M-CAM Training Area:
☐CNC/Machining ☒Multi-Skilled Mechatronics ☐Production Operation ☐Welding/Fabrications

Program(s): Automated Systems

Course: Automated Systems METS 145

Course Description:
This course introduces students to automated system basics, including electrical components, mechanical components, electrical drives, pneumatic and hydraulic control circuits, and programmable logic controllers (PLCs). The student will be able to troubleshoot a complex mechatronics system and correct malfunctions.

Delivery method is hybrid.

Date Created: Fall Semester, 2016

Employer/Industry Partner: various manufacturing companies in Mid-Michigan. See Advisory Board to LCC's Technical Careers Division and corporate training needs from LCC's Business & Community Institute.

Faculty Developer(s)/Instructional Designers(s): Nathan Joseph/Sid Mosley/Ann Lapo

College Contact: Jill Doederlein

    Phone: 517.483.9665

    Email: doederj@lcc.edu

Additional Information/Comments: Developed to answer the needs of manufacturing companies served by Lansing Community College as recommended by Advisory Board membership to LCC's Technical Careers Division and faculty expertise.

The eight community colleges and MCAM is an equal opportunity employer/program provider. Auxiliary aids and services are available upon request to individuals with disabilities. TTY users please call 1-877-878-8464 or visit www.michigan.gov/mdcr."

LANSING COMMUNITY COLLEGE *Where Success Begins*

AUTOMATED SYSTEMS METS-145

Fall 2016   Section All   3 Credits   08/25/2016 to 11/21/2016   Modified 08/04/2016

DESCRIPTION

This course introduces students to automated system basics, including electrical components, mechanical components, electrical drives, pneumatic and hydraulic control circuits, and programmable logic controllers (PLCs). The student will be able to troubleshoot a complex mechatronics system and correct malfunctions. (Sp)

Requisites

Prerequisite: Minimum 2.0 in (METS 102 or ELTE 102 or DCTM 102 or HVAC 102 or WELD 102 or concurrently) and Reading Level 3 and Writing Level 2 and Math Level 3

Contact Hours

Lecture	24	Lab	48	Other	0	Total Hrs	72

OUTCOMES

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

1. Apply safety rules while working on a mechatronic system.
2. Describe what comprises an automated system or subsystem.
3. Describe the basic physical properties of hydraulic, pneumatic, electrical, and mechanical components.
4. Trace and describe the flow of energy in a given automated system or subsystem.
5. Explain the role of various electrical, mechanical, robotic, and PLC components within a given system.
6. Given technical documents, reports, and prints, identify malfunctions in automated systems.
7. Correct malfunctions or identify the expertise required to correct the malfunction(s).
8. Transfer troubleshooting skills learned from one system to another.

MATERIALS

Tools, Equipment, or Apparel (required of the student)

1. Safety glasses (worn during labs).
2. Leather type shoes are required to protect students (no canvas type or open type shoes will be accepted).

EVALUATION

Student Electronic Access to Grades

Desire2Learn (D2L) is the College's Course Management System which includes a gradebook function allowing students access to their grades in order to receive timely and meaningful feedback on their progress in the course at any time. These grades will align with the Evaluation Criteria listed in this syllabus. D2L is accessed through the MyLCC page.

Whenever practicable, results for graded items should be posted electronically within 48 hours after the instructor has completed the grading process for the items, and final grades for the course should be entered no later than the specified grading day.

If your instructor is using an electronic gradebook system other than D2L, instructions on accessing that system will be provided below.

Criteria

Type	Weight	Topic	Notes
Assignments	10-25%		
Final Exam	15-30%		
Projects/Labs	10-30%		
Quizzes	10-30%		

Breakdown

College Standard	
College Grading Standards	Recommended Guidelines for Student Grades
4.0 --- Excellent	4.0 --- 91 – 100%
3.5 --- ---------	3.5 --- 86 – 90%
3.0 --- Good	3.0 --- 81 – 85%
2.5 --- ---------	2.5 --- 76 – 80%
2.0 --- Satisfactory	2.0 --- 71 – 75%
1.5 --- ---------	1.5 --- 66 – 70%
1.0 --- Poor	1.0 --- 60 – 65%
0.0 --- --------	0.0 --- 0 – 59%

COURSE POLICIES

Class Attendance/Participation

Other

Extra Credit

Extra credit may be available in this course. This information is provided by the section instructor.

Electronic Gradebook

INSTITUTIONAL POLICIES

Transfer Potential

For transfer information, please consult the LCC website at http://www.lcc.edu/transfer.

The Michigan Transfer Agreement (MTA) and the MACRAO Transfer Agreement simplify the transfer of students from one Michigan institution to another. MACRAO will be replaced by the MTA which is effective for students entering Fall 2014 or later. Students who started prior to Fall 2014 will be able to complete the MACRAO Transfer Agreement through Summer 2019, or they may complete the MTA requirements. The most current MTA information can be found at http://www.lcc.edu/transfer/mta.aspx and the current MACRAO information is available at http://www.lcc.edu/transfer/macrao_agreement.aspx.

For additional transfer information contact the Academic Advising Center in the Gannon Building - Star Zone, (517) 483-1904.

Disability Statement

Students with disabilities who believe that they may need accommodations in this class are encouraged to contact the Center for Student Access, Gannon Building, Star Zone - Campus Resources (http://lcc.edu/odss) or by calling (517) 483-1924 [TTY (517) 483-1207] as soon as possible to better ensure that such accommodations are implemented in a timely fashion.

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/student rulesguidelines.aspx#code.

It is the responsibility of the student to be familiar with, and abide by, the Student Code of Conduct, as well as the General Rules and Guidelines. Furthermore, the instructor may establish reasonable guidelines within the classroom environment. Violations of the Student Code may be reported to the Office of Student Compliance.

Enrollment Verification

Class attendance and participation are essential to student success. Instructors will update class rosters by the 8th day after the start date of sections less than 8 weeks long, and by the 15th day after the start date of sections 8 weeks or longer to accurately reflect student enrollment in each course. Students who have not attended by these dates may be administratively dropped and responsible for any required tuition and fee charges.

Robotics and Automated Systems
Class Schedule
(Schedule subject to change as class needs warrant.)

Week/Date	Topic	Exercise/Activity	Homework
Week 1 First meeting time	Introductions, Festo system, four families of components, D2L, Course layout	Operate the Festo system, communicate using D2L, identify components within the four families of electrical, mechanical, fluid power, and computer control	Read from the beginning of the Festo distribution station manual through to and including page 22
Week 1 Second meeting time	Mechatronics curriculum and certifications, applications and characteristics of power supplies	Power supply exercise	Read electrical fundamentals pages 1-7 and review resistor specs color code
Week 2 First meeting time	Review power supplies, simple troubleshooting, multimeters	Multimeter exercise using resistors, begin distribution lab 1	Finish reading electrical fundamentals
Week 2 Second meeting time	Schematics		
Week 3 First meeting time	Data sheets	Distribution lab 1-2	Read electrical control devices
Week 3 Second meeting time	Component user manuals and parts list	Distribution lab 3	Review troubleshooting guide

Week 4 First meeting time	Grafcet, comparison of IEC and NEMA symbols, troubleshooting	Troubleshooting – instructor implements faults, assign roles of troubleshooters and observers	Review metric prefixes
Week 4 Second meeting time	I/O list	Distribution lab 4	Review American wire gauge conductor size table and sensors document
Week 5 First meeting time	Open class discussion	Distribution lab 5-6	Review all troubleshooting documents
Week 5 Second meeting time	Sensors	Testing lab 1	
Week 6 First meeting time	Siemens troubleshooting method	Troubleshooting – instructor implements faults, swap role of troubleshooter and observer	Read Festo fundamentals of pneumatics
Week 6 Second meeting time	PowerPoint on vacuum	Vacuum lab	

Week 7 First meeting time	CVS design template and graphic symbols guide	Testing lab 2	Gain familiarity with the CVS guide
Week 7 Second meeting time		Testing lab 3	
Week 8 First meeting time	ISO symbols presentation, fluid power symbols	Testing lab 4	Review fluid power documents
Week 8 Second meeting time	Open class discussion	Troubleshooting – instructor implements faults, students choose role of troubleshooter and observer	Relax
Week 9 First meeting time	Mechanical vs electrical components	Testing lab 5	Review DC motors
Week 9 Second meeting time	DC motor basics, and working principle of DC motors	Process lab 1	Review gear types

Week 10 First meeting time	Gear types	Process lab 2	Review PLC fundamentals
Week 10 Second meeting time	PLCs overview	Troubleshooting – students implement faults and choose roles	Review basic PLC operation
Week 11 First meeting time	PLC hardware	Process lab 3	Review lessons in electric circuits
Week 11 Second meeting time	PLC software, Boolean fundamentals	Process lab 4	Gain familiarity with Siemens and AB PLC documentation
Week 12 First meeting time	PLC programming and applying Boolean logic	Process lab 5	Review PLC documentation
Week 12 Second meeting time	Open class discussion, PLC troubleshooting	Final troubleshooting – instructor implements faults	

Updated 10/16/16

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: Automated Systems Technology

Title of Course: Mechatronics Automated Systems

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: _____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:			

M-CAM   Bay de Noc | Grand Rapids | Kellogg | Lake Michigan | Lansing | Macomb | Mott | Schoolcraft

Robert C. Hess

47737 Remer Ave.
Shelby Twp., MI 48317
586-322-1033
bob.hess@mhtechnologies.net

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

- 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

- 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

- 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

- 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

Education **1977 – 1981** **Ferris State University** **Big Rapids, MI**

- BSEE