

Lansing Community College

Course Cover Sheet



M-CAM Training Area:

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

Program(s): Intro to Mechatronics Block 1-3

Course: Fluid Power and Electrohydraulic/Pneumatics

Course Description: This course covers the principals of fluid power, calculations of physical properties of fluids, troubleshooting fluid power components and systems with an emphasis on safety.

Student will learn how to use control valves, pumps, actuators, accumulators, reservoirs, fluids, filters, hose, piping, and tubing. Preventive and predictive maintenance techniques will also be discussed.

Date Created: July, 2016. February/March, 2017

Employer/Industry Partner: Magna/DexSys, Lansing, Michigan and various manufacturing companies in Mid-Michigan.

Faculty Developer(s)/Instructional Designers(s): Sidney Mosley/Ann Lapo

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Additional Information/Comments: Due to the increased need to offer a flexible delivery format to meet the needs of students'/workers' busy schedules, LCC partnered with AMTEC (Automotive Manufacturing Technical Education Collaborative) led by Kentucky Community Technical College to offer open entry open exit modular courses in a hybrid format (lessons online and hands-on labs with an instructor on campus). LCC instructors added content based on the needs of local industry.

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DESCRIPTION:

This course covers the principals of fluid power, calculations of physical properties of fluids, troubleshooting fluid power components and systems with an emphasis on safety.

Student will learn how to use control valves, pumps, actuators, accumulators, reservoirs, fluids, filters, hose, piping, and tubing. Preventive and predictive maintenance techniques will also be discussed.

TOTAL TIME REQUIREMENT for the course is approximately 112 hours.

PREREQUISITES: Reading Level 4. Writing Level 4. Math Level 5. All Introduction to Mechatronics Block 1 courses (Safety, Computer Literacy, Print Reading, Machine Tool Operations, Welding) and knowledge of Basic Electricity or equivalent.

OBJECTIVES: (for a complete list of objectives, see each module)

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

- List and describe safety rules specific to hydraulics and pneumatics.
- Demonstrate an understanding of safety circuits and guarding.
- Describe the OSHA requirements for lock out tag out, as well as blockout equipment for safety, removing lock out tag out, and restoring service.
- List ways hazardous waste is properly handled.
- Describe the properties, advantages, and disadvantages of fluid power systems.
- Calculate force, pressure, flow, and area requirements using formulas as applied to fluid power systems.
- Explain series parallel rules in regard to fluid flow and velocity.
- List the typical components of a basic pneumatic system.
- Explain the relationships of compressed air in terms of pressure, volume, and temperature.
- Describe vacuum types used in a pneumatic system.
- Interpret fluid power schematics, sequence of operations, and exploded views.
- Select the appropriate type of valve for an application.
- Describe valve mounting methods and standards.
- Disconnect valve from manifold.
- Replace a valve following appropriate replacement practices; confirming appropriate type, and return valve to service.
- Troubleshoot hydraulic pumps: pressure and flow, visual inspection for leaks, inspection of coupling device to motor, abnormal heat, sound or vibration, checking operation of relief valve.
- Repair hydraulic pumps: disassembly and replacement of bad components, flushing pump with chemicals as appropriate, and cleaning with compressed air.
- Identify air compressor types and uses.
- Describe troubleshooting actuators in terms of: inspection for leaks, verification of air or fluid to the actuator (pressure), documenting maintenance and service.
- Verify functions, style and type of accumulators: bladder-type, diaphragm-type, piston-type, spring-loaded type.

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OBJECTIVES *(continued)*:
for a complete list of objectives, see each module

- Explain how accumulators work.
- Describe the maintenance of actuators: installing gas accumulators, charging gas accumulators, removing bladder-type and piston-type accumulators, repairing piston-type accumulators.
- Describe the proper way to add hydraulic fluid to a tank.
- Identify types of hydraulic oil coolers.
- Describe pneumatics reservoirs, types of pneumatic dryers and their functions.
- Explain the types and physical/chemical properties of hydraulic fluids
- Explain the sources and effects of contamination in hydraulic and pneumatic systems: hydraulic fluid, hydraulic components, pneumatic components.
- Apply ISO cleanliness codes.
- Describe the maintenance of filtration systems.
- Replace hydraulic filters.
- Size hose and tubing based on flow and velocity (fps) of oil in the line.
- Demonstrate tube flaring, compression fitting and hose crimping.
- Adjust the pneumatic pressure regulator and hydraulic pressure relief valve correctly.
- Identify the impact of pressure and flow on mechanical equipment.
- Demonstrate the ability to adjust pressure and flow to equipment specifications.
- Describe the procedures for Zero and Span adjustment on the AMTEC Trainer (or equivalent equipment).
- Describe the procedures for Gain and Ramp adjustment on the AMTEC Trainer (or equivalent equipment).
- Adjust the pressure sensor (and counter-pressure if required).
- Make an adjustment to a switch.
- Explain the steps of the Troubleshooting Method.
- Explain the Assessment Stage of the Troubleshooting Method: pre-assess, actual assess.
- Explain the stages of the Troubleshooting Method: Planning, Diagnosis, Repair, Confirm, Document.

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101 Fluid Power and Electrohydraulics/Pneumatics consists of seven modules:

1011 - Fundamentals of Fluid Power and Electrohydraulics/Pneumatics (5 lessons to read on your own.)

Explains the fundamental concepts of fluid power: the principals of fluid power, calculations of physical properties of fluids and their ability to do work. This module introduces the various fluid power components, symbols, circuits. It introduces troubleshooting of fluid power components and systems with an emphasis on safety.

1012 - Flow, Directional, Pressure Control Valves (3 lessons to read on your own, 5 labs to do at LCC with an instructor)

Explains hydraulic and pneumatic control valves: directional controls, which control the direction of fluid flow; pressure controls, which perform functions such as limiting maximum system pressure and regulating reduced pressure in certain portions of a circuit; and the use and types of flow controls in a hydraulic and pneumatic circuit.

1013 - Pumps, Actuators and Accumulators (4 lessons, 7 labs)

Explains different types of pumps, actuators and accumulators used in fluid power systems, which create flow and change fluid power into mechanical power, and devices that store energy in the system.

1014 - Reservoirs, Fluids and Filters (4 lessons, 2 labs)

This module covers the functions of hydraulic/pneumatic reservoir and reservoir components. Students will learn properties and requirements for fluids as well as how filters are used to maintain cleanliness in fluid power systems.

1015 - Hose, Piping and Tubing (3 lessons, 2 labs)

Covers various types of conductors that carry fluid through a system. The focus will be on fittings, hose, and steel tubing used in fluid power systems. Participants will cover selection, proper assembly, installation, and troubleshooting of these components to achieve a leak-free system.

1016 - Electrohydraulic/Pneumatic (10 lessons, 9 labs)

An introduction to the fundamentals of electro-fluid power, including basic electrical principles, basic fluid power principles, electro-fluid power limit devices, common electro-fluid power troubleshooting principles and practices, as well as preventive and predictive maintenance of electro-fluid power systems.

1017 - Fluid Power Systems and System Troubleshooting (7 lessons, 8 labs)

This module explains troubleshooting of hydraulic and pneumatic systems: tracing out systems, isolating the problem, safe testing and inspection techniques, combination circuits and combined electro-hydraulic/pneumatic systems.

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MATERIALS:

Online portion of the class:

Software: Internet access, Web browser, word-processing software, Adobe Reader, up-to-date virus protection for the online portion of this course.

- Go to elearning.autoworkforce.org – modules 1012, 1013, 1014, 1015, 1016, 1017 to access the lessons, labs specifications and assessments for this course.

Hands-on labs portion of the class:

- Tools and equipment specified in the Resources section—per module — for each hands-on lab.

GRADING POLICY:

- Successful completion of all Labs (at least 80% recommended). Rubrics provided in AMTEC online specify how grading is determined.
- Successful completion of each module’s post-assessment (at least 80% recommended).

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%

ACCEPTABLE USE POLICY:

Computer Resources

Use of College-owned computer resources is a privilege extended by the College to students, employees, and other authorized users as a tool to promote the mission of the College. All users agree to be bound by the terms and conditions of the LCC Acceptable Use Policy at the time they complete an account application form. Copies of the LCC Acceptable Use Policy are available at the Library Circulation Desk and may also be accessed on the World Wide Web. The URL is http://www.lcc.edu/policy/policies_1.aspx#ACCEPTABLE_USE_POLICY

Transfer Potential

For transferability information, please consult the Transfer Equivalency Information located at the LCC website at <http://www.lcc.edu/transfer>. 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.

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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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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:

Title of Course: Mechatronics Fluidpower and Electrohydraulic/Pneumatic

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. In Lab 1016, the document is cut off, must resize to be able to see document.

Reviewers Signature _____ Robert C Hess _____

Date: _____ 3/8/17 _____

**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.		X	
Prerequisites and/or any required competencies are clearly stated.		X	
Learning objectives are specific and well-defined.		X	
Learning objectives describe outcomes that are measurable.		X	
Outcomes align to occupational focus (industry skills and standards).		X	
Comments or recommendations:			
2. Material and Resources	Exceptional	Satisfactory	Ineffective
The instructional materials contribute to the achievement of the course learning objectives.		X	
The materials and resources meet/reflect current industry practices and standards.		X	
The instructional materials provide options for a variety of learning styles.		X	
Resources and materials are cited appropriately. If applicable, license information is provided.		X	
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.		X	
Activities are linked to current industry practices and standards.		X	

**Michigan Coalition for Advanced Manufacturing
Subject Matter Expert Course Review**

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

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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 | Warren, MI |
| Senior Instructional Designer/Trainer | | |
| <ul style="list-style-type: none">• 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 | Shelby Twp. MI |
| Business Owner – R.C. Technologies | | |
| <ul style="list-style-type: none">• 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 – 2002 | DCT Inc. | Sterling Heights, MI |
| Training Designer | | |
| <ul style="list-style-type: none">• Research and quote training programs• Design training programs, system manuals, student workbooks, and job aids• Deliver on-site training programs | | |
| 1990 – 1995 | Bond Robotics | Sterling Heights, MI |
| Training Manager / Field Service Engineer | | |
| <ul style="list-style-type: none">• 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 | | |
| <ul style="list-style-type: none">• Research, installation, programming and training of 3D vision guided robotic welding and sealant systems for military, aerospace, and automotive industry | | |
| Education | 1977 – 1981 | Ferris State University |
| | | Big Rapids, MI |
| | | <ul style="list-style-type: none">• BSEE |