAW-S, GMAW Spray Transfer) Module 9: Welding Inspection And Testing Key Indicators
WLT 1143 Flux Cored Arc Welding (FCAW)	NCCER Welding Level 2 Module 29205-15—GMAW and FCAW: Equipment and Filler Metals Module 29206-15—GMAW and FCAW: Plate NCCER Welding Level 1 Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 6: Flux Cored Arc Welding (FCAW-G/GM, FCAW-S) Module 9: Welding Inspection And Testing Key Indicators
WLT 1135 Gas Tungsten Arc Welding (GTAW)	NCCER Welding Level 2 Module 29207-15—GTAW: Equipment and Filler Metals Module 29208-15—GTAW: Plate NCCER Welding Level 1 Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 7: Gas Tungsten Arc Welding (GTAW) Module 9: Welding Inspection and Testing Key Indicators
WLT 1232 Blueprint Reading, Welding Symbols, and Metallurgy	NCCER Welding Level 2 Module 29201-15—Welding Symbols Module 29202-15—Reading Welding Detail Drawings Module 29203-15—Physical Characteristics and Mechanical Properties of Metal Module 29204-15—Pre-heating and Post-Heating of Metals NCCER Welding Level 1 Module 29106-15—Weld Quality OR AWS Sense Level 1 Module 3: Drawing and Welding Symbol Interpretation Module 9: Welding Inspection and Testing Key Indicators

PROGRAM DESCRIPTION

The Welding and Cutting Technology program prepares students for entry level employment in the field of welding and cutting. The curriculum includes Blueprint Reading, Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), Plasma Arc Cutting (PAC), Carbon Arc Cutting, Oxyfuel Cutting, and Gas Tungsten Arc Welding (GTAW). Electives are available in advanced levels of welding and cutting.

The welding competencies required in this curriculum were developed to coincide with the Guide for the Training and Qualification of Welding Personnel: Entry-Level Welders (AWS EG2.0-2017) and Specification for Qualification and Certification for Entry-Level Welders (AWS QC 10-2017).

One major goal of this program is to prepare graduates to complete NCCER Core Curriculum, NCCER Level 1 and 2, or AWS Sense Level 1.

SUGGESTED COURSE SEQUENCE

Accelerated Career Pathway

			SCH Breakdown			Clock Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Clock Hours	Lecture	Lab	Certification Name
WLT 1173	Introduction to Welding and Safety	3	2	2	60	30	30	NCCER Core, NCCER Level 1, AWS Modules 1 and 2
WLT 1313	Cutting Processes	3	1	4	75	15	60	NCCER Level 1 AWS Level 1
	Approved Technical Electives	9						
	TOTAL	**15**	**3**	**6**	**135225**	**45**	**90**	

Career Certificate Required Courses

			SCH Breakdown			Clock Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Clock Hours	Lecture	Lab	Certification Name
WLT 1173	Introduction to Welding and Safety	3	2	2	60	30	30	NCCER Core, NCCER Level 1, AWS Modules 1 and 2
WLT 1115	Shield Metal Arc Welding I	5	1	8	135	15	120	NCCER Level 1 AWS Level 1
WLT 1225	Shield Metal Arc Welding II	5	1	8	135	15	120	NCCER Level 1 AWS Level 1
WLT 1313	Cutting Processes	3	1	4	75	15	60	NCCER Level 1 AWS Level 1
WLT 1124	Gas Metal Arc Welding	4	1	6	105	15	90	NCCER Level 1 and 2 AWS Level 1
WLT 1135	Gas Tungsten Arc Welding	5	1	8	135	15	120	NCCER Level 1 and 2 AWS Level 1
WLT 1143	Flux Cored Arc Welding	3	1	4	75	15	60	NCCER Level 1 and 2 AWS Level 1
WLT 1232	Blueprint Reading, Welding and Metallurgy	2	1	2	45	15	30	NCCER Level 1 and 2 AWS Level 1
	TOTAL	**30**	**9**	**42**	**765**	**135**	**630**	

Technical Certificate Required Courses

			SCH Breakdown			Clock Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Clock Hours	Lecture	Lab	Certification Name
WLT 1155	Pipe Welding	5	1	8	135	15	120	NCCER Level 1 AWS Level 1
WLT 2912 or WLT 2812 or WLT 1252	Welding Code or Welding Metallurgy or Advanced Pipe Welding	2	2		30	30		NCCER Level 1 and 2 AWS Level 1
	Approved Technical Elective	8						
	TOTAL	**15**	**3**	**8**	**165**	**45**	**120**	

General Education Core Courses

To receive the Associate of Applied Science degree, a student must complete all of the required coursework found in the Career Certificate option, Technical certificate option, and a minimum of 15 semester hours of General Education core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science degree at their college. The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) Section 9 Standard 3 of the *Principles of Accreditation: Foundations for Quality Enhancement*[1] describes the general education core.

Section 9 Standard 3:

3. The institution requires the successful completion of a general education component at the undergraduate level that

   a) is based on a coherent rationale.

   b) is a substantial component of each undergraduate degree program. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours of the equivalent; for baccalaureate programs, a minimum of 30 semester hours or the equivalent.

   c) ensures breadth of knowledge. These credit hours include at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. These courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

General Education Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
	Humanities/Fine Arts	3						
	Social/Behavioral Sciences	3						
	Math/Science	3						
	Academic electives	6						
	TOTAL	**15**						

[1] Southern Association of Colleges and Schools Commission on Colleges. (2017). *The Principles of Accreditation: Foundations for Quality Enhancement.* Retrieved from http://www.sacscoc.org/2017ProposedPrinc/Proposed%20Principles%20Adopted%20by%20BOT.pdf

Technical Electives

			SCH Breakdown				Clock Hour Breakdown			Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Clinical/ Internship	Total Clock Hours	Lecture	Lab	Clinical/ Internship	Certification Name
WLT 1162	Gas Metal Arc Aluminum Welding	2	1	2		45	15	30		NCCER Level 1 AWS Level 1
WLT 192(1-6)	Supervised Work Experience in Welding and Cutting Tech	1-6			3-18	45-270			45-270	
WLT 2812	Welding Metallurgy	2	2	0		30	30			NCCER Level 1 AWS Level 1
DDT 1114	Fundamentals of Drafting	4	2	4		90	30	120		
WLT 1426	Basic Fabrication of Pipefitting	6	2	8		150	30	240		
PPV 1436	Basic Pipe Fabrication	6								
PPV 1823	Steel Ship Building and Marine Construction	3	2	2		60	30	60		
WLT 2514	Fundamentals of Robotic Welding	4	2	4		90	30	120		
WLT 2524	Advanced Robotic Welding	4	2	4		90	30	120		
WLT 191(1-6)	Special Problem in Welding and Cutting Technology	1-6		2-12		30-180		60-360		
WLT 1931	Welding Seminar I	1		2		30		60		
WLT 1941	Welding Seminar II	1		2		30		60		
WBL 191(1-3) WBL 192(1-3) WBL 193(1-3) WBL 291(1-3) WBL 292(1-3) WBL 293(1-3)	Work-Based Learning	1-6			3-18	45-270			45-270	
WLT 2924	Heavy Equipment Welding and Fabrication	4	2	4		90	30	60		
WLT 2936	Structural Fabrication	6	2	8		150	30	120		
IMM 1934	Manufacturing Skills Basic	4	2	4		90	30	60		NC3 (1Mechanical Systems and Precision

										Measurement Instrument Certification)
	Other Instructor Approved Elective(s)									

COURSE DESCRIPTIONS

Course Number and Name: **WLT 1115** **Shielded Metal Arc Welding I**

Description: This course is designed to teach students introductory welding techniques using the SMAW process.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
5	1	8	165

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 1

Module 29105-15—Base Metal Preparation

1. Identify safety practices related to preparing base metals and describe basic cleaning procedures
    a. Identify safety practices related to preparing base metals
    b. Describe the basic properties and types of carbon and stainless steel
    c. Describe basic metal cleaning procedures and concerns

2. Identify and describe basic weld joint design and types of welds
    a. Identify and describe the loads that are routinely placed on weld joints
    b. Identify and describe the various types of weld joints
    c. Describe a welding procedure specification (WPS) and the information it provides

3. Describe how to prepare joints for welding
    a. Describe how to mechanically prepare joints for welding
    b. Describe how to thermally prepare joints for welding

Module 29107-15—SMAW-Equipment and Setup

1. Identify SMAW-related safety practices and explain how electrical characteristics apply to explain how electrical characteristics apply to SMAW
    a. Define SMAW and identify related safety practices
    b. Explain how various current characteristics apply to SMAW

2. Identify and describe SMAW equipment
    a. Identify and describe various types of SMAW machines
    b. Identify and describe SMAW welding cable and connectors
    c. Identify common tools used to clean a weld

3. Explain how to set up and start SMAW equipment
    a. Explain how to set up SMAW equipment
    b. Explain how to start, stop, and maintain SMAW equipment

Module 29108-15—SMAW-Electrodes

1. Describe the SMAW electrode classification system and how to select the proper electrode for the task
    a. Describe the AWS filler metal specification system and various electrode characteristics
    b. Describe the characteristics of the four main electrode groups

2. Explain how to select electrodes and describe their proper care and handling
    a. Identify various considerations in the selection of the proper electrode
    b. Describe the proper handling and storage of electrodes

Module 29109-15—SMAW-Beads and Fillet Welds

1. Explain how to prepare for SMAW welding and how to strike an arc
    a. Identify safety practices related to SMAW
    b. Explain how to prepare the area and equipment for welding
    c. Explain how to strike an arc and respond to arc blow

2. Explain how to successfully complete various types of beads and welds
    a. Explain how to properly restart and terminate a weld pass
    b. Describe the technique required to produce stringer beads
    c. Describe the technique required to produce weave and overlapping beads
    d. Describe the techniques required to produce fillet welds in various positions

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 4: Shielded Metal Arc Welding (SMAW)

1. Performs safety inspections of SMAW equipment and accessories
2. Makes minor external repairs to SMAW equipment and accessories
3. Sets up for SMAW operations on carbon steel
4. Operates SMAW equipment on carbon steel
5. Makes fillet weld in all positions on carbon steel
6. Makes groove welds, n all positions, on carbon steel
7. Passes SMAW welder performance qualifications test (2G and 3G, uphill, limited thickness test plates) on carbon steel

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts

2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1124 Gas Metal Arc Welding (GMAW)**

Description: This course is designed to give the student experience in various welding applications with the GMAW process using various modes of transfer.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	1	6	105

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 2 **(***Students will only focus on GMAW process of the following NCCER Standards.)*

Module 29205-15—GMAW and FCAW: Equipment and Filler Metals

1. Describe basic GMAW/FCAW processes and related safety practices
    a. Describe basic GMAW/FCAW processes
    b. Identify GMAW/FCAW-related safety practices
    c. Describe the various GMAW metal transfer modes
    d. Describe the FCAW metal transfer process

2. Describe GMAW and FCAW equipment and explain how to prepare for welding
    a. Identify common GMAW/FCAW welding equipment
    b. Describe power source control considerations
    c. Identify and describe welding cables and terminations
    d. Identify and describe external wire feeders and their controls
    e. Identify and describe GMAW and FCAW guns, contact tips, and nozzles
    f. Identify various shielding gases and their related equipment
    g. Explain how to set up welding equipment for GMAW and FCAW welding

3. Identify various GMAW and FCAW filler metals
    a. Identify various GMAW filler metals
    b. Identify various FCAW filler metals

Module 29209-15—GMAW

1. Identify GMAW-related safety practices and explain how to set up for welding
    a. Describe basic GMAW processes
    b. Identify GMAW-related safety practices
    c. Explain how to safely set up the equipment and work area for welding

2. Describe equipment control and welding procedures for GMAW and explain how to produce basic weld beads
    a. Describe equipment control and welding techniques related to GMAW
    b. Explain how to produce basic GMAW weld beads

3. Describe the welding procedures needed to produce proper fillet and V-groove welds using GMAW welding techniques
    a. Describe the welding procedures needed to produce proper fillet welds using GMAW welding techniques
    b. Describe the welding procedures needed to produce proper V-groove welds using GMAW welding techniques

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 5: Gas Metal Arc Welding (GMAW-S, GMAW Spray Transfer)

1. Performs safety inspections of GMAW equipment and accessories
2. Makes minor external repairs to GMAW equipment and accessories
3. Short Circuiting Transfer
4. Sets up for GMAW-S operations on carbon steel
5. Operates GMAW-S equipment on carbon steel
6. Makes fillet welds in all positions on carbon steel
7. Makes groove welds in all positions on carbon steel
8. Passes GMAW-S welder performance qualification test on carbon steel
9. Spray Transfer
10. Sets up for GMAW (spray) operations on carbon steel
11. Operates GMAW (spray) equipment on carbon steel
12. Makes fillet welds in the1F and 2F positions on carbon steel
13. Makes groove welds in the1G position on carbon steel
14. Passes GMAW (spray) welder performance qualification test on carbon steel

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:

NCCER Welding Level 1 and 2
AWS Sense Level 1

Course Number and Name: **WLT 1135 Gas Tungsten Arc Welding (GTAW)**

Description: This course is designed to give the student experience in various welding applications using the GTAW process.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
5	1	8	135

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 2

Module 29207-15—GTAW: Equipment and Filler Metals

1. Identify GTAW-related safety practices and describe the electrical characteristics that affect GTAW
    a. Identify GTAW-related safety practices
    b. Describe the electrical characteristics that affect GTAW

2. Identify and describe GTAW equipment and consumables
    a. Identify and describe GTAW welding machines
    b. Identify and describe GTAW torches
    c. Identify and describe GTAW torch nozzles and electrodes
    d. Identify and describe GTAW shielding gases
    e. Identify and describe GTAW filler metals

3. Explain how to set up for GTAW welding
    a. Explain how to select and position the welding machine
    b. Explain how to connect and set up the shielding gas flow rate
    c. Explain how to select and prepare the tungsten electrode
    d. Explain how to select and install the nozzle along with the tungsten electrode

Module 29208-15—GTAW: Plate

1. Identify GTAW-related safety practices and explain how to set up for welding
    a. Identify GTAW-related safety practices
    b. Explain how to safely set up the equipment and work area for welding

2. Describe welding techniques for GTAW and explain how to produce basic weld beads
    a. Describe welding techniques related to GTAW
    b. Explain how to produce basic GTAW weld beads

3. Describe the welding techniques needed to produce proper fillet and open V-groove welds using GTAW welding techniques
    a. Describe the welding techniques needed to produce proper fillet welds using GTAW
    b. Describe the welding techniques needed to produce proper open V-groove welds using GTAW

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions

b. Identify and describe discontinuities that result in cracking
c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 7: Gas Tungsten Arc Welding (GTAW)

1. Performs safety inspections of GTAW equipment and accessories
2. Makes minor external repairs to GTAW equipment and accessories

Carbon Steel

3. Sets up for GTAW operations on carbon steel
4. Operates GTAW equipment on carbon steel
5. Makes fillet welds in all positions on carbon steel
6. Makes groove welds in all positions on carbon steel
7. Passes GTAW welder performance qualification test on carbon steel

Austenitic Stainless Steel

8. Sets up for GTAW operations on austenitic stainless steel
9. Operates GTAW equipment on austenitic stainless steel
10. Makes fillet welds in the IF, 2F, and 3F positions, on austenitic stainless steel
11. Makes groove welds in the1G and 2G positions, on austenitic stainless steel.
12. Passes GTAW welder performance qualification test on austenitic stainless steel

Aluminum

13. Sets up for GTAW operations on aluminum
14. Operates GTAW equipment on aluminum
15. Makes fillet welds in the IF and 2F positions, on aluminum
16. Makes groove welds in the lG position, on aluminum
17. Passes GTAW welder performance qualification test on aluminum

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:

Modules of NCCER Welding Level 1 and 2
AWS Sense Level 1

Course Number and Name: **WLT 1143 Flux Cored Arc Welding (FCAW)**

Description: This course is designed to give the student experience using FCAW process.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
3	1	4	75

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 2 (*Students will only focus on FCAW process of the following NCCER Standards***.)**

Module 29205-15—GMAW and FCAW: Equipment and Filler Metals

1. Describe basic GMAW/FCAW processes and related safety practices
    a. Describe basic GMAW/FCAW processes
    b. Identify GMAW/FCAW-related safety practices
    c. Describe the various GMAW metal transfer modes
    d. Describe the FCAW metal transfer process

2. Describe GMAW and FCAW equipment and explain how to prepare for welding
    a. Identify common GMAW/FCAW welding equipment
    b. Describe power source control considerations
    c. Identify and describe welding cables and terminations
    d. Identify and describe external wire feeders and their controls
    e. Identify and describe GMAW and FCAW guns, contact tips, and nozzles
    f. Identify various shielding gases and their related equipment
    g. Explain how to set up welding equipment for GMAW and FCAW welding

3. Identify various GMAW and FCAW filler metals
    a. Identify various GMAW filler metals
    b. Identify various FCAW filler metals

Module 29210-15—FCAW: Plate

1. Identify **FCAW** -related safety practices and explain how to set up for welding
    a. Describe basic **FCAW** processes
    b. Identify **FCAW** -related safety practices
    c. Explain how to safely set up the equipment and work area for welding

2. Describe equipment control and welding procedures for **FCAW** and explain how to produce basic weld beads
    a. Describe equipment control and welding techniques related to **FCAW**
    b. Explain how to produce basic **FCAW** weld beads

3. Describe the welding procedures needed to produce proper fillet and V-groove welds using **FCAW** welding techniques
    a. Describe the welding procedures needed to produce proper fillet welds using **FCAW** welding techniques
    b. Describe the welding procedures needed to produce proper V-groove welds using **FCAW** welding techniques

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements

a. Identify the various welding code organizations and their sponsoring organizations
b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 6: Flux Cored Arc Welding (FCAW-G/Gm, FCAW-S)

1. Performs safety inspections of FCAW equipment and accessories
2. Makes minor external repairs to FCAW equipment and accessories

Gas Shielded

3. Sets up for FCAW-G/GM operations on carbon steel
4. Operates FCAW-G/GM equipment on carbon steel
5. Makes fillet welds in all positions on carbon steel
6. Makes groove welds in all positions on carbon steel
7. Passes FCAW-G/GM welder performance qualification test on carbon steel

Self-Shielded

8. Sets up for FCAW-S operations on carbon steel
9. Operates FCAW-S equipment on carbon steel
10. Makes fillet welds in all positions on carbon steel
11. Makes groove welds in all positions on carbon steel
12. Passes FCAW-S welder performance qualification test on carbon steel

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:

Modules of NCCER Welding Level 1 and 2
AWS Sense Level 1

Course Number and Name: **WLT 1155 Pipe Welding**

Description: This course is designed to give the student experience in pipe welding procedures.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
5	1	8	135

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Demonstrate safety precautions, and identify pipe weld test positions
2. Describe differences in pipe and tubing and describe faults in pipe welding
3. Use correct methods for preparation and fitting of pipe, and demonstrate correct pipe welding procedures
4. Perform open V-grooved pipe welds and bend tests
    a. Fabricate and weld a 2G and 5G open root V-grooved pipe weld using multiple positions using E-6010, E-7018, or other instructor approved electrodes
    b. Pass a 6G guided bend test on an open root

AND

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1162 Gas Metal Arc Aluminum Welding**

Description: This course is designed to give the student experience in Gas Metal Aluminum Welding.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
2	1	2	45

Pre-requisite: Instructor Approved

Student Learning Outcomes:

1. Identify aluminum alloys, aluminum weld ability, and results of welding aluminum
    a. List advantages of aluminum alloys
    b. Identify factors that make aluminum difficult to weld

2. Perform multi-pass welds
    a. Fabricate and weld multi-pass fillet welds
    b. Fabricate and weld 2G and 3G V-grooved butt joint

AND

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1173 Introduction to Welding and Safety**

Description: This course is designed to give student an introduction to the welding profession and experience in safety procedures related to welding.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
3	2	2	60

Prerequisite: None

Student Learning Outcomes:

NCCER Core

Module 00101-15--Basic Safety

1. Describe the importance of safety, the causes of workplace incidents, and the process of hazard recognition and control
    a. Define incidents and the significant costs associated with them
    b. Identify the common causes of incidents and their related consequences
    c. Describe the processes related to hazard recognition and control, including the Hazard Communication (HAZCOM) Standard and the provisions of a Safety Data Sheet (SDS)

2. Describe the safe work requirements for elevated work, including fall protection guidelines
    a. Identify and describe various fall hazards
    b. Identify and describe equipment and methods used in fall prevention and fall arrest
    c. Identify and describe the safe use of ladders and stairs
    d. Identify and describe the safe use of scaffolds

3. Identify and explain how to avoid struck-by and caught-in-between hazards
    a. Identify and explain how to avoid struck-by and caught-in-between hazards
    b. Identify and explain how to avoid caught-in and caught-between hazards

4. Identify common energy-related hazards and explain how to avoid them
    a. Describe basic job-site electrical safety guidelines
    b. Explain the importance of lockout/tagout and describe basic procedures

5. Identify and describe the proper use of personal protective equipment (PPE)
    a. Identify and describe the basic use of PPE used to protect workers from bodily injury
    b. Identify potential respiratory hazards and the basic respirators used to protect workers against those hazards

6. Identify and describe other specific job-site safety hazards
    a. Identify various exposure hazards commonly found on job sites
    b. Identify hazards associated with environmental extremes
    c. Identify hazards associated with hot work
    d. Identify fire hazards and describe basic firefighting procedures
    e. Identify confined spaces and describe the related safety considerations

Module 00102-15---Introduction to Construction Math

1. Identify whole numbers and demonstrate how to work with them mathematically
    a. Identify different whole numbers and their place values
    b. Demonstrate the ability to add and subtract whole numbers

c. Demonstrate the ability to multiply and divide whole numbers

2. Explain how to work with fractions
    a. Define equivalent fractions and show how to find lowest common denominators
    b. Describe improper fractions and demonstrate how to change an improper fraction to a mixed number
    c. Demonstrate the ability to add and subtract fractions
    d. Demonstrate the ability to multiply and divide fractions

3. Describe the decimal system and explain how to work with decimals
    a. Describe decimals and their place values
    b. Demonstrate the ability to add, subtract, multiply, and divide decimals
    c. Demonstrate the ability to convert between decimals, fractions, and percentages

4. Identify various tools used to measure length and show how they are used
    a. Identify and demonstrate how to use rulers
    b. Identify and demonstrate how to use measuring tapes

5. Identify and convert units of length, weight, volume, and temperature between the imperial and metric systems of measurement
    a. Identify and convert units of length measurement between the imperial and metric systems
    b. Identify and convert units of weight measurement between the imperial and metric systems
    c. Identify and convert units of volume measurement between the imperial and metric systems
    d. Identify and convert units of temperature measurement between the imperial and metric systems

6. Identify basic angles and geometric shapes and explain how to calculate their area and volume
    a. Identify various types of angles
    b. Identify basic geometric shapes and their characteristics
    c. Demonstrate the ability to calculate the area of two-dimensional shapes
    d. Demonstrate the ability to calculate the volume of three-dimensional shapes

Module 00103-15---Introduction to Hand Tools

1. Identify and explain how to use various types of hand tools
    a. Identify and explain how to use various types of hammers and demolition tools
    b. Identify and explain how to use various types of chisels and punches
    c. Identify and explain how to use various types of screwdrivers
    d. Identify and explain how to use various types of non-adjustable and adjustable wrenches
    e. Identify and explain how to use various types of socket and torque wrenches
    f. Identify and explain how to use various types of pliers and wire cutters

2. Identify and describe how to use various types of measurement and layout tools
    a. Identify and explain how to use rules and other measuring tools
    b. Identify and explain how to use various types of levels and layout tools

3. Identify and explain how to use various types of cutting and shaping tools
    a. Identify and explain how to use handsaws
    b. Identify and explain how to use various types of files and utility knives

4. Identify and explain how to use other common hand tools
    a. Identify and explain how to use shovels and picks
    b. Identify and explain how to use chain falls and come-alongs
    c. Identify and explain how to use various types of clamps

Module 00104-15---Introduction to Power Tools

1. Identify and explain how to use various types of power drills and impact wrenches
    a. Identify and explain how to use common power drills and bits
    b. Identify and explain how to use a hammer drill
    c. Identify and explain how to use pneumatic drills and impact wrenches

2. Identify and explain how to use various types of power saws
    a. Identify and explain how to use a circular saw
    b. Identify and explain how to use saber and reciprocating saws
    c. Identify and explain how to use a portable band saw
    d. Identify and explain how to use miter and cutoff saws

3. Identify and explain how to use various grinders and grinder attachments
    a. Identify and explain how to use various types of grinders
    b. Identify and explain how to use various grinder accessories and attachments

4. Identify and explain how to use miscellaneous power tools
    a. Identify and explain how to use pneumatic and powder-actuated fastening tools
    b. Identify and explain how to use pavement breakers
    c. Identify and explain the uses of hydraulic jacks

Module 00105-15---Introduction to Construction Drawings

1. Identify and describe various types of construction drawings, including their fundamental components and features
    a. Identify various types of construction drawings
    b. Identify and describe the purpose of the five basic construction drawing components
    c. Identify and explain the significance of various drawing elements, such as lines of construction, symbols, and grid lines
    d. Identify and explain the use of dimensions and various drawing scales
    e. Identify and describe how to use engineer's and architect's scales

Module 00106-15---Introduction to Basic Rigging

1. Identify and describe various types of rigging slings, hardware, and equipment
    a. Identify and describe various types of slings
    b. Describe how to inspect various types of slings
    c. Identify and describe how to inspect common rigging hardware
    d. Identify and describe various types of hoists
    e. Identify and describe basic rigging hitches and the related Emergency Stop hand signal

Module 00107-15---Basic Communication Skills

1. Describe the communication, listening, and speaking processes and their relationship to job performance
    a. Describe the communication process and the importance of listening and speaking skills
    b. Describe the listening process and identify good listening skills
    c. Describe the speaking process and identify good speaking skills

2. Describe good reading and writing skills and their relationship to job performance
    a. Describe the importance of good reading and writing skills
    b. Describe job-related reading requirements and identify good reading skills
    c. Describe job-related writing requirements and identify good writing skills

Module 00108-15---Basic Employability Skills

1. Describe the opportunities in the construction business and how to enter the construction workforce
    a. Describe the construction business and the opportunities offered by the trades
    b. Explain how workers can enter the construction workforce

2. Explain the importance of critical thinking and how to solve problems
    a. Describe critical thinking and barriers to solving problems
    b. Describe how to solve problems using critical thinking
    c. Describe problems related to planning and scheduling

3. Explain the importance of social skills and identify ways good social skills are applied in the construction trade
    a. Identify good personal and social skills
    b. Explain how to resolve conflicts with co-workers and supervisors
    c. Explain how to give and receive constructive criticism
    d. Identify and describe various social issues of concern in the workplace
    e. Describe how to work in a team environment and how to be an effective leader

Module 00109-15--Introduction to Material Handling

1. Describe the basic concepts of material handling and common safety precautions
    a. Describe the basic concepts of material handling and manual lifting
    b. Identify common material-handling safety precautions
    c. Identify and describe how to tie knots commonly used in material handling

2. Identify various types of material handling equipment and describe how they are used
    a. Identify non-motorized material-handling equipment and describe how they are used
    b. Identify motorized material-handling equipment and describe how they are used

NCCER Welding Level 1

Module 29101-15-Welding Safety

1. Describe basic welding processes, the welding trade, and training/apprenticeship programs
    a. Describe basic welding processes and the welding trade
    b. Describe NCCER standardized training and explain apprenticeship programs

2. Identify, and describe personal protective equipment (PPE) related to the welding trade
    a. Identify and describe body, foot, and hand protective gear

b. Identify and describe ear, eye, face, and head protective gear

3. Identify and describe welding safety practices related to specific hazards or environments
    a. Describe the importance of welding safety and identify factors related to accidents
    b. Describe basic welding safety practices related to the general work area
    c. Describe hot work permits and fire watch requirements
    d. Describe confined spaces and their related safety practices
    e. Identify safety practices related to welding equipment
    f. Identify and describe respiratory hazards, respiratory safety equipment, and ways to ventilate welding work areas
    g. Explain the purpose of the SDS/MSDS and how it is used

OR

AWS Sense Welding Level 1

Module 1: Occupational Orientation

1. Prepares time or job cards, reports or records
2. Performs housekeeping duties
3. Follows verbal instructions and complete work assignments
4. Follows written instructions to complete work assignments

Module 2: Safety and Health of Welders

1. Demonstrates proper use and inspection of personal protection equipment (PPE)
2. Demonstrates proper safe operation practices in work areas
3. Demonstrates proper use and inspection of ventilation equipment
4. Demonstrates proper HotZone operation
5. Demonstrate proper work actions for working in confined spaces
6. Demonstrate proper use of precautionary labeling and MSDS information
7. Demonstrate proper inspection and operation of equipment use for each welding and thermal cutting process. (Tills are best done as part of the process module/unit for each of the required welding and thermal cutting processes)

National Assessment:

NCCER Core Curriculum, selected modules from NCCER Level 1
AWS Modules 1 & 2

Course Number and Name: **WLT 1225 Shielded Metal Arc Welding II**

Description: This course is designed to teach students advanced welding techniques using the SMAW process.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
5	1	8	135

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 1

Module 29110-15—Joint Fit-Up and Alignment

1. Identify and describe various types of fit-up and alignment tools
    a. Identify and describe various fit-up gauges and measuring devices
    b. Identify and describe common weldment positioning equipment
    c. Identify and describe various plate alignment tools
    d. Identify and describe various pipe and flange alignment tools

2. Describe techniques to avoid weldment distortion and describe the role of codes and specifications
    a. Describe the causes of weldment distortion
    b. Describe the techniques and tools used to control weldment distortion
    c. Describe the role of codes and specifications in welding procedures and techniques

Module 29111-15—SMAW- Groove Welds with Backing

1. Identify various types of groove welds and describe how to prepare for groove welding
    a. Identify various types of groove welds and define related terms
    b. Describe how to prepare for groove welding

2. Describe the technique required to produce various groove welds
    a. Describe the technique required to produce groove welds in the 1G and 2G positions
    b. Describe the technique required to produce groove welds in the 3G and 4G positions

Module 29112-15—SMAW-Open-Root Groove Welds- Plate

1. Identify various types of groove welds and describe how to prepare for groove welding
    a. Identify various types of groove welds and define related terms
    b. Describe how to prepare the work area and plate for groove welding

2. Describe the technique required to produce various open V-groove welds
    a. Describe the technique required to produce open V-groove welds in the 1G and 2G positions
    b. Describe the technique required to produce open V-groove welds in the 3G and 4G positions

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking

c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 4: Shielded Metal Arc Welding (SMAW) *(Continued from WLT 1115)*

1. Performs safety inspections of SMAW equipment and accessories
2. Makes minor external repairs to SMAW equipment and accessories
3. Sets up for SMAW operations on carbon steel
4. Operates SMAW equipment on carbon steel
5. Makes fillet weld in all positions on carbon steel
6. Makes groove welds, n all positions, on carbon steel
7. Passes SMAW welder performance qualifications test (2G and 3G, uphill, limited thickness test plates) on carbon steel

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1232 Blueprint Reading, Welding Symbols, and Metallurgy**

Description: This course is designed to give the student experience in blueprint reading, welding symbols, and metallurgy.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
2	1	2	45

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 2

Module 29201-15—Welding Symbols

1. Identify and interpret welding symbols and their structure
    a. Describe the structure and placement of welding symbols and identify basic symbols
    b. Identify and interpret size and dimension markings for common types of welds
    c. Identify and interpret various supplemental symbols
    d. Identify and interpret less common welding symbols

Module 29202-15—Reading Welding Detail Drawings

1. Describe welding detail drawings and identify basic drawing elements and features
    a. Describe the object views used to depict welding details
    b. Identify basic drawing elements related to welding detail drawings

2. Identify and explain how to interpret dimensional information, notes, and a bill of materials
    a. Identify and explain how to interpret dimensional information
    b. Identify and explain how to interpret notes and a bill of materials

Module 29203-15—Physical Characteristics and Mechanical Properties of Metals

1. Describe the composition and classification systems for a variety of metals
    a. Describe the composition and classification system for ferrous metals
    b. Describe the composition and classification system for low-alloy steel
    c. Describe the composition and classification system for common-grade stainless steel
    d. Describe the composition and classification system for specialty-grade stainless steel
    e. Describe the composition and classification system for nonferrous metals

2. Describe the physical and mechanical characteristics of metals and explain how to identify base metals
    a. Describe the physical characteristics of different metals
    b. Describe the mechanical properties of different metals
    c. Explain how to identify base metals in field conditions
    d. Describe metallurgy-related considerations for welding

3. Identify the common structural shapes of metal
    a. Identify the most common structural steel shapes
    b. Identify different structural beam shapes
    d. Identify pipe and tubing types
    e. Identify other common metal forms, including rebar

Module 29204-15—Preheating and Postheating of Metals

1. Describe the relationship between heat and metal and identify preheating methods
    a. Describe the relationship between heat and metal
    b. Identify and describe methods used to preheat metal prior to welding

c. Identify and describe devices and products used to measure temperature

2. Describe interpass temperature control and postheating processes
    a. Describe interpass temperature control
    b. Describe various postheating processes

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 3: Drawing and Welding Symbol Interpretation

1. Interprets basic elements of a drawing or sketch
2. Interprets welding symbol information
3. Fabricates parts from a drawing or sketch

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

Supplemental/Reinforcement Material:

NCCER Welding Core Curriculum

Module 00105-15---Introduction to Construction Drawings

1. Identify and describe various types of construction drawings, including their fundamental components and features
    a. Identify various types of construction drawings
    b. Identify and describe the purpose of the five basic construction drawing components
    c. Identify and explain the significance of various drawing elements, such as lines of construction, symbols, and grid lines
    d. Identify and explain the use of dimensions and various drawing scales
    e. Identify and describe how to use engineer's and architect's scales

National Assessment:
Modules of NCCER Welding Level 1 and 2
AWS Sense Level 1

Course Number and Name: **WLT 1252 Advanced Pipe Welding**

Description: This course is designed to give the student advanced pipe welding techniques using shielded metal arc and gas tungsten arc welding processes.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
2	1	2	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Fabricate and weld pipe according to specifications using multiple positions
    a. Fabricate and weld an open root V-grooved pipe weld using the downhill technique
    b. Fabricate and weld an open root V-grooved multiple diameter pipe weld utilizing the GTAW process

2. Perform open butt V-groove pipe welds using multiple positions and bend tests
    a. Fabricate and weld an open root V-grooved pipe weld using GTAW and E-7018 electrodes
    b. Pass a 6G guided bend test on open root V-grooved pipe weld using GTAW and E-7018 electrodes as per AWS D1.1 Code

AND

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1313 Cutting Processes**

Description: This course is designed to give the student experience in oxyfuel cutting principles and practices, air carbon cutting and gouging, and plasma arc cutting.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
3	1	4	75

Prerequisite: None

Student Learning Outcomes:

NCCER Welding Level 1

Module 29102-15—Oxyfuel Cutting

1. Describe oxyfuel cutting and identify relate safe work practices
    a. Describe basic oxyfuel cutting
    b. Identify safe work practices related to oxyfuel cutting

2. Identify and describe oxyfuel cutting equipment and consumables
    a. Identify and describe various gases and cylinders used for oxyfuel cutting
    b. Identify and describe hoses and various types of regulators
    c. Identify and describe cutting torches and tips
    d. Identify and describe other miscellaneous oxyfuel cutting accessories
    e. Identify and describe specialized cutting equipment

3. Explain how to setup, light, and shut down oxyfuel equipment
    a. Explain how to properly prepare a torch set for operation
    b. Explain how to leak test oxyfuel equipment
    c. Explain how to light the torch and adjust for the proper flame
    d. Explain how to properly shut down oxyfuel cutting equipment

4. Explain how to perform various oxyfuel cutting procedures
    a. Identify the appearance of both good and inferior cuts and their causes
    b. Explain how to cut both thick and thin steel
    c. Explain how to bevel, wash, and gouge
    d. Explain how to make straight and bevel cuts with portable oxyfuel cutting machines

Module 29103-15—Plasma Arc Cutting

1. Explain plasma arc cutting processes and identify related safety precautions
    a. Describe the plasma arc cutting processes
    b. Identify safety practices related to plasma arc cutting

2. Identify and describe plasma arc cutting equipment
    a. Identify and describe plasma arc power units
    b. Identify and describe plasma arc torches and accessories
    c. Identify and describe plasma arc cutting gases and gas control devices

3. Describe how to set up, safely operate, and care for plasma arc cutting equipment
    a. Describe how to set up plasma arc cutting equipment and the adjacent work area
    b. Describe how to safely operate plasma arc cutting equipment
    c. Describe how to care for plasma arc cutting equipment

Module 29104-15—Air Carbon Arc Cutting and Gouging

1. Define air-carbon arc cutting and identify the related equipment and consumables
    a. Define air-carbon arc cutting
    b. Identify and describe air-carbon arc cutting equipment
    c. Identify and describe various types of electrodes
    d. Identify safety practices related to air-carbon arc cutting

2. Describe how to set up, safely operate, and care for air-carbon arc cutting equipment
    a. Describe how to prepare the equipment and work area for air-carbon arc cutting
    b. Describe how to wash and gouge metals
    c. Describe how to care for air-carbon arc cutting equipment

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 8: Thermal Cutting Processes

Manual Oxyfuel Gas Cutting (OFC)

1. Performs safety inspections of manual OFC equipment and accessories
2. Makes minor external repairs to manual OFC equipment and accessories
3. Sets up for manual OFC operations on carbon steel
4. Operates manual OFC equipment on carbon steel
5. Performs straight, square edge cutting operations, in the flat position, on carbon steel
6. Performs shape, square edge cutting operations, in the flat position, on carbon steel
7. Performs straight, bevel edge cutting operations, in the flat position, on carbon steel
8. Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel

Mechanized Oxyfuel Gas Cutting (OFC) [E.G., Track Burner]

1. Performs safety inspections of mechanized OFC equipment and accessories
2. Makes minor external repairs to mechanized OFC equipment and accessories
3. Sets up for mechanized OFC operations on carbon steel
4. Operates mechanized OFC equipment on carbon steel

5. Performs straight, square edge cutting operations in the flat position, on carbon steel
6. Performs straight, bevel edge cutting operations in the flat position, on carbon steel

Manual Plasma Arc Cutting (PAC)

1. Performs safety inspections of manual PAC equipment and accessories
2. Makes minor external repairs to manual PAC equipment and accessories
3. Sets up for manual PAC operations on carbon steel, austenitic stainless steel, and aluminum
4. Operates manual PAC equipment on carbon steel, austenitic stainless steel, and aluminum
5. Performs straight, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel, and aluminum
6. Performs shape, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel and aluminum

Manual Air Carbon Arc Cutting (CAC-A) Key Indicators

1. Performs safety inspections of manual CAC-A equipment and accessories
2. Makes minor external repairs to manual CAC-A equipment and accessories
3. Sets up for manual CAC-A scarfing and gouging operations on carbon steel
4. Operates manual CAC-A equipment on carbon steel
5. Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:
Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 1426** **Basic Fabrication for Pipefitting**

Description: This course is designed for the use of pipefitting tools and equipment, different ways of cutting and fitting pipes, methods of calculating pipe fittings, and various types of fit-ups for different types of pipe.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
6	2	8	150

Prerequisite: None

Student Learning Outcomes:

1. Explain and identify the use of various pipefitting tools and equipment
    a. Explain the safe use of tools and equipment
    b. Identify the proper tools for each specific task
    c. Identify and explain the use of the equipment for each specific task

2. Describe and fabricate various pipe assemblies
    a. Describe methods for preparing different types of pipe for fabrication
    b. Estimate fitting take-out
    c. Fabricate a butt weld pipe assembly
    d. Fabricate a socket weld pipe assembly
    e. Fabricate a screw pipe assembly
    f. Fabricate a piping assembly from a blueprint
    g. Fabricate a pipe hanger

National Assessment:
None

Course Number and Name: **WLT 191(1-6) Special Problem in Welding and Cutting Technology**

Description: A course to provide students with an opportunity to utilize skills and knowledge gained in other Welding and Cutting Technology courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project.

Hour Breakdown:

Scheduled Hours	Lab	Clock Hours
1	2	45
2	4	90
3	6	135
4	8	180
5	10	225
6	12	270

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Develop a written plan that details the activities and projects to be completed
    a. Use a written plan that details the activities and projects to be completed
    b. Perform written occupational objectives in the special problem

2. Assess accomplishment of objectives
    a. Prepare daily written assessments of accomplishment of objectives
    b. Present weekly written reports to the instructor of activities performed and objectives accomplished

3. Use and follow a set of written guidelines for the special problem
    a. Develop and follow a set of written guidelines for the special problem

National Assessment:
None

Course Number and Name: **WLT 192(1-6) Supervised Work Experience in Welding and Cutting Technology**

Description: A course that is a cooperative program between industry and education designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Scheduled Hours	Externship	Clock Hours
1	3	45
2	6	90
3	9	135
4	12	180
5	15	225
6	18	270

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Follow a set of instructor-written guidelines for the supervised work experience program

2. Apply skills needed to be a viable member of the workforce
    a. Prepare a description of skills to be developed in the supervised work experience program
    b. Practice skills needed to be a viable member of the workforce

3. Practice human relationship skills in the supervised work experience program

4. Practice positive work habits, responsibilities, and ethics

5. Develop written occupational objectives in the supervised work experience program

6. Assess performance of occupational skills
    a. Prepare daily written assessments of work performance as specified in the occupational objectives
    b. Present weekly written reports to the instructor of activities performed and objectives accomplished

National Assessment:
None

Course Number and Name: **WLT 1931 Welding Seminar I**

Description: Instruction is designed to facilitate activities incorporated in the Skills USA and professional organizations related to each student's career goal. This course will allow regular assembly of students to accomplish goals and objectives set by the Skills USA club, related organizations, and committees of these organizations. Leadership skills, understanding and participation in group projects, rapport with peers, community service and educational enrichment are encouraged.

Hour Breakdown:

Scheduled Hours	Lab	Clock Hours
1	2	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Develop a written plan that details the activities and projects to be completed
    a. Use a written plan that details the activities and projects to be completed
    b. Perform written occupational objectives in the special problem

2. Assess accomplishment of objectives
    a. Prepare daily written assessments of accomplishment of objectives
    b. Present weekly written reports to the instructor of activities performed and objectives accomplished

3. Use and follow a set of written guidelines for the special problem
    a. Develop and follow a set of written guidelines for the special problem

National Assessment:
None

Course Number and Name: **WLT 1941 Welding Seminar II**

Description: Instruction is designed to facilitate activities incorporated in the Skills USA and professional organizations related to each student's career goal. This course will allow regular assembly of students to accomplish goals and objectives set by the Skills USA club, related organizations, and committees of these organizations. Leadership skills, understanding and participation in group projects, rapport with peers, community service and educational enrichment are encouraged.

Hour Breakdown:

Scheduled Hours	Lab	Clock Hours
1	2	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Develop a written plan that details the activities and projects to be completed
    a. Use a written plan that details the activities and projects to be completed
    b. Perform written occupational objectives in the special problem

2. Assess accomplishment of objectives
    a. Prepare daily written assessments of accomplishment of objectives
    b. Present weekly written reports to the instructor of activities performed and objectives accomplished

3. Use and follow a set of written guidelines for the special problem
    a. Develop and follow a set of written guidelines for the special problem

National Assessment:
None

Course Number and Name: **WLT 2514 Fundamentals of Robotic Welding**

Description: This course is designed to introduce the student to industrial robots. Topics to be covered include robotics history, industrial robot configurations, operation, and basic programming.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	90

Prerequisite: None

Student Learning Outcomes:

1. Describe the various major components of all robots
    a. Explain the axes of movement
    b. Label each major component
    c. Identify four general types of work envelopes
    d. Discuss three general forms of robot actuation
    e. Identify different types of input devices used with robot controllers
    f. Describe the characteristics of a robot that distinguish it from other types of automated machinery

2. Demonstrate safety procedures used in the automated environment.
    a. Apply safety rules for personal and general shop safety including eye, ear, and body protection; general rules of shop conduct; and the use of safety color coding
    b. Apply general safety rules for tool and equipment use including hand tools, air and electric power tools, and other shop equipment
    c. Apply general safety rules associated with working on various robotics systems
    d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of firefighting devices

3. Demonstrate the ability to operate robots
    a. Evaluate robot performance
    b. Apply basic programming skills
    c. Identify and discuss end effectors
    d. Identify and discuss visual and tactile sensors
    e. Demonstrate basic troubleshooting techniques

National Assessment:
None

Course Number and Name: **WLT 2524 Advanced Robotic Welding**

Description: This course teaches the operating systems and advanced programming methods of industrial robots. Actual industrial grade robots are used to train the student in the areas of operation, maintenance, troubleshooting, service procedures, and robotics applications.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	90

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Demonstrate the ability to integrate a robot into a process
    a. Write programs on industrial robots to perform simulated industrial processes to operate within the confines of each robot's work envelope
    b. Demonstrate the improvement of the efficiency of an automated robotics process by reducing cycle time, decreasing memory usage, using advanced programming techniques, and so forth

2. Demonstrate the ability to integrate peripheral equipment
    a. Program and interface peripheral devices such as a programmable logic controller into robotics work cells
    b. Interface contact and non-contact sensors into robotics work cell

3. Demonstrate the ability to troubleshoot and maintain a robotics work cell
    a. Locate and isolate faults in robotics applications
    b. Demonstrate the use of test equipment and troubleshooting logic to repair faults
    c. Perform routine maintenance procedures on robots with the use of checklists and service equipment (null servo valves, zero encoders, calibrate potentiometers, etc.)

National Assessment:
None

Course Number and Name: **WLT 2812 Welding Metallurgy**

Description: This course is designed to give the student experience in the concept of metallurgy and how metals react to internal and external strains and temperature changes.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
2	2	0	30

Prerequisite: None

Student Learning Outcomes:

1. Explore metals and effect that heat has on these metals
    a. Identify different types of metals by ASTM classification, and describe the characteristics and uses
    b. Identify the effect different ranges of heat have on base metal
    c. Identify the different structures of metal

2. Explore the use hardness testing equipment
    a. Identify and describe the use of hardness testing equipment
    b. Safely perform hardness testing procedures

3. Explore the Heat Affected Zone on weldments
    a. Describe the effect of the heat input on the weld area
    b. Describe methods of prevention and correction of damage to the base metal

AND

NCCER Welding Level 1

Module 29106-15—Weld Quality

1. Identify and describe the various code organizations that apply to welding and their basic elements
    a. Identify the various welding code organizations and their sponsoring organizations
    b. Identify and describe the basic provisions of welding codes

2. Identify and describe weld discontinuities and their causes
    a. Identify and describe discontinuities related to porosity and inclusions
    b. Identify and describe discontinuities that result in cracking
    c. Identify and describe discontinuities related to joint penetration, fusion, and undercutting
    d. Identify and describe acceptable and unacceptable weld profiles

3. Describe various non-destructive and destructive weld examination practices
    a. Describe basic visual inspection methods including measuring devices and liquid penetrants
    b. Describe magnetic particle and electromagnetic inspection processes
    c. Describe the radiographic and ultrasonic inspection processes
    d. Describe destructive testing processes

4. Describe the welder performance testing process
    a. Describe the qualification of welders by position
    b. Describe welder qualification testing to meet American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) requirements
    c. Describe the process for completing a weld test

OR

AWS Sense Welding Level 1

Module 9: Welding Inspection and Testing Key Indicators

1. Examines cut surfaces and edges of prepared base metal parts
2. Examines tacks, root passes, intermediate layers, and completed welds

National Assessment:

Modules of NCCER Welding Level 1
AWS Sense Level 1

Course Number and Name: **WLT 291(2-3) Welding Code**

Description: This course is designed to give the student experience in the various welding codes and the experience in interpretation of these codes.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
2	2	0	30
3	3	0	45

Prerequisite: None

Student Learning Outcomes:

1. Explore AWS D1.1 Code
    a. Examine how WPSs, PQRs, and WQTR are relevant to code
    b. Examine various weld joints and weld configurations
    c. Examine base materials and electrodes related to processes used under code provisions

2. Explore API 1104 Code
    a. Examine how WPSs, PQRs, and WQTR are relevant to code
    b. Examine various weld joints and weld configurations
    c. Examine base materials and electrodes related to processes used under code provisions

3. Explore ASME Section 9 Code
    a. Examine how WPSs, PQRs, and WQTR are relevant to code
    b. Examine various weld joints and weld configurations
    c. Examine base materials and electrodes related to processes used under code provisions

National Assessment:
None

Course Number and Name: **DDT 1163 Engineering Graphics**

Description: This course provides an introduction to fundamentals and principles of drafting to provide the basic background needed for all other drafting courses.

Hour Breakdown:

Semester Hours	Lecture	Lab	Contact Hours
3	2	2	60
3	1	4	75

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Discuss classroom procedures and drafting occupations
    a. Describe proper classroom/lab procedures
    b. Describe the various occupations in drafting and their requirements

2. Apply proper techniques in technical drawings
    a. Demonstrate the ability to scale drawings
    b. Construct various angles
    c. Recognize and construct the alphabet of lines

3. Sketch and develop views of basic shapes
    a. Develop a pictorial view from three principal views
    b. Develop three principal views from a pictorial view
    c. Complete three principal views when lines are missing

4. Use geometric constructions
    a. Construct tangent arcs and lines
    b. Divide lines or arcs into equal and/or proportional parts
    c. Develop geometric shapes

5. Construct orthographic projections
    a. Develop a top view, with front and right side views given
    b. Develop a front view, with top and right side views given
    c. Develop a right side view, with top and front views given
    d. Construct a drawing consisting of three principal views

6. Dimension objects
    a. Recognize lines, symbols, features, and conventions used in dimensioning
    b. Recognize and use size and location dimensions
    c. Recognize and use general and local notes
    d. Dimension a drawing using contour, chain, and baseline dimensioning

7. Construct sectional views
    a. Construct full and half sectional views
    b. Recognize removed, revolved, offset, and aligned sectional views

National Assessment:
None

Course Number and Name: **WLT 2936 Structural Fabrication**

Description: A course of instruction to include the use of rulers/scales, layout and hand tools, welding joint designs, shearing and sawing materials, grinders and belt sanders and assembly projects by various welding processes. The plasma, flame tracer will be introduced. Complete a fabrication project, beginning by interpreting a set of print; developing a plan; and working to cut, prepare, fit and weld raw materials together. The fabrication project will resemble a real-world scenario related to the shipbuilding, construction, structural steel fabrication, aeronautical or related industries on a smaller scale. This welding course focuses on skills required to fabricate a project from an engineering drawing to the finished product. Emphasis is placed on interpreting engineering drawings, proper use of tools and equipment, math, proper fitting techniques and shop safety.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
6	2	8	135

Prerequisite: None

Student Learning Outcomes:

1. Perform accurate measurements for specified fabrication projects
2. Properly prepare material surfaces for fitting
3. Demonstrate proper safety precautions to deal with hazards pertaining to fitting and welding
4. Develop a fabrication plan based on prints or specifications
5. Introduces layout tools, fitting tools, and fitting aids used to fit up and align plate joints
6. Incorporates hands-on tasks through which the beginning fitter will learn how to perform basic layout, alignment, and fit-up tasks
7. Accurately perform correct fit and alignment of gussets, pad eyes, clips, frames etc. on steel beams, bulkheads etc.

Course Number and Name: **WLT 2924 Heavy Equipment Welding and Fabrication**

Description: In this course, students will learn proper safety and fundamentals of oxy-fuel cutting and shielded metal arc welding gas metal arc welding, flux cored arc welding, and air carbon arc cutting as it relates to the heavy equipment repair field. Students will learn advanced concepts of industrial fabrication in the maintenance of heavy duty equipment, develop a strong understanding of metals and their applications, and have the ability to bend, heat, and apply welding techniques that will support heavy duty equipment for long term use.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	90

Prerequisite: None

Student Learning Outcomes:

1. Apply failure analysis of weld defects
2. Demonstrate adjustment of regulators
3. Demonstrate cutting techniques
4. Demonstrate welding equipment set up
5. Display shop safety procedures
6. Identify cylinder types
7. Identify oxygen and acetylene regulators
8. Identify weld defects
9. Identify weld joint types and positions
10. Identify welding compressed gas types
11. Identify welding electrodes
12. Operating heating torch and the ability to field fit sheet metal, plate etc.
13. Perform various 6011, 7018, GMAW, and FCAW welding joints out of position
14. Perform various aluminum and stainless welding in a repair setting
15. Use sheet metal forming tools and equipment

Course Number and Name: **IMM 1934 Manufacturing Skills Basic**

Description: Manufacturing Skills is the initial course designed to provide the student with the basic skills needed to be successful in a high-performance manufacturing environment. The course covers 5 major areas of knowledge that are considered critical for employment in a high-performance manufacturing company. The topics covered include: Basic Computer Literacy, Safety and CPR, Blueprint Reading, Precision Measurement, and an introduction to manufacturing improvement methods that covers Lean Manufacturing, Quick Changeover, 5S, Teamwork and Problem-solving.

Hour Breakdown:

Semester Hours	Lecture	Lab	Contact Hours
4	2	4	90

Prerequisite: None

Student Learning Outcomes:

1. Complete a 10 hour OSHA Safety training program that includes the following topics at a minimum: OSHA 29CFR-1910 10 hour certification
    a. Introduction to OSHA
    b. Electrical
    c. Exit Routes, Emergency Action Plans, Fire Prevention Plans, and Fire Protection
    d. Flammable and Combustible Liquids
    e. Personal Protective Equipment
    f. Hazard Communication
    g. Machine Guarding
    h. Ergonomics
    i. Walking-Working Surfaces
    j. Lockout/Tag out Procedures
    k. Workplace violence
    l. Safety and Health Programs

2. Apply skills needed to read industrial blueprints NC3 (1 Mechanical Systems)
    a. Read an orthographic drawing
    b. Read various different types of drawings used in manufacturing such as isometric, auxiliary and sectional views
    c. Determine dimensions from various mechanical drawings
    d. Demonstrate the ability to recognize symbols used in different types of drawings

3. Apply precision measurement skills NC3(Precision Measurement Instrument Certification)
    a. Recognize precision measuring instruments
    b. Demonstrate the proper use and care of precision measuring instruments
    c. Demonstrate the ability to measure accurately with English measurement scales
    d. Demonstrate the ability to measure accurately with metric measurement scales
    e. Apply precision measurement devices in simulated job tasks

4. Apply techniques used in high-performance manufacturing
    a. Demonstrate Teamwork and problem-solving skills
    b. Describe High-Performance manufacturing procedures to include:

i. Lean manufacturing
ii. 5S
iii. SMED
iv. Identifying customers and their needs
v. Quality control
vi. Understanding of ISO 70
vii. Value stream mapping

c. Research and present a manufacturing topic

5. Apply basic interviewing skills
    a. Perform interviewing skills
    b. Create a resume for a job interview

6. Perform basic computer literacy skills
    a. Run a program from the desktop and the Start Menu
    b. Demonstrate how to operate a browser
    c. Enter a website by entering the URL
    d. Demonstrate how to save a website URL as a favorite or bookmark
    e. Demonstrate how to use a search engine
    f. Establish and use an email account
    g. Demonstrate how to create and save a word processing file
    h. Create and save a spreadsheet file
    i. Send, receive, save and open an attachment using an email account
7. CPR American Heart Association or American Red Cross

National Coalition of Certification Centers
NC3 (1 Mechanical Systems)
NC3 (Precision Measurement Instrument Certification)

OSHA 29CFR-1910 10 hour certification
American Heart Association or American Red Cross

Course Number and Name: **WBL 191(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

Course Number and Name: **WBL 192(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

Course Number and Name: **WBL 193(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

Course Number and Name: **WBL 291(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

Course Number and Name: **WBL 292(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

Course Number and Name: **WBL 293(1-3) Work Based L earning**

Description: A structured work-site learning experience in which the student, program area teacher, work-based learning coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. This site is designed to integrate the student's academic and technical skills into a work environment, and may include regular meetings and seminars with school personnel for supplemental instruction and progress reviews. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1		3	45
2		6	90
3		9	135

National Assessment: None

Prerequisite: Instructor Approved Technical Elective

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
    a. Demonstrate technical skills necessary to complete job requirements.
    b. Demonstrate academic skills necessary to complete job requirements.
    c. Perform tasks detailed in an educational training agreement at the work setting.
    d. Demonstrate knowledge of employability skills such as creating cover letters, resumes, etc.

2. Apply general workplace skills to include positive work habits necessary for successful employment.
    a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
    b. Utilize time, materials, and resource management skills.
    c. Use critical thinking skills such as problem solving, decision making, and reasoning.
    d. Acquire, evaluate, organize, maintain, interpret, and communicate information.

APPENDIX A: RECOMMENDED TOOLS AND EQUIPMENT

Capitalized Items

Access to some tools and equipment may be provided by Machine Shop, Electrical, Plumbing/Pipefitting, Automotive, and Welding Program facilities.

1. Oxyfuel burning table with dross pan and replaceable slats (4 ft x 8 ft x 31 in.) (1)
2. OSHA approved exhaust system (1)
3. Guided bend test jig or machine (hydraulic) (1)
4. Plasma arc cutting device with min. 1/2 in. cutting depth with accessories (2)
5. Combination (multi-process) machine with power source (6 or 8 pack) with cables and accessories for 4 GTAW and 4 GMAW setup with accessories (13)
6. Shielded metal arc welding machines (AC/DC - constant current 250-300 amp @ 60%) with cables and with accessories (13)
7. Oxyfuel gas cutting equipment with regulators, hoses, torch, tips, cart, and accessories (5 sets)
8. Machine oxyfuel gas cutting equipment with regulators, hoses, torch, tips, rails or track, and accessories (1 set)
9. Leather jacket, cape, sleeves or apron, and leather gloves (1 set per student)
10. Ironworker with accessories (70 ton) (1)
11. Large drill press with accessories (1)
12. Small drill press with accessories (1)
13. Band saw (vertical or horizontal) (1)
14. Portable abrasive cutoff saw (min. 16 in.) (1)
15. Heavy-duty four-wheel material mover (1)
16. Crane (A-frame) heavy duty, with 5 T electric hoist (1)
17. Pipe bevel machine for mild steel (oxyfuel) (1)
18. Welder, engine driven (200 A, constant current/constant voltage @ 60% duty cycle) (1)
19. Electrode shop oven (1)
20. AWS Welding Educator's Library, Miami, FL: American Welding Society, 1995
21. Microcomputer with CD-ROM, SVGA graphics card, and modem and operating software (20)
22. Fork lift (1)

Non-Capitalized Items

1. First aid kit (2)
2. Emergency eye wash station (1)
3. Workbench with medium duty vise (4)
4. 8-in. C-clamps (1 per student)
5. 4 1/2-in. right angle grinder (5)
6. 9-in. right angle grinder (5)
7. Work area protective screens (as required) (1 for each welding booth)
8. Framing squares (24 in. x 18 in.) (6)
9. Compressed air hose (50 ft) with retractable reel (2)
10. Compressed air regulator (1)
11. Male and female quick couples and adaptors (2)
12. Hose repair kit with crimping tool for oxyfuel cutting equipment (2)
13. Safety glasses with side shields (1 per student)
14. Burning goggles (1 per student)
15. Face shield (10 per program)
16. #5 Filter plate/lens for burning goggles (1 per student)
17. Clear cover plate/lens for burning goggles (2 per student)
18. Welding helmet #10 shaded filter plate/lens, with head gear and accessories (20)

19. Welding lenses to match helmet, #11 shaded filter plate/lens (6 sets)
20. Clear cover plate/lens for welding helmets (2 per student)
21. Stainless steel wire brush (20)
22. 16-oz ball-peen hammer (4)
23. 4-lb shop hammer (4)
24. Electric hand drill (1/2 inch chuck) (2)
25. Retractable extension cords (4)
26. Center punches (1 set)
27. Metal scribe (6)
28. Steel dividers (radius maker, min. 6 in.) (2)
29. Steel tape measure (minimum 10 ft) (20)
30. Combination square set (4)
31. Chipping hammer (20)
32. 10 inch mill file (half round-bastard cut) (20)
33. Cold chisels (1 set)
34. Adjustable wrenches (12 in., 10 in., 8 in., 6 in.) (1 set)
35. Tank wrench (2)
36. 10-in. groove or slip joint pliers (8)
37. 6-in. combination side cutting/needle nose pliers (10)
38. 10-in. vise grips (4)
39. 10-in. vise grip clamp or tongs (20)
40. Allen or hex wrenches, standard and metric (1/16 - 3/8) (2 sets)
41. Screwdrivers, flat head (1 set)
42. Screwdrivers, Phillips head (1 set)
43. Oxyfuel friction lighter, with flints and tip cleaners (12)
44. Fillet gages (2 sets)
45. Pedestal grinder (2)
46. Jack stands (2 sets)
47. Carbon arc gouging whip (5)
48. Steel wire brush (20)
49. AWS Safety in Welding and Cutting (ANSI/ASC Z49.1-88). Miami, FL: American Welding Society, 1988 (1)
50. Rescue body harness (3)
51. Lock-out/tag-out equipment

Recommended Instructional Aids

It is recommended that instructors have access to the following items:

1. Screen, projection (1 per program)
2. Overhead projector (1) and Cutting Technology
3. Video out (Microcomputer to TV monitor) (1)
4. Interactive presentation board with accessories (1)

APPENDIX B: INTEGRATED PATHWAY COURSE NUMBER CROSSWALK

The Mississippi Integrated Pathway Model is designed to allow students to complete coursework in smaller semester credit hour courses. Content from each module can be found in the courses listed in the first column of the following table.

Traditional Course Number	Integrated Pathway Course Number	Aligned Industry Certification
WLT 1173 Introduction to Welding Safety	WLT 1111 Welding Safety, Math, and Hand Tools	NCCER Core Curriculum • Module 00101-15— Basic Safety • Module 00102-15—Introduction to Construction Math • Module 00103-15—Introduction to Hand Tools NCCER Welding Level 1 • Module 29101-15—Welding Safety
	WLT 1121 Welding Power Tools, Drawings, and Rigging	NCCER Core Curriculum • Module 00104-15—Introduction to Power Tools • Module 00105-15—Introduction to Construction Drawing • Module 00106-15—Basic Rigging
	WLT 1131 Communication Skills, Employability Skills, and Materials Handling	NCCER Core Curriculum • Module 00107-15—Basic Communication Skills • Module 00108-015—Basic Employability Skills • Module 00109-15—Introduction to Materials Handling
WLT 1115 Shielded Metal Arc Welding I	WLT 1141 SMAW Basic Metal Preparation	NCCER Welding Level 1 • Module 29105-015—Base Metal Preparation
	WLT 1151 SMAW Equipment and Setup	NCCER Welding Level 1 • Module 29107-015—SMAW-Equipment and Setup
	WLT 1171 SMAW Electrodes	NCCER Welding Level 1 • Module 29108-15—Shielded Metal Arc Welding-Electrodes
	WLT 1181 SMAW Beads and Fillet Welds	NCCER Welding Level 1 • Module 29109-15—SMAW-Beads and Fillet Welds
	WLT 1191 SMAW Weld Quality	NCCER Welding Level 1 • Module 29106-15—Weld Quality

WLT 1225 Shielded Metal Arc Welding II	WLT 1211 SWAM Joint Fit-Up and Alignment	NCCER Welding Level 1 • Module 29110-15—Joint Fit-Up and Alignment
	WLT 1221 SWAM Groove Welds and Backing	NCCER Welding Level 1 • Module 29111-15—SMAW- Groove Welds with Backing
	WLT 1241 SWAM Open V-Groove Welds	NCCER Welding Level 1 • Module 29112-15—Open V-Groove Welds
	WLT 1261 SMAW II Weld Quality I	NCCER Welding Level 1 • Module 29106-15—Weld Quality
	WLT 1271 SMAW II Weld Quality II	NCCER Welding Level 1 • Module 29106-15—Weld Quality
WLT 1313 Cutting Processes	WLT 1311 Oxyfuel Cutting	NCCER Welding Level 1 • Module 29102-15—Oxyfuel Cutting • Module 29106-15—Weld Quality
	WLT 1321 Plasma Arc Cutting	NCCER Welding Level 1 • Module 29103-15—Plasma Arc Cutting • Module 29106-15—Weld Quality
	WLT 1331 Air Carbon Arc Cutting and Gouging	NCCER Welding Level 1 • Module 29104-15—Air Carbon Arc Cutting and Gouging (GMAW Only) • Module 29106-15—Weld Quality
WLT Gas Metal Arc Welding (GMAW)	WLT 1342 GMAW Equipment and Filler Metals	NCCER Welding Level 1 • Module 29205-15—GMAW and FCAW: Equipment and Filler Metals (GMAW Only) • Module 29106-015—Weld Quality
	WLT 1352 GMAW Plate	NCCER Welding Level 1 • Module 29206-15—GMAW and FCAW: Plate (GMAW Only) • Module 29106-015—Weld Quality
WLT 1143 Flux Cored Arc Welding (FCAW)	WLT 1361 FCAW Equipment and Filler Metals	NCCER Welding Level 1 • Module 29205-15—GMAW and FCAW: Equipment and Filler Metals (FCAW Only)
	WLT 1371 FCAW Plate	NCCER Welding Level 1 • Module 29206-15—GMAW and FCAW: Plate (FCAW Only)
	WLT 1381 FCAW Weld Quality	NCCER Welding Level 1 • Module 29106-15—Weld Quality (FCAW Only)
WLT 1135 Gas Tungsten Arc Welding (GTAW)	WLT1412 GTAW: Equipment and Filler Metals	NCCER Welding Level 2 • Module 29207-15—GTAW: Equipment and Filler Metals
	WLT 1422 GTAW: Plate	NCCER Welding Level 2 • Module 29208-15—GTAW: Plate

	WLT 1431 GTAW Weld Quality	NCCER Welding Level 1 • Module 29106-15—Weld Quality (GTAW)
WLT 1232 Blueprint Reading, Welding Symbols, and Metallurgy	WLT 1451 Welding Symbols and Drawings	NCCER Welding Level 2 • Module 29201-15—Welding Symbols • Module 29202-15—Reading Welding Detail Drawings
	WLT 1461 Metallurgy	NCCER Welding Level 2 • Module 29203-15—Physical Characteristics and Mechanical Properties of Metal • Module 29204-15—Pre-heating and Post-Heating of Metals NCCER Welding Level 1 • Module 29106-15—Weld Quality (GTAW)

APPENDIX C: CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community colleges in reporting students

- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students

- Classification – Courses may be classified as the following:
    - Career Certificate Required Course – A required course for all students completing a career certificate.
    - Technical Certificate Required Course – A required course for all students completing a technical certificate.
    - Technical Elective – Elective courses that are available for colleges to offer to students.

- Description – A short narrative that includes the major purpose(s) of the course

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course

- Corequisites – A listing of courses that may be taken while enrolled in the course

- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
    - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
    - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
    - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
    - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
    - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas

- Sequencing of the course within a program is left to the discretion of the local college. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.

- In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
- Revising or extending the student learning outcomes
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

APPENDIX D: COURSE CROSSWALK

COURSE CROSSWALK
Welding Technology
CIP 48.0508 Welding Technology/Welder

Note: Courses that have been added or changed in the 2018 curriculum are highlighted.

Existing			Revised		
2014 MS Curriculum Framework			**2018 MS Curriculum Framework**		
Course Number	**Course Title**	**Hours**	**Course Number**	**Course Title**	**Hours**
WLT 1115	Shield Metal Arc Welding I	5	WLT 1115	Shield Metal Arc Welding I	5
WLT 1124	Gas Metal Arc Welding	4	WLT 1124	Gas Metal Arc Welding	4
WLT 1135	Gas Tungsten Arc Welding	5	WLT 1135	Gas Tungsten Arc Welding	5
WLT 1143	Flux Cored Arc Welding	3	WLT 1143	Flux Cored Arc Welding	3
WLT 1155	Pipe Welding	5	WLT 1155	Pipe Welding	5
WLT 1173	Introduction to Welding and Safety	3	WLT 1173	Introduction to Welding and Safety	3
WLT 1225	Shield Metal Arc Welding II	5	WLT 1225	Shield Metal Arc Welding II	5
WLT 1232	Blueprint Reading, Welding and Metallurgy	2	WLT 1232	Blueprint Reading, Welding and Metallurgy	2
WLT 1252	Advanced Pipe Welding	2	WLT 1252	Advanced Pipe Welding	2
WLT 1313	Cutting Processes	3	WLT 1313	Cutting Processes	3
			WLT 291(2-3)	Welding Code	2-3
			IMM 1934	Manufacturing Skills Basic	4
			WLT 2924	Heavy Equipment Welding and Fabrication	4
			WLT 2936	Structural Fabrication	6

APPENDIX E: RECOMMENDED TEXTBOOK LIST

Recommended Textbook List CIP 48.0508 Welding Technology/Welder		
Book Title	**Author(s)**	**ISBN**
Core Curriculum: Introductory Craft Skills (Trainee Guide) 5th edition	NCCER	9780134130989
Welding Trainee Guide (Level 1) 5th edition	NCCER	9780134131108
Welding Trainee Guide (Level 2) 5th edition	NCCER	9780134311104
Core Curriculum: Introductory Craft Skills 5th edition	NCCER	9780134131436