

---

**LAKELAND COMMUNITY COLLEGE – COURSE OUTLINE FORM**

---

\*\*\* WORK-IN-PROCESS VERSION, NOT YET APPROVED \*\*\*

---

<b>ORIGINATION DATE:</b>	9/28/17	<b>APPROVAL DATE:</b>	
<b>LAST MODIFICATION DATE:</b>	11/16/17	<b>EFFECTIVE TERM/YEAR:</b>	FALL/ 18

---

**PRINTED:** 8/8/2018

**COURSE ID:** WELD2320  
**COURSE TITLE:** Advanced SMAW (Stick) Welding

	<b>LECTURE</b>	<b>LAB</b>	<b>CLINICAL</b>	<b>TOTAL</b>	<b>OBR MIN</b>	<b>OBR MAX</b>
<b>CREDITS:</b>	1.00	1.00	0.00	2.00	2.00	3.00
<b>CONTACT HOURS:</b>	1.00	3.00	0.00	4.00		

---

**PREREQUISITE:**

WELD 1040 (can be taken concurrently), WELD 1320; or permission of instructor

---

## COURSE DESCRIPTION:

This course introduces students to the advanced concepts of design and production of many types of weldments used in industry, with emphasis on proper design, set-up, trouble shooting, and techniques to produce cost effective fillet and groove welds in the vertical and overhead positions using the Shielded Metal Arc Welding (SMAW) process. Laboratory experience includes skill development in advanced SMAW welding techniques, along with project-based learning concepts, blueprint reading, manufacturing of projects, fabrication technique, and producing fillet and groove welds in the vertical and overhead positions. At the conclusion of this course, students take either a 3G or 4G pass/fail welder Certification of Qualification test using the SMAW process. The student must furnish: welding helmet (shade #10 or above); safety glasses; work gloves; long pants; welding jacket; leather work boots, preferably steel toe; 8" crescent wrench; soapstone and holder; tape measure; combination square; chipping hammer; wire brush; tool bag; center punch; and 12 oz. ball peen hammer. 4 1/2" grinder is optional.

---

## RATIONALE FOR COURSE:

This course provides practical welding experience and knowledge for students wanting to gain an in-depth understanding of SMAW (Stick) Welding and produce fillet and groove welds in the vertical and overhead positions. This course will provide a pathway for employment in a welding field and for welding certification.

---

## OUTCOMES:

**The course will:**

1. Reinforce student's understanding of essential welding safety equipment and procedures
2. Enable student to recognize an acceptable SMAW fillet and groove weld that is properly made in the vertical and overhead position using appropriate techniques, select the electrodes to be used, and understand the safety techniques involved.

3. Emphasize instruction on the various power sources, current requirements, machine settings, and the special manipulative techniques required to produce acceptable fillet and groove welds using the SMAW process in the vertical and overhead positions.
  4. Provide instruction in the various tests and examinations for the qualification of a welder per the American Welding Society (AWS) D1.1 code.
  5. Provide instruction in how mechanical properties of welds, such as strength and toughness can be influenced and improved by using proper welding techniques.
  6. Provide instruction on how voltage and amps are proportional to the welding arc.
  7. Give students hands-on experience in how to properly design, set-up, and then use appropriate techniques to produce cost effective fillet and groove welds utilizing the SMAW process in the vertical and overhead positions.
  8. Provide instruction and develop the student's ability to utilize the SMAW process in the vertical and overhead positions and complete a project involving welding carbon steel.
- 

## **PERFORMANCE INDICATORS:**

**Upon completion of the course, the student should be able to**

1. Describe the various safety hazards involved in SMAW welding, including those associated with producing a fillet and groove weld in the vertical and overhead positions.
2. Properly set the machine controls for the transformer, rectifier, and motor generator power sources for producing a fillet and groove weld in the vertical and overhead positions.
3. Produce acceptable vertical up and overhead fillet and lap welds employing proper techniques and settings using E6010 and E7018 electrodes.
4. Produce acceptable vertical down fillet and lap weld employing proper techniques and settings using E6010 electrode.
5. Produce acceptable vertical up and overhead 1" bevel test plates using E7018 electrodes.
6. Demonstrate the difference in techniques used when producing a fillet and groove weld in the vertical and overhead welding positions compared to the flat and horizontal positions.
7. Read and understand a simple shop drawing or print and use standard measuring instruments to lay-out a component part or assemble a weldment.
8. Describe the tests as used by AWS and the American Society of Mechanical Engineers (ASME) to qualify welders for making welds in the 3F, 4F, 3G, and 4G positions, and demonstrate the proper welding techniques according to the respective codes.
9. Demonstrate proficiency in the SMAW process in the 3F, 4F, 3G, and 4G positions by producing weld test plates that meet the applicable AWS bend test requirements as taken from the plates prepared and tested by the Instructor.

---

## COURSE OUTLINE:

- I. Considerations Related to Advanced Shielded Metal Arc Welding
  - A. Safety concerns when using SMAW in the vertical and overhead positions
    - 1. Personal Protective equipment - includes ear plugs (explain)
    - 2. Fumes and gases - type items worked on makes of greater concern
    - 3. Electric shock can kill - more danger when in confined spaces
    - 4. Burns - more concern as to molten metal falling on welder
    - 5. Falls - much more likely than when welding in vertical and overhead positions
    - 6. UV and IR rays - always a concern
  - B. Changes in the characteristics of electrodes for advanced welding
    - 1. Flux is different - it has to solidify faster, so less fluid
  - C. Welding current
    - 1. Must be more carefully selected and useable range is smaller
  - D. Electrodes
    - 1. Electrode size is limited - if too big weld pool hard to control
    - 2. Cannot use electrodes in fast fill group
  - E. Power sources
    - 1. Constant current type - typically transformer rectifier, DC motor generator, inverter or rectified alternator
- II. Manipulative Variables and Techniques for Producing Fillet and Groove Welds in the Vertical and Overhead Positions
  - A. Manipulative variables not set at same values as for basic welding
    - 1. Travel speed - typically slower
    - 2. Travel angle - depends on specific situation
    - 3. Transverse (work) angle - usually similar
    - 4. Tip to work distance - will sometimes be different
    - 5. Tip location - depends on position and if single or multi-pass
  - B. Manipulative Techniques
    - 1. Drag - often used
    - 2. Whip - Not used except sometimes for root pass
    - 3. Special weave patterns used for most welds
  - C. Rod angles and bead placement
    - 1. Rod angles and when used
      - a. 45 degrees
      - b. 60 degrees
      - c. 30 Degrees
    - 2. Proper placement for vertical and overhead welds
      - a. Coverage
        - i. 1<sup>st</sup> pass even in the corner
        - ii. 2<sup>nd</sup> pass cover 1<sup>st</sup> pass 75 to 90%
        - iii. 3<sup>rd</sup> pass cover 2<sup>nd</sup> pass 50%
    - 3. Beads must be fairly uniform
      - a. Best technique
      - b. 6010 and 6011
        - i. Whip rod and stack ripples
      - c. All other electrodes we drag and/or weave
    - 4. Good wash-in - critical
      - a. Undercut (concave)
        - i. Too hot
        - ii. Too fast
        - iii. undercut on one plate not the other wrong rod angle.
  - D. Special manipulative techniques difficult to learn
    - 1. Requires extensive practice and careful attention to detail
    - 2. Welds must be made per welding procedure specification
  - E. Arc blow
    - 1. Arc blow is a phenomenon encountered in DC welding current where the magnetic field does not follow the shortest path
      - a. occurs beginning and end of the plates

- b. can be encountered when welding in advanced positions
- F. Vertical up vs vertical down
  - 1. 1/4" rule
    - a. 1/4" and thicker vertical up
    - b. 1/4" and thinner vertical down

### III. Project Experience

- A. Introduction to Reading Prints and Shop Drawings
- B. Use of tape measure and measuring instruments used in fabricating
- C. Review of math involving fractions

### IV. Welder Qualification Test

- A. Hands-on skills test of student's ability to make acceptable SMAW welds
  - 1. Take either 3G or 4G Certification of Qualification Test in the SMAW process
  - 2. Pass/fail test
  - 3. Industry Recognized Certification of Qualification is awarded to students passing independent 3<sup>rd</sup> party test of welds made using a qualified or pre-qualified Welding Procedure Specification

---

## INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:

Lectures, Project Based Learning, videos, online resources, and/or handouts may be used for instruction of the fundamental concepts. Students set up and practice welding using various types of welding equipment during laboratory.

---

## GRADING PROCEDURES:

Examinations and/or quizzes  
Class participation and discussion  
Lab work, individual projects, papers or reports and/or  
Homework

---

## COURSE EVALUATION PROCEDURES:

This course will be reviewed bi-annually by faculty and the Advisory Committee. Students will complete course evaluations each semester.

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. The course and services are available without regard to a participant's race, color, religion, ancestry, age, handicap, sex, marital status or national origin. The number for TDD/TYY or relay services is 440-525-7006.



This work is licensed under the Creative Commons Attribution 4.0 International License. It is attributed to Ohio TechNet. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

**LAKELAND STUDENT LEARNING OUTCOMES**

<b>LEARNS ACTIVELY</b>	<b>I</b>	<b>R</b>	<b>D</b>
1. Takes responsibility for his/her own learning.			
2. Uses effective learning strategies.			
3. Reflects on effectiveness of his/her own learning strategies.			
<b>THINKS CRITICALLY</b>	<b>I</b>	<b>R</b>	<b>D</b>
4. Identifies an issue or idea.			D
5. Explores perspectives relevant to an issue or idea.			
6a. Identifies options or positions.			D
6b. Critiques options or positions.			D
7. Selects an option or position.			D
8a. Implements a selected option or position.			D
8b. Reflects on a selected option or position.			D
<b>COMMUNICATES CLEARLY</b>	<b>I</b>	<b>R</b>	<b>D</b>
9a. Uses correct spoken English.			
9b. Uses correct written English.			
10. Conveys a clear purpose.			
11. Presents ideas logically.			
12a. Comprehends the appropriate form(s) of expression.			
12b. Uses the appropriate form(s) of expression.			D
13. Engages in an exchange of ideas.			
<b>USES INFORMATION EFFECTIVELY</b>	<b>I</b>	<b>R</b>	<b>D</b>
14. Develops an effective search strategy.			
15a. Uses technology to access information.			
15b. Uses technology to manage information.			
16. Uses selection criteria to choose appropriate information.			
17. Uses information responsibly.			
<b>INTERACTS IN DIVERSE ENVIRONMENTS</b>	<b>I</b>	<b>R</b>	<b>D</b>
18a. Demonstrates knowledge of diverse ideas.			
18b. Demonstrates knowledge of diverse values.			
19. Describes ways in which issues are embedded in relevant contexts.			
20a. Collaborates with others.			
20b. Collaborates with others in a variety of situations.			
21. Acts with respect for others.			

**Definitions:**

**Introduces (I)**

Students first learn about key ideas, concepts, or skills related to the performance indicator. This usually happens at a general or very basic level, such as learning one idea or concept related to the broader outcome.

**Reinforces (R)**

Students are given the opportunity to synthesize key ideas of skills related to the performance indicator at increasingly proficient levels.

**Demonstrates (D)**

Students should demonstrate mastery of the performance indicator with the level of independence expected of a student attaining an associate's degree.