LAKELAND COMMUNITY COLLEGE – COURSE OUTLINE FORM*

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

ORIGINATION DATE:	9/28/17	**APPROVAL DATE:**	
LAST MODIFICATION DATE:	11/16/17	**EFFECTIVE TERM/YEAR:**	FALL/ 18
		PRINTED:	8/8/2018

COURSE ID: **WELD1370**

COURSE TITLE: Basic Pipe Welding

	LECTURE	LAB	CLINICAL	TOTAL	OBR MIN	OBR MAX
CREDITS:	1.00	2.00	0.00	3.00	2.00	3.00
CONTACT HOURS:	1.00	4.00	0.00	5.00		

PREREQUISITE:

WELD 1030, WELD 1320; or permission of instructor

COURSE DESCRIPTION:

This course introduces students to the basic American Society of Mechanical Engineers (ASME), American Petroleum Industry (API) and American Welding Society (AWS) pipe welding standards. Students will choose one of these three standards to develop their welding skills in the laboratory. Laboratory sessions will provide hands-on time to develop skills to produce quality welds on flat plate and then on pipe in the flat and horizontal positions. The course covers functions and specific uses of manual-welding equipment, various welding techniques, prepping and fitting of pipe coupons, and welding certification requirements. Students must furnish: long pants; welding helmet (shade #10 or above); safety glasses; work gloves; welding jacket; leather work boots, preferable steel toe; 8” crescent wrench; soapstone and holder; tape measure; combination square; chipping hammer; wire brush; center punch; 12 oz. ball peen hammer; and tool bag. 4 1/2” grinder is optional.

RATIONALE FOR COURSE:

This course is designed to introduce students how to prep, fit, tack, and weld pipe to the ASME or API standards in the flat and horizontal pipe position.

OUTCOMES:

The course will

1. Introduce students to essential safety principles, equipment and procedures.

2. Enable students to recognize an acceptable weld that is properly produced using various techniques utilized in the flat and horizontal positions and the safety techniques involved.

3. Enable students to recognize the importance of fit up, understand the various welding techniques and the use of various electrodes.

4. Provide instruction in the various power sources and machine settings required to make welds in the flat and horizontal positions.

5. Provide instruction in the various qualification tests and examinations for a professional welder.

6. Introduce students to the mechanical properties of a weld, including tensile and yield strength, toughness, per cent reduction of area, and per cent elongation.

7. Provide instruction in how voltage and amps relate to the welding arc.

8. Provide instruction of the AWS numbering system.

9. Provide students with experience in manual electric arc welding of pipe in the flat and horizontal joint positions.

PERFORMANCE INDICATORS:

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

1. Describe the various safety hazards involved in arc welding.

2. Describe the safety equipment and its function in welding.

3. Explain the different positions 1G and 2G.

4. Weld 6” schedule 40 pipe to ASME or API standard in flat and horizontal position.

5. Properly set the machine controls for the transformer, rectifier, and motor generator power sources for the specific welding task.

6. Produce an acceptable pipe weld in the positions flat and horizontal position using the shielded metal arc welding method.

7. Produce an acceptable flat or horizontal root pass depending on code or standard the welder has chosen weld using E6010 electrodes.

8. Produce an acceptable flat or horizontal fill and cap weld using E6010 and 7018 electrodes determined by code or standard chosen.

9. Produce a quality flat and horizontal 6” schedule 40 test pipe and cut out and bend specimens.

10. Describe the qualification tests as used by API and ASME, and demonstrate the proper welding and fit up technique.

11. Identify the difference between API and ASME standards

COURSE OUTLINE:

I. Pipe Welding Codes and Standards
   - A. ASME
     - 1. American Society of Mechanical Engineering
       - a. Most of the time done in the up-hill position
       - b. Power plants in house piping
   - B. API
     - 1. American Petroleum Institute
       - a. Most of the time done in the down-hill position
       - b. Oil and gas industry Cross country pipeline

C. AWS
1. American Welding Society
a. Structural

II. Safety
A. E205 safety hand out
B. ANSI Z49.1
C. MSDS Sheets
D. Safety Glasses
E. Warning
F. Safety Label

III. Position for Pipe Welding
A. 1G Rotated parallel to the ground
B. 2G Fixed Pipe vertical weld is horizontal

IV ASME and API Fit Up
A. Bevel angles
1. 30 to 37.5 degrees
B. Root face (land)
1. 3/32 or 1/8
C. Root opening (gap)
1. 3/32 or 1/8
D. Typically welded vertical up

V. API Fit Up
A. Bevel
1. 30 degree +or- 5 degrees
B. Root face (land)
1. 1/16 +or- 1/64
C. Root opening (gap)
1. 1/16 +or- 1/64
D. Typically welded vertical down

VI. Pipe Welding Fit Up
A. Root face (land)
1. Grinder
2. File
3. Mechanical beveller
B. Root opening (Gap)
1. Bare electrodes
2. Nickle or a dime
3. Sheet metal shims
4. Anything that is equal to the gap on the pipe
C. Internal alignment of the pipe (high Low)

VII. Tack Up
A. Tack
1. ½” to ¾” long
a. If it tack good it will weld good
b. Adjust your amps while you are tacking up your pipe
B. 12 o’clock
C. 6 o’clock
D. 3 o’clock
E. 9 o’clock

VIII. Grinding of Tacks
A. Feathering
1. Grind tack welds leading and back edge very thin so the transition from the root to tack ties in.

IX. Root Pass Stringer Bead
A. Drag technique
1. ASME

a. DC+ 1/8” 6010 80 to 90 amps

B. Stitch technique
1. ASME
a. DC+ 1/8” 6010 70 to 80 amps

C. Drag technique
1. API
a. DC+ 1/8” 6010 80 to 90 amps
i. Typically down vertical down Cellulose electrode

X. Wagon Tracks
A. Slag trapped alongside of the root pass

XI. Grinding of the Root Pass
A. Grind down the high spot on the root pass to expose the wagon tracks

XII. Hot Pass ASME
A. Burn out the wagon track DC+ ten amps greater than that of the root Pass
B. 10 minutes to put in the hot pass after the root pass is put in

XIII. Fill Passes (Could Be Multiple Passes) ASME
A. 7018
1. Slight drag or weave
B. 6010
1. Shuffle or whip

XIV. API Hot Pass
A. Shuffle step
1. Burn out wagon tacks
2. Rod angle 10 to 15 degree drag angle

XV. Fill and Stripper Pass
A. Shuffle step
1. Stripper pass is the fill pass on the pipe between 2 O’clock and 5 O’clock and between 7 O’clock and 10 O’clock this is where the weld might become thin because of the travel speed was picked up because of gravity and fluidity of the puddle.

XVI. API Cap Pass
A. Stinger
B. Weave
1. Europe full stove means Vertical down welding full joint
2. Dolly Mix means Vertical up root vertical down fill and cap

XVII. Six Things That Control The Key Hole
A. Land
1. Too large- small key hole
2. Too Small- large Key Hole

B. Gap
1. Too large Big key hole
a. Decrease Amps stitch Technique
2. Too small-small Key hole
a. Switch polarity DC- A.S.M.E. increase amps

C. Amperage
1. Too many- Large key hole
a. Decrease amps
2. Too few – small key hole
a. Increase amps

D. Travel speed
1. Too fast- lack of penetration and window
a. Slow down
2. Too slow- excessive burn through and internal reinforcement
a. Speed up

3. With ideal travel speed you will see a small flickering "keyhole"

E. Rod angle
   1. 5 to 10 degree to pipe center
   2. A.S.M.E.
      a. Too much lead angle excessive weld internal reinforcement
      b. Too much push angle lack of penetration
   3. A.P.I.
      a. Too much lead angle- decrease penetration
      b. Too much push angle- increase penetration

F. Pressure
   1. Too much- small keyhole
      a. Relax pressure
   2. Too little- big keyhole
      a. Increase pressure
   3. Pressure- force applied to the electrode in the pipe joint root opening

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INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:

Lectures, videos, online, 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.

See pages 17-19 of Curriculum Procedures & Guidelines for definitions of course outline terms.

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LAKELAND STUDENT LEARNING OUTCOMES

		I	R	D
	LEARNS ACTIVELY			
1.	Takes responsibility for his/her own learning.			
2.	Uses effective learning strategies.			
3.	Reflects on effectiveness of his/her own learning strategies.			

		I	R	D
	THINKS CRITICALLY			
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.			
7.	Selects an option or position.			D
8a.	Implements a selected option or position.			D
8b.	Reflects on a selected option or position.			

		I	R	D
	COMMUNICATES CLEARLY			
9a.	Uses correct spoken English.			
9b.	Uses correct written English.			
10.	Conveys a clear purpose.			
11.	Presents ideas logically.			D
12a.	Comprehends the appropriate form(s) of expression.			D
12b.	Uses the appropriate form(s) of expression.			D
13.	Engages in an exchange of ideas.			

		I	R	D
	USES INFORMATION EFFECTIVELY			
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.			

		I	R	D
	INTERACTS IN DIVERSE ENVIRONMENTS			
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.