New Course Form

MET 200 Robotics and Motion Control 4

Originator: Kenny Keith **Status:** Approved **Date Created:** 02/01/2013

Department: MET: Mechatronics **Submitted:** 02/05/2013 **Completed:** 02/27/2013

To ACETS:

Course Prefix: MET

Course Number: 200

Course Title: Robotics and Motion Control

Cross-listing: No

Cross-listing information:

Semester for Implementation: Fall

Year of Implementation: 2013

Course Type: Required Transfer Vocational

Credit Hours: 4

Transfer Course: BAS-articulation discussions are underway

Course Catalog Description: Provides the student with a background in the programming and application of industrial robots and general purpose synchronized multi-axis motion control. Expands upon those concepts by combining multiple axes of motion to perform useful functions such as creating a flexible manufacturing system utilizing robots.

Rationale: Industrial robots are used in a wide range of industries such as machine tool, automotive, food processing and packaging. General purpose motion control is used not only to build robots but also in specific stand-alone applications in printing, converting, packaging, and processing. Both robotics and motion control are key enables of productivity that have not yet been fully exploited by US industry. This course will prepare the student to assist in the application, operation and maintenance of these important technologies for the discrete and hybrid industries.

Total Lecture Contact Hours per Week: 3

Total Lab Contact Hours per Week: 3

Total Contact Hours: 90

Load Factor: 5.1

Requisites:	Yes
Prerequisites:	MET 140 Introduction to PLC's MET 160 Rotating Electrical Machines
Co-requisites:	
Mode of Instructional Delivery:	(1) Traditional classroom instruction (3) Hybrid: internet with live lab (5) Laboratory
If "other" mode of instruction, specify:	
Library Resources:	N/A
Assessment of Student Learning - Methods:	(1) Written Examinations (5) Demonstration of Skills
IF "other" assessment, specify:	
Recommend Course Enrollment:	
Credit by Examination:	No
Literacy/ Critical Inquiry Component:	N/A
Ethnic/ Gender Awareness:	N/A
Sustainability:	No
Sustainability (explanation):	
COURSE TOPICS:	This course broadens that knowledge by using different programming languages to initiate and control motion sequences. The student will learn how to implement electronically many of the simple machines introduced in Industrial Mechanics 1 & 2 such as gear drives, belt drives, line shafts and cams. This course also introduces the student to techniques and products that are based upon IEC international standards and discusses the concepts of standards-based control.
COURSE OUTCOMES:	1.Describe safety rules and devices for working with or around industrial robots. 2.Describe advantages, functions, components, operation and applications of industrial robots and end effectors. 3.Describe how robots are applied to material handling, plastic injection molding, CNC machine loading, and parts inspection. 4.Describe how robots are applied to packaging of food and consumer products

by collating, picking, placing, orienting, cartooning, casing and palletizing.
5.Describe the function, operation, storage and retrieval of robot programs and position points.
6.Describe the use, function and operation of on-line programming, off-line programming, teach pendants, operator stations, and digital inputs and outputs for industrial robots.
7.Use a teach pendant to teach robot position points, test points and edit points.
8.Use a teach pendant to enter, test, edit, run, stop, store, delete, and retrieve robot programs and to power up, shut down, jog, home and operate the arm and gripper of an industrial robot.
9.Use a teach pendant to test digital inputs and outputs.
10.Use a PC and robot programming software to design, enter, edit, upload, download, delete and run robot programs and to power up, power down, jog and home a robot.
11.Use the following commands in a robot program: PMOVE, LABEL, BRANCH, GRASP, RELEASE, SPEED, DELAY, WAITI, WRITEO, MON, MOFF, IF-THEN, IFIN, ELSE, ENDIF, INP, CALL, RETURN, SUB, DDMOVE, TESTI, FLAG, SET, RESET, IF FLAG, FOR, NEXT, STEP, MEASURE, PRINT, PRINTLN, IFCT, INCR CTR, DECR CTR, CLEAR CTR, GRWIDTH, DPMOVE, POINT, LMOVE, LINEAR, XMOVE, YMOVE, ZMOVE, XTLMOVE, YTLMOVE, ZTLMOVE, PALLET, GETPART, NEXTPART, REPEAT, UNTIL, SETPART, PREVPART, PALLETPT, TESTP, CHR$, ASC, RIGHT$, LEFT$, MID$, RUN, HALT, MONITOR, ENDMONITOR, SENSOR, GUARD, ENDGUARD, and QPOSITION.
12.Use flow charts to design programs with conditional, branching, subroutine, multitasking and interrupt functions.
13.Use variable names, variables, global variables, point variables and point arrays in a robot program.
14.Use the Cartesian coordinate system to command robot position and program with World Coordinates and Tool Coordinates.
15.Demonstrate how to connect, configure, program and operate a robot in conjunction with both servo-driven and non-servo-driven conveyors.
16.Design robot programs to handle material, use operator stations, unload an automatic machine, interface with conveyors, sort parts, measure parts, provide an operator interface on a computer screen, perform palletizing, perform point-to-point assembly, perform linear motion assembly, and exchange data with a barcode reader or gauge.
17.Describe how to interface a robot to other machines such as a CNC or packaging machine using solid state I/O, relays or RS-232 serial communications.
18.Use robot simulation software to design a workcell.
19.Describe the functions, components and operations of general purpose, synchronized, multi-axis motion control.
20.Describe the use of real and virtual master axes.
21.Demonstrate the operation of electronic camming, gearing, lineshafting and clutching.
22.Describe the need for deterministic networking for the implementation of synchronized multi-axis motion control. 23.Describe the applicable standards and commonly used networks for motion control.

24.Describe the three controller types and the four network types that may be involved in a multi-axis motion control application.
25.Describe the programming languages that are specified by IEC 61131 and the advantages and disadvantages of each for various types of applications.
26.Use an IEC61131 programming language to design and implement a synchronized multi-access motion control application
27.Describe the PLC Open motion function blocks.
28.Describe the purpose of International Standards and the advantages and disadvantages of applying standards-based control.
29.Use PLC Open motion function blocks to implement a synchronized mutli-axis motion application.
30.Describe how multi-axis motion control is applied to construct a robot arm.
31.Describe how multi-axis motion control is applied to applications such as printing, depositing, molding, wrapping, and bagging.
32.Describe the issues of interfacing a high speed synchronized motion application with a PLC.
33.Troubleshoot a multi-axis motion system.

Proposer: Kenny Keith