LAKELAND COMMUNITY COLLEGE – COURSE OUTLINE FORM*

*** APPROVED VERSION, EFFECTIVE Fall/ 18

ORIGINATION DATE:	8/10/17	**APPROVAL DATE:**	12/5/17
LAST MODIFICATION DATE:	1/23/18	**EFFECTIVE TERM/YEAR:**	FALL/ 18
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COURSE ID: **WELD1330**

COURSE TITLE: Basic GTAW (TIG) 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 (can be taken concurrently)

COURSE DESCRIPTION:

This course introduces students to the basic concepts involved in using the Gas Tungsten Arc Welding (GTAW) or (TIG) process to produce cost effective fillet and groove welds in the flat and horizontal positions. Welds are made in carbon steel, stainless steel, and aluminum. Familiarization with the equipment, set up, materials, and the manipulation technique are emphasized. 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 provides practical welding experience and knowledge for students wanting to understand and perform GTAW (TIG) fillet and groove welds in the flat and horizontal positions. This course will provide a pathway for employment in a welding field.

OUTCOMES:

The course will

1. Introduce students to essential welding safety equipment and procedures.

2. Provide knowledge as to the equipment, base materials and consumables used to make GTAW (TIG) fillet and groove welds in the flat and horizontal positions in carbon steel, stainless steel and aluminum.

3. Enable students to recognize an acceptable fillet and groove weld that is properly produced using various techniques utilized with the flat and horizontal positions and the safety techniques involved.

4. Introduce students to proper design, set-up, and techniques to produce cost effective fillet and groove welds utilizing the GTAW (TIG) process in the flat and horizontal positions.

5. Provide instruction and fillet and groove welding skill development in the GTAW (TIG) process in the flat and horizontal positions for carbon steel, stainless steel, and aluminum.

6. Enable students to recognize the advantages and disadvantages of using the process GTAW (TIG) fillet and groove welding in the flat and horizontal positions.

7. Introduce instruction in how industry uses the American Welding Society (AWS) numbering system.

PERFORMANCE INDICATORS:

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

1. Identify and apply safety procedures when working with welding equipment.

2. Identify 5 basic joint types and different weldment positions.

3. Produce an acceptable T, lap, butt, corner and edge joint in the flat and horizontal position on aluminum, carbon, and stainless steel utilizing the GTAW (TIG) process.

4. Describe the complete functionality of a GTAW welding machine.

5. Troubleshoot the GTAW machine and process to ensure proper settings and production of quality weldments.

6. Demonstrate proficiency in the GTAW process by producing welds in carbon steel, stainless steel and aluminum in the 1F. 2F. 1G & 2G positions that meet the visual inspection quality requirements of the AWS D1.1 code.

COURSE OUTLINE:

I. Safety
   - A. Personal protective equipment
   - B. Fumes and gases
   - C. Electric shock can kill
   - D. Fire and explosion
   - E. Arc rays can burn
   - F. Safe handling of compressed gas cylinders and related equipment

II. GTAW
   - A. Gas tungsten arc welding
     1. Alternate names for GTAW
        - a. Gas tungsten arc welding
        - b. Tungsten Inert Gas (TIG)
        - c. Heli-Arc

III. Electrodes
   - A. Tungsten or alloyed tungsten
     1. Non consumable electrode

IV. Shielding Gases
   - A. Inert gas =is a chemically unreactive and will not form a compound or react with the molten base metal
     1. Argon
     2. Helium
     3. Neon
     4. Krypton
     5. Xenon

B. Active gas = is reactive and will have a chemical reaction with the molten base metal

V. Shielding Gasses for GTAW Advantages and Disadvantages
- A. Argon
  1. Transfers less heat at 19 to 20 volts
  2. Better resistance to cross draft
  3. More abundant & low cost
- B. Helium
  1. 1.7 times hotter arc then the arc of argon
  2. Transfer more heat 23 to 24 volts

VI. Gas Flow
- A. SCFH Standard Cubic feet per hour
  1. Argon
  2. 15 to 20 scfh
- B. Helium
  1. 45 to 60 scfh

VII. Regulators
- A. Flowmeter / pressure regulator
- B. Cylinder pressure gauge
- C. Cylinder valve stem

VIII. Power Sources
- A. Constant Current
  1. SMAW
  2. GTAW
- B. Constant Voltage
  1. FCAW
  2. GMAW

IX. Current and Control Devices
- A. Foot
- B. Hand

X. Polarity
- A. AC Alternating polarity
  1. Aluminum
     a. DC- Penetration
     b. DC+ Cleaning
- B. DC-
  1. 70% heat in the plate
  2. 30% in the electrode
- C. DC+
  1. 70% heat in the electrode
  2. 30% heat in the plate

XI. High Frequency
- A. Continuous
  1. AC Aluminum and magnesium only
- B. Start only
  1. DC- only
- C. Off
  1. SMAW only

XII. Sine Wave Vs Square Wave
- A. Arc re-ignition
- B. Wave form percentages

XIII. Pulse
- A. Pulse per second

B. Background current
C. On time

XIV. Electrode Selection and Shape
A. Types EWX
1. Red, green, Brown, Grey
B. Thoriated types
1. Slightly radioactive
2. Not harmful unless grinding dust is inhaled

C. Sharpening and prepping
1. Conical
2. Balling

XV. AWS Filler Classification
A. Sizes typically used
B. ER70S-X
1. E-electrode
2. R-rod
3. 70-min. tensile strength
4. S-solid
5. X-chemistry
C. Stainless
1. 308L
2. 309L
3. 316L
D. Aluminum
1. 4043
2. 5356
E. Silicon Bronze
1. ERCuSi-A

XVI. TIG Torch
A. Water cooled
B. Air cooled

XVII. TIG Torch Parts
A. Back caps
B. Collet
C. Collet body
D. Nozzle
E. Gas lens

XVIII. Start Controls
A. Preflow
1. Gas before welding
B. Start control
1. Current at which arc initiates
C. Upslope
1. Time arc initiation to maximum current

XIX. End Controls
A. Finish current
1. Current at which the arc is terminated
B. Down slope
1. Time in seconds arc goes form max output to finish current
C. Post flow
1. Gas flow after arc is terminated

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.			
	THINKS CRITICALLY	**I**	**R**	**D**
4.	Identifies an issue or idea.			D
5.	Explores perspectives relevant to an issue or idea.			
6a.	Identifies options or positions.			
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.			
	COMMUNICATES CLEARLY	**I**	**R**	**D**
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.			
	USES INFORMATION EFFECTIVELY	**I**	**R**	**D**
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.			
	INTERACTS IN DIVERSE ENVIRONMENTS	**I**	**R**	**D**
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.