LAKELAND COMMUNITY COLLEGE – COURSE OUTLINE FORM*

*** APPROVED VERSION, EFFECTIVE Fall/ 18

ORIGINATION DATE:	9/28/17	**APPROVAL DATE:**	12/5/17
LAST MODIFICATION DATE:	1/30/17	**EFFECTIVE TERM/YEAR:**	FALL/ 18
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COURSE ID: **WELD1300**

COURSE TITLE: Thermal Cutting, Gouging, Brazing and Soldering

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

PREREQUISITE:

COURSE DESCRIPTION:

This course introduces students to oxyfuel cutting, carbon arc gouging, plasma arc cutting, oxyfuel hand and machine cutting, oxyfuel braze welding, brazing and soldering. Laboratory experience includes the oxy-acetylene cutting of low carbon steels, and manual oxy-acetylene and straight-line oxy-propane machine cutting of low carbon steel as well as carbon arc gouging on low carbon steel. Students learn how to plasma arc cut, use a plasma arc cutting table, and learn the basics in brazing and soldering on sheet metal and copper tubing. Laboratory experience includes an emphasis on individual instruction. The student must furnish: welding helmet (shade #10 or above); welding googles (shade 3-5); 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 introduces students to all of the various types of cutting, gouging, brazing and soldering processes used in industry today

OUTCOMES:

The course will

1. Introduce students to essential welding safety equipment and procedures.
2. Provide basic understanding of the oxy-acetylene and oxy-propane cutting processes.
3. Provide basic understanding of plasma arc cutting and carbon arc gouging processes.
4. Provide basic understanding of brazing and soldering on sheet metal and copper tubing.
5. Present the advantages, disadvantages, and quality of the different cutting processes.

6. Present the differences between brazing, soldering and welding.

PERFORMANCE INDICATORS:

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

1. Identify and apply safety procedures when working with thermal cutting equipment.

2. Perform oxyfuel cutting utilizing the hand-held torch on metal thicknesses of 1/8 to 1/2 in. steel plate.
3. Perform oxy-acetylene cutting utilizing the hand-held torch on metal thicknesses of 1/8 to 1/2 in. steel plate.

4. Perform oxy-propane cutting utilizing a cutting machine with straight-line capability, for low carbon steel of 3/16 to 1 in. plate thickness.

5. Perform carbon arc gouging on various joint configurations (t-joints, lap joints, butt joints, edge joints, corner joints and around pipe).

6. Perform plasma arc cutting on various ferrous and non-ferrous materials 20 gauge up to ½ inch.

7. Perform basic programing of the CNC plasma-cutting table. Create and cut out a project.

8. Demonstrate all processes in each position: Flat, horizontal, vertical (up & down), and overhead.

9. Compare the quality and merits of various cutting processes.

10. Perform brazing and soldering technique on sheet metal and copper tubing using the different joint configurations lap, t-joint, butt, corner, and edge joints.

COURSE OUTLINE:

I. Safety
   - A. Personal protective equipment
   - B. Safe handling of compressed gas cylinders and related equipment
   - C. Fire hazards
   - D. Hot work permit
   - E. Unique dangers associated with oxygen, acetylene and other gasses
   - F. Confined space
   - G. Safe practices when cutting tanks and other containers.

II. Oxyfuel Cutting
   - A. Oxygen supply
     1. Safety handling
     2. Liquid air process
   - B. Acetylene supply
     1. Safety handling
     2. Manufacturing process
   - C. Equipment
     1. Cylinders
     2. Valves
     3. Regulators
     4. Hoses
     5. Touch
   - D. Set-up
     1. Pressure settings

2. Tip sizes
E. Practical Cutting
1. Lighting/ Shut Down Procedures
2. Setting your Flame
a. Carburizing/ Reducing
b. Neutral
c. Oxidizing
3. Touch angles and speed
4. Visual Inspection
a. Drag Lines
b. Kurf
c. Dross
5. Metal gages 10 to 1/2in thick cutting
6. Demonstration, practice, and evaluation

III. Oxyfuel Cutting (Hand-Held Torch)
A. Principle of cutting
B. Plate preparation
C. Touch settings
D. Speed of operation
E. Demonstration, practice, evaluation

IV. Oxyfuel Machine Cutting
A. Comparison of different gases for cutting
B. Cutting machine operation
C. Comparison of different types of cutting machines
D. Electronic tracing explanation
E. Demonstration, practice, evaluation

V. Carbon Arc Gouging
A. Electrode Holder
B. Polarity
C. Air Supply
1. Air Pressure
D. Electrode Extension
E. Positions
F. Types of Materials
1. Ferrous and Non-ferrous
G. Demonstrate, Practice, and Evaluation

VI. Plasma Arc Cutting
A. Air Quality
B. Parts of the Torch
C. Air Pressure
D. Materials Thicknesses
E. Material Types
F. Material Positioning
G. Fourth State of Matter
H. Demonstrate, Practice, and Evaluation

VII. Basic Oxyfuel Cutting, Plasma Arc Cutting and Carbon Arc Gouging Metallurgy
A. Heat-affected zone
B. Audition of carbon from the oxy-acetylene flame
C. Distortion
D. Hard surfacing
E. Annealing

VIII. Plasma Arc Cutting Table
A. Basic Programming
B. Advantages of manufacturing with a cutting table
C. Duplication of parts
D. Quality, craftsmanship, and tolerances.

IX. Project Based Learning
- A. Basic Layout
  1. Soapstone
  2. Center Punch
  3. Scribe
  4. Blue Dykem
  5. Tape measure
  6. Ruler
  7. Speed Square
  8. Compass
- B. Basic Blueprint Reading
- C. Demonstrate, Practice, and evaluation

X. Brazing, Braze Welding and Soldering
- A. Joint design
  1. Lap
  2. Butt
- B. surface preparation
  1. Commercial Solvent
  2. Pickling in acid
  3. Sanding, filing, wire brush
- C. Fluxes& AWS numbering system
  1. Boric acid 3a
  2. Borates 3a
  3. Fluoride 1
  4. Fluoroborates 3b
  5. Chlorides 2
- D. Stopoffs
  1. Material used to outline areas not to be brazed
- E. Filler metals AWS classification
  1. B designates brazing process
     a. BAlSi (Aluminum-silicon
     b. BCuP (copper-phosphorus
     c. BAu (precious Metals
     d. BCuZm (copper-Zinc)
     e. BNi (nickel)
     f. BMg (Magnesium)
- F. Methods
  1. Furnace
  2. Torch
  3. Induction
  4. Dip
  5. Resistance

- G. Temperature
  1. Brazing
     a. 840 degrees F and higher
  2. Soldiering
     a. Less than 840 degrees F

INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:

Lectures, Project Based Learning, 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.			
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.			

		I	R	D
	COMMUNICATES CLEARLY			
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.			
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.