Lansing Community College



Course Cover Sheet

M-CAM Training Area:

CNC/Machining Multi-Skilled Mechatronics Production Operation Welding/Fabrications

Program(s): Welding Technology Certificate of Completion

Course: Welding 103 Combination Welding

Course Description:

Welding Basics-Combination Welding is a 96-hour beginning theory and practice course which will introduce the safe operations and applications of oxyacetylene, torch cutting, plasma cutting, Shielded Metal Arc Welding (SMAW) and Gas Metal Arc Welding (GMAW). Using these methods, students will join steel in the horizontal, flat and vertical positions.

Delivery method is hybrid.

Date Created: March, 2015.

Employer/Industry Partner: various manufacturing companies in Mid-Michigan.

Faculty Developer(s)/Instructional Designers(s): Scott Poe/Ann Lapo

College Contact: Jill Doederlein

Phone: 517.483.9665

Email: doederj@lcc.edu

Additional Information/Comments: Added use of the virtual welders to enhance course content.

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DESCRIPTION:

Welding Basics-Combination Welding is a 96-hour beginning theory and practice course which will introduce the safe operations and applications of oxyacetylene, torch cutting, plasma cutting, Shielded Metal Arc Welding (SMAW) and Gas Metal Arc Welding (GMAW). Using these methods, students will join steel in the horizontal, flat and vertical positions.

TOTAL TIME REQUIREMENT for the course is 96 hours.

PREREQUISITES: Reading Level 4.

OBJECTIVES:

After completing this course, the student should be able to:

Welding Safety and Fundamentals

- Choose the protection that should be worn for welding.
- Demonstrate cautionary handling of high pressure cylinders.
- Describe how to ventilate a welding area.
- Explain how to avoid electric shock.
- Identify and avoid possible health hazards for welding.
- Prevent fires in the welding shop.
- Identify and explain the safety devices built into oxygen and acetylene tanks.
- Distinguish between a fillet and groove weld.
- List the five basic welding joints.
- Name the four weld positions.
- Apply the Five Essentials of welding.
- Identify the parts of a weld, such as toes, legs, throat, fusion, and root.
- Identify discontinuities and defects including overlap, undercut, and porosity, and use nondestructive and destructive testing to evaluate welds.
- Interpret oxyacetylene tip chart by choosing the correct tips for various base metals and different metal thickness.
- Determine if regulators, both single and double stage, are functioning safely.
- Explain the steel designation system.
- Explain the elements of mild steel and the three categories of mild steel and weldability.
- Describe the functions of fluxes in making brazing joints.
- Identify different alloys and the temperature differences in brazing and soldering.

Oxyacetylene Cutting (OAC)

- Explain how the flame cutting process works.
- Set up an oxyacetylene cutting torch.
- Safely use an oxyacetylene gas cutting torch to make a variety of cuts.
- Clean a cutting tip.
- Check tip seal for leaks.

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OBJECTIVES: (continued)

SMAW Fundamentals

- Set up and safely operate shielded metal arc welding equipment.
- Identify the different types of power supplies used in welding.
- List the Five Essentials of welding.
- Explain the advantages and disadvantages of SMAW.
- Explain the fundamentals of alternating and direct current; as well as the application and principles of polarity.
- Explain and determine the amperage and voltage used, and the variables of amperage, for different material thicknesses.
- Describe the primary electrical device that is used to produce low-voltage, high-amperage current.
- Explain and demonstrate how to minimize and relieve stress and distortion.
- Choose the types of electrodes for different applications.
- Identify ferrous metals and non-ferrous metals.

Plasma Arc & Air Carbon Arc Cutting

- Demonstrate safety procedures for plasma arc cutting.
- Describe an electrical plasma.
- Explain how a plasma cutting machine and torch function.
- Set up and operate plasma arc cutting equipment
- Identify plasma arc cutting accessories.
- List the advantages and disadvantages of using a plasma arc cutting torch.
- Demonstrate safety procedures for carbon arc gouging.
- Set up and operate carbon arc gouging equipment.
- Explain the difference between a CAC-A torch and an electrode holder.
- Identify the base metals and electrodes used in CAC-A.

Gas Metal Arc Welding

- Provide technical understanding and applications of Gas Metal
- Demonstrate the safety procedures used in Gas Metal Arc Welding
- Define and use the major metal transfers in short circuit and spray metal transfers.
- Explain the consumable wire classification system for solid wire used in MIG Welding.
- Demonstrate the welding procedures and proper set-up for amperage (wire feed speed), effects of proper voltage, gas flow, wire stick out and MIG gun angles.

MATERIALS:

- <u>Welding: Principles & Applications</u>, 8th Ed.
- Modern Welding: complete coverage of the Welding Field

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MATERIALS: (continued)

- Arlo Steel:
 - 5 -sheets of 48"x96"x11 gauge Hot rolled mild steel
 - 5 -sheets of 48"x96" x 7 gauge hot rolled steel
 - o 1 sheets of 48"x96"x16 gauge hot rolled steel
 - 1- ¼"x7"x20' hot rolled steel (cut in half)
 - o 10'x3" schedule 40 pipe
- Air Gas
 - 9 cylinders of 75/25 shielding gas
- Purity
 - o 5 packs (10 in each) of .35 MIG Tips Part #KP2744-035
 - 10 each Nozzles Part #KP2742-1-62R
 - o 4 each SURARC S-6 .035 spool (44#) Part #ED030614
 - Grainger: Safety Glasses

GRADING POLICY:

- Satisfactory completion of training (at least 75%) recommended.
- Required competencies must be met for certification.

College Grading Standards	Percent
4.0 Excellent	91-100%
3.5	86-90%
3.0 Good	81-85%
2.5	76-80%
2.0 Satisfactory	71-75%
1.5	66-70%
1.0	60-65%
0.0	0-59%

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Transfer Potential

For transferability information, please consult the Transfer Equivalency Information located at the LCC website at <u>http://www.lcc.edu/transfer</u>. For additional transferability information, contact the LCC Academic Advising Center, (517) 483-1904.

The MACRAO Transfer Agreement simplifies the transfer of students from one Michigan institution to another. The most current MACRAO Transfer Agreement information can be found at http://www.lcc.edu/transfer/macrao_agreement.aspx.

Student Code of Conduct and General Rules and Guidelines

LCC supports a positive educational environment that will benefit student success. In order to ensure this vision, the College has established the LCC Student Code of Conduct and the Student General Rules and Guidelines to ensure the protection of student rights and the health and safety of the College community, as well as to support the efficient operation of College programs. In addition, the College has established guidelines for the redress of grievances by individuals accused in such proceedings. A copy of the most current Code can be found on the College's website at http://www.lcc.edu/catalog/policies_procedures/studentrulesguidelines.aspx#code.

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Activity
Lecture: Introduction to the course. Chapter: 2 Safety in welding
Lab: Flat bead
Lecture : Chapter 31 Oxyfuel welding equipment setup and operation and safety
Lab: Lap Weld
Lecture: Chapter 32 Oxyacetylene Welding
Lab: Flat Butt Weld
Lecture: Chapter 31Oxyfuel Gases and Filler Metals
Welding Defects associated with oxyacetylene welding
Lab: Vertical Up Butt Weld
Lecture: Chapter 33 Soldering, Brazing and Braze Welding
Lab: Horizontal Tee Braze
Lecture: Chapter 7 Flame Cutting, Review for Mid Term
Lab: Flat Butt Braze, Vertical up Braze, Torch Cutting Assignments
Lecture: Mid Semester Exam- Written Test
Lab: Mid Semester Exam- Practical Test
Lecture: Chapter 3 Introduction to Shielded Metal Arc Welding
Lab: Flat Pad 7018 electrode
Lecture: Chapter 3 & 4 Shielded Metal Arc Welding
Lab: Flat Pad with 7018 & 6010
Lecture: Chapter 4 & 28 Filler Metal Selection
Lab: Three Pass T Weld 7018 electrode
Lecture: Chapter 27 & 28 Filler Metal Selection and Weldability of Metals
Lab: Three Pass T Weld 6010 electrode

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12	Lecture: Effects of Distortion and ways to eliminate it, Welding Safety SMAW
	Lab: Vertical Down Weld 6010 electrode
13	Lecture: Chapter 25 Welding Metallurgy and Defects Associated with SMAW
	Lab: Vertical Up Weld 7018 electrode
14	Lecture: Chapter 8 & 9 Plasma Arc Cutting and Air Carbon Arc Gouging
	Lab: Vertical Up Tee Joints with 7018 & 6010 electrodes- Plasma Cutting and Air Carbon Arc Gouging
15	Lecture: Review SMAW and Oxyfuel Cutting for Final Exam
	Lab: Complete all unfinished Lab assignments
16 Final Exam	Lecture: Final- Written Exam
	Lab: Final- Practical Exam

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Upon successful completion of this course, students should be able to:

A. Welding Safety & Fundamentals

- 1. Choose the protection that should be worn for welding.
- 2. Demonstrate cautionary handling of high pressure cylinders.
- 3. Describe how to ventilate a welding area.
- 4. Explain how to avoid electric shock.
- 5. Identify and avoid possible health hazards for welding.
- 6. Prevent fires in the welding shop.
- 7. Identify and explain the safety devices built into oxygen and acetylene tanks.
- 8. Distinguish between a fillet and groove weld.
- 9. List the five basic welding joints.
- 10. Name the four weld positions.
- 11. Apply the Five Essentials of welding.
- 12. Identify the parts of a weld, such as toes, legs, throat, fusion, and root.
- 13. Identify discontinuities and defects including overlap, undercut, and porosity, and use nondestructive and destructive testing to evaluate welds.

B. Gas Welding

- 1. Explain how oxygen and acetylene are made and stored.
- 2. Determine tank pressures when the tanks are full.
- 3. Evaluate the similarities and differences between oxidizing, neutral, and carburizing flames and apply to various situations.
- 4. Identify and explain the uses of various parts of an oxyacetylene torch.
- 5. Demonstrate and/or explain the use of welding equipment to troubleshoot malfunctions and backfires.
- 6. Demonstrate the use of tip cleaners.
- 7. Interpret oxyacetylene tip chart by choosing the correct tips for various base metals and different metal thickness.
- 8. Determine if regulators, both single and double stage, are functioning safely.
- 9. Explain the steel designation system.
- 10. Explain the elements of mild steel and the three categories of mild steel and weldability.

C. Brazing and Soldering

- 1. Apply safety principles to brazing.
- 2. Define the terms soldering, brazing, and braze welding.
- 3. Explain the advantages and disadvantages of brazing.
- 4. Clean, assemble, and perform required brazing joints.
- 5. Describe the functions of fluxes in making brazing joints.
- 6. Identify different alloys and the temperature differences in brazing and soldering.

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D. Oxyacetylene Cutting (OAC)

- 1. Explain how the flame cutting process works.
- 2. Set up an oxyacetylene cutting torch.
- 3. Safely use an oxyacetylene gas cutting torch to make a variety of cuts.
- 4. Clean a cutting tip.
- 5. Check tip seal for leaks.

E. SMAW Fundamentals E-6010 and E-7018

- 1. Set up and safely operate shielded metal arc welding equipment.
- 2. Identify the different types of power supplies used in welding.
- 3. Use SMAW power supplies.
- 4. List the Five Essentials of welding.
- 5. Explain the advantages and disadvantages of SMAW.
- 6. Explain the fundamentals of alternating and direct current; as well as the application and principles of polarity.
- 7. Explain and determine the amperage and voltage used, and the variables of amperage, for different material thicknesses.
- 8. Describe the primary electrical device that is used to produce low-voltage, highamperage current.
- 9. Explain and demonstrate how to minimize and relieve stress and distortion.
- 10. Choose the types of electrodes for different applications.
- 11. Identify ferrous metals and non-ferrous metals.
- 12. Use the American Welding Society (AWS) electrode classification system.

F. Plasma Arc & Air Carbon Arc Cutting

- 1. Demonstrate safety procedures for plasma arc cutting.
- 2. Describe an electrical plasma.
- 3. Explain how a plasma cutting machine and torch function.
- 4. Set up and operate plasma arc cutting equipment
- 5. Identify plasma arc cutting accessories.
- 6. List the advantages and disadvantages of using a plasma arc cutting torch.
- 7. Demonstrate safety procedures for carbon arc gouging.
- 8. Set up and operate carbon arc gouging equipment.
- 9. Explain the difference between a CAC-A torch and an electrode holder.
- 10. Identify the base metals and electrodes used in CAC-A.

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Subject Matter Expert (SME) Course Review Summary

College: Lansing Community College

M-CAM Training Area: CNC/Machining Multi-Skilled/Mechatronics Production Operation Welding/Fabrication

Degree Program Name: Welding Technology Certificate of Completion

Title of Course: Combination Welding

Subject Matter Expert (SME) Reviewer Information

Name: Robert C. Hess

Title: Senior Instructional Designer/Trainer

Phone: 566-322-1033

Email: bob.hess@mhtechnologies.net

Organization/Affiliation: MH Technologies

Attach Resume or provide credentials (showing years of experience and work experience that is relevant to course content):

Synopsis of Findings:

1. Acceptable for training.



Reviewers Signature _____ Robert C. Hess

Date: <u>3/8/17</u>



Michigan Coalition for Advanced Manufacturing Subject Matter Expert Course Review

1. Course Overview and Objectives	Exceptional	Satisfactory	Ineffective
The goals and purpose of the course is clearly stated.		Х	
Prerequisites and/or any required competencies are clearly stated.		Х	
Learning objectives are specific and well-defined.		Х	
Learning objectives describe outcomes that are measurable.		Х	
Outcomes align to occupational focus (industry skills and standards).		Х	
Comments or recommendations:			
2. Material and Resources	Exceptional	Satisfactory	Ineffective
The instructional materials contribute to the achievement of the course learning objectives.		х	
The materials and resources meet/reflect current industry practices and standards.		х	
The instructional materials provide options for a variety of learning styles.		Х	
Resources and materials are cited appropriately. If applicable, license information is provided.		Х	
Comments or recommendations:			
3. Learning Activities	Exceptional	Satisfactory	Ineffective
Provide opportunities for interaction and active learning.		X	
Help understand fundamental concepts, and build skills useful outside of the learning object.		Х	
Activities are linked to current industry practices and standards.		X	

A Accordment Tools (Criteria for Evaluation	Exceptional	Satisfactory	Inoffective
	Exceptional	Satisfactory	ineffective
The course evaluation criteria/course grading policy is stated clearly on syllabus.		Х	
Measure stated learning objectives and link to industry standards.		Х	
Align with course activities and resources.		Х	
Include specific criteria for evaluation of student work and participation.		X	
Comments and recommendations:			
5. Equipment/Technology	Exceptional	Satisfactory	Ineffective
5. Equipment/Technology Meets industry standards and needs.	Exceptional	Satisfactory X	Ineffective
5. Equipment/Technology Meets industry standards and needs. Supports the course learning objectives.	Exceptional	Satisfactory X X	Ineffective
5. Equipment/Technology Meets industry standards and needs. Supports the course learning objectives. Provides students with easy access to the technologies required in the course/module.	Exceptional	Satisfactory X X X	Ineffective
5. Equipment/Technology Meets industry standards and needs. Supports the course learning objectives. Provides students with easy access to the technologies required in the course/module. Comments and recommendations:	Exceptional	Satisfactory X X X X	Ineffective
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Robert C. Hess

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Qualifications

Dedicated, articulate, and enthusiastic with strong analytical and organizational abilities. Effective communication and interpersonal skills. Ability to work independently or as an integral part of a team to accomplish goals. Experience prioritizing and completing numerous concurrent responsibilities while meeting time and organizational goals. Sound professional attitude, strong work ethic and pride in personal performance.

Experience

2015 – Present M H Technologies LLC Senior Instructional Designer/Trainer

- Perform Needs Analysis and quote training programs
- Develop on-line training programs, system manuals, student workbooks, and job aids •
- Deliver on-site training programs

2002 - 2015 **R.C.** Technologies

Business Owner – R.C. Technologies

- Research and quote training programs
- Development of training programs for Ford Motors, DaimlerChrysler, General Motors, Kuka Robotics, Fame Conveyor, Lamb Technicon, Delphi, Magna, and SPX
- Design training programs, system manuals, student workbooks, PowerPoint presentations, and job aids
- Deliver on-site training programs .
- Professional Industrial photography

1995 - 2002DCT Inc.

Training Designer

- Research and quote training programs •
- Design training programs, system manuals, student workbooks, and job aids
- Deliver on-site training programs •

1990 - 1995**Bond Robotics Training Manager / Field Service Engineer**

- Managed Training Department •
- Research and quote training programs •
- Design operation and maintenance manuals plus training guides •
- Deliver all training programs
- Perform on-site electrical and mechanical customer support for installation, start-up, and debugging of pressroom automation

1986 - 1990**Robotic Vision Systems, Inc. Sterling Heights** Field Service Engineer / Trainer

Research, installation, programming and training of 3D vision guided robotic welding and sealant systems for military, aerospace, and automotive industry

1977 - 1981 Education

Ferris State University

Big Rapids, MI

BSEE

Shelby Twp. MI

Sterling Heights, MI

Sterling Heights, MI

Warren, MI