Lake Michigan College

Course Cover Sheet

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

Program(s): Mechatronics Technology

Course: Introduction to Robotics

Course Description:

SUBJECT	TITLE	CONTACT HOURS	COURSE DESCRIPTION
MANU 122	INTRODUCTION TO ROBOTICS	45	An introductory course designed to familiarize students with types of robots, axis designation, applications, terminology, drive systems and control systems as related to industrial robots.

Date Created: Work completed on 08/18/15

Faculty Developer(s)/Instructional Designers(s): Nathan Kramb

Employer/Industry Partner: Miller Welding Supply (Steve Hollis)

College Contact: **Kenneth W. Flowers, PhD.**

          Phone: **(269) 927-4103**

          Email: **flowers@lakemichigancollege.edu**

Additional Information/Comments:

This course existed at Lake Michigan College prior to the involvement in the TAACCCT grant. The development done linked to the grant was to incorporate Tooling U., an online curriculum vendor. Course adaptation was completed in August, 2015. The college's Manufacturing Committee provided guidance regarding the adaptation of this course. Mach Mold, Liberty Steel, Custom Tool, Kelm Acubar, Shoreline Mold, M & I, JRR Automation, Hanson Mold, QME, K & M, Midwest Tool, West Michigan Tool, Maximum Mold, Michigan Mold, Griffin Tool, Accu Die, Eagle Technologies, and Standard Tool, are members of the Manufacturing Advisory Committee.

INTRO TO ROBOTICS
COURSE SYLLABUS

I.   COURSE IDENTIFICATION

A.	Discipline	Manufacturing
B.	Title & Number	Introduction to Robotics MANU 122
C.	Credit Hours	2
D.	Contact Hours	3
E.	Instructor	Nathan Kramb
F.	Office Number	MT 101
G.	Telephone	927-4244
H.	Email address	nkramb@lakemichigancollege.edu
I.	Prerequisite(s)	
J.	Semester & Academic Year	

II.   TEXTBOOKS AND/OR EQUIPMENT /SUPPLIES

   (purchased by student)

A.   Required : **Tooling U subscription**

B.   Additional Resources

III.   COURSE DESCRIPTION FROM CATALOG

An introductory course designed to familiarize students with types of robots, axis designation, applications, terminology, drive systems, and control systems as related to industrial robots.

IV.   GENERAL EDUCATION AREA(S) MET

There are no General Education areas met in this course:

V.   GOALS AND OBJECTIVES

Upon completion of this course the student will/should be able to:

1.   Explain productivity as related to manufacturing nationally and internationally.

   A.   Explain what productivity is and how it is measured.

   B.   Explain how international productivity affects productivity in the U.S.A.

   C.   Describe the factors leading to increased productivity.

2. Describe the significance automation will have in increasing productivity.
   A. Understand what part automation has played in the history of manufacturing in the United States.
   B. Understand what part automation will play in the future of manufacturing in the United States.

3. Understand what an industrial robot is, and explain the capabilities and limitations.
   A. Describe the four configurations a robot may have.
   B. Describe the three levels of control a robot may have.
   C. Describe the three power sources a robot may have.

4. Identify input devices robots may have to sense characteristics of the real world.
   A. Distinguish between contact and non-contact sensors.
   B. List what types of real world objects can be sensed.
   C. Describe the capabilities and limitations of vision systems.

5. Identify jobs robots are currently performing and explain why robots are incapable of performing many manufacturing jobs.
   A. List jobs robots are doing and explain why.
   B. List jobs robots cannot do and explain why.

6. Explain the process of economically justifying a robotic installation.
   A. Identify the cost and saving factors of a robotic installation.
   B. Understand the financial cost and saving factors of a robotic installation.
   C. Understand the financial analysis methods used to evaluate the cost effectiveness of installing robots and automated systems.

7. Explain why robots and automation in themselves are not the solution to America's lagging productivity.

VI. EXPECTED STUDENT OUTCOME(S)
Students will be able to identify three basic components of an industrial robot and the three additional components that are needed to complete a typical industrial robot system.

VII. INSTRUCTIONAL METHODOLOGY
During the semester you may be asked to participate in Assessment of learning activities that will not be graded. Your instructor will use the

information that you provide to better gage your comprehension of course material: and, as appropriate, will modify how course material is presented in order to better prepare you to successfully complete graded assignments.

VIII. WRITING ACROSS THE CURRICULUM STRATEGY

The student will find three articles, in newspapers, magazines, internet, or trade journals, related to robotics or automated manufacturing. The student will then write a one page report of the article, including his/her personal reaction.

IX. GRADING CRITERIA AND REQUIREMENTS

Grading criteria is based on average points scored determined by labs, Tooling U assessments, and/or other assignments listed on assignment schedule. See grading scale below to identify averages.

X. GRADING SCALE

Grading Scale:100-90% = **A**   89-80% = **B** 79-70% = **C** 69-605 = **D** 59-0% = **E**

XI. MAKE-UP POLICY

Make-up Policy will be at the discretion of the instructor.

XII. ATTENDANCE POLICY/WITHDRAWAL POLICY

Students are expected to attend all class sessions. If classes are missed, it is the student's responsibility to complete all assignments. A sign-in sheet will be used for attendance. Failure to sign-in may result in an absence. For withdrawal policy, see College catalog.

Mindful of the diverse student body that Lake Michigan College serves, and the varied belief systems that its students represent, the College will make a reasonable effort to accommodate students who need to be excused from classes for the observance of religious holidays. This policy does not apply to students who knowingly register for classes scheduled to meet on days that consistently conflict with their day of worship, e.g., a student who signs up for Saturday classes when the student normally worships on Saturday.

XIII.   ACADEMIC HONESTY POLICY

The principles of truth and honesty are recognized as fundamental to a community of teachers and scholars. Lake Michigan College expects that both faculty and students will honor these principles and in doing so protect the integrity of College grades. This means that all academic work will be done by the student to whom it is assigned without giving or receiving unauthorized aide of any kind. Instructors will exercise care in the planning and supervision of academic work so that honest effort will be positively encouraged. Cheating and plagiarism are the two most obvious violations of academic honesty. In brief, plagiarism is borrowing ideas, words, organization, etc. from another source or person and claiming them as original.

Any dishonest activity may result in failure of specific assignments or an entire course. Flagrant and/or repeated violations of Academic Honesty will result in disciplinary action up to and including expulsion from Lake Michigan College.

XIV.   DISABILITY STATEMENT

Students with a documented disability may wish to consult with the Student Resource Center. They can be reached at 269-927-8866. A counselor can work with you to develop an accommodation plan that will be shared with your instructors. See me if you need further information.

XV.   ASSIGNMENT SCHEDULE
The Assignment Schedule will be followed as closely as possible; however, changes may be made at the instructor's discretion.

ASSIGNMENT SCHEDULE

Category	Assignment Name	Due Date
ToolingU Courses	Intro to Robotics 110	All due by _____
	Robot Safety 115	
	Robot Components 120	
	End Effectors 125	
	Applications for Robots 130	
	Robot Axes 140	
	Robot Sensors 150	
	Robot Troubleshooting 160	
	Robot Maintenance 170	
	Concepts of Robot Programming 210	
	Robotic Drives, Hardware, and Components 220	
	Robot Installations 230	
	Robotic Control Systems 240	
	Vision Systems 250	
	Industrial Network Integration 260	
Introductory Paper	Student will do a one page paper on how robotics can be used in their place of employment. **PLEASE EMAIL ALL WRITTEN ASSIGNMENTS TO flowers@lakemichigancollege.edu**	Due by _____
Research Assignments	Student will read three articles(magazine, books or internet) and write a summary not to exceed one page. **PLEASE EMAIL ALL WRITTEN ASSIGNMENTS TO flowers@lakemichigancollege.edu**	Article 1 due _____ Article 2 due _____ Article 3 due _____

MANU 122 Introduction to Robotics
Weekly Schedule

Date:	Lectures/Discussion	Machine Demo & Practice (Labs)	Homework	Tooling U HW. Class ID Class Name
Week 1	• Course Introduction • Syllabus Overview • Intro to Robot Jogging	• Demo Robot Jogging • Student Practice		-Intro to Robotics 110 -Robot Safety 115
Week 2	• Jogging in Joint, World, & Tool Modes • Resetting Errors • POSN button	• Robot Movement/Jogging		-Robot Components 120
Week 3	• Tool Center Point Setup – 3 Point Method	• Tool Center Point using 3 point method	**Intro Paper Due**	-End Effectors 125
Week 4	• Introduction to Programming • Termination Types • Speeds & Testing	• Create a program that moves the robot to 3 or more objects • Create a program that traces shapes with straight edges. Vary the speeds & terminations		-Applications for Robots 130
Week 5	• Copy/Paste Commands • WJT Option • Direct Entry TCP • Introduction to User Frames	• Create a program that uses various copy/paste commands • Input a TCP using the direct entry method • Create user frame		-Robot Axes 140
Week 6	• User Frames (cont.) • Circular Motions • Point Information	• Create and use user frame • Create a program that traces shapes that contain arcs & circles	**Article 1 Due**	-Robot Sensors 150
Week 7	• Inputs/Outputs • WAIT commands • Program Looping	• Input/Output Lab		-Robot Troubleshooting 160
Week 8	• Midterm Exam	• Midterm Exam • Open Lab (catchup/practice)		-Robot Maintenance 170
Week 9	• CALL commands	• MAIN program creation		-Concepts of

* Assignment schedule may change without notice.

	• WAIT (time) • Remarks, Timers, Comments	• CALL sub-programs • Document programs		Robot Programming 210
Week 10	• IF/CALL • Registers for counting • Registers to loop x times	• IF/CALL Lab • Registers & Looping lab	**Article 2 Due**	-Robotic Drives, Hardware, and Components 220
Week 11	• SELECT Instruction	• SELECT command lab		-Robot Installations 230 -Robot Control Systems 240
Week 12	• File Handling • Backups • Multiple USER/TOOL frames	• File Handling & Backup Lab • Multiple Frame Lab		-Vision Systems 250
Week 13	• Position Registers • Review for Final Exam	• Position Registers Lab • Final Exam Review		-Industrial Network Integration 260
Week 14	• Final Exam	• Final Exam	**Article 3 Due**	**ToolingU Assignments Due**

Students are encouraged to come in and use the lab during off hours in order to complete lab projects.

* Assignment schedule may change without notice.

Subject Matter Expert (SME) Course Review Summary

College: Lake Michigan College

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

Degree Program Name: Manufacturing Technology

Title of Course: Intro to Robotics

Subject Matter Expert (SME) Reviewer Information

Name: Steve Hollis

Title: Sales Manager

Phone: 269 233 9419

Email: shollis@millerweldingsupply.com

Organization/Affiliation: Program Advisor

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

See attached.

Synopsis of Findings:

The Intro to Robotics course at the college is a great introduction into the robotics field. The robotics training stations at LMC's Hanson Technology Center are state of the art.

Reviewers Signature _____ Date: 6·22·17

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: The new equipment and updated curriculum provide a strong link to industry standards.			

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: The online vendor provides support to learning outcomes.			

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		
Comments or recommendations: Learning activities mirror industry practice.			

Michigan Coalition for Advanced Manufacturing
Subject Matter Expert Course Review

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: Each objective is clearly addressed in the syllabi.			

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: The equipment is state of the art and mirrors industry standards.			

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

Michigan Coalition for Advanced Manufacturing
Subject Matter Expert Course Review

Steven Hollis Resume
Miller Welding Supply
shollis@millerweldingsupply.com

Professional Experience

April 1996- Present Miller Welding Supply

Miller Welding Supply is a Leader in the welding supply and automation industry as well as industrial and specialty gases. Established in 1942, it is family owned and operated.

Education

Southwestern Michigan College   Mechanical Engineering

Lincoln Electric Certifications
- Distributor Welding Fundamentals
- Intermediate Distributor Training
- Advanced Distributor Training
- Lincoln Filler Metals
- Weld Processes
- VRTEX Virtual Reality Weld System
- Real Weld System

Miller Electric/Hobart Welding School Certificates
- Hobart Filler Metals
- Weld Processes and power sources

Conoca Training
- Product Taining (regulators and manifold systems)

Koike Aronson Inc
- Product Training
- General Sales School