New Course Form

MET 220 Advanced Programmable Logic Controllers 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: 220

Course Title: Advanced Programmable Logic Controllers

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: This course covers advanced principles and applications of programmable logic controllers (PLCs) and familiarizes them with a more advanced PLC family than that used in Introduction to PLCs. The student has the option of working with the Rockwell / Allen-Bradley ControlLogix system or the Siemens S7 system.

Rationale: This course covers the advanced applications of PLCs that prepares the student to support and maintain PLC systems in most any discrete, hybrid or continuous industrial environment.

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

Co-requisites: MET 200 Robotics, MET 210 Process Control & Instrumentation

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 (3) Oral Presentations (5) Demonstration of Skills
IF "other" assessment, specify:	
Recommend Course Enrollment:	15
Credit by Examination:	No
Literacy/ Critical Inquiry Component:	N/A
Ethnic/ Gender Awareness:	N/A
Sustainability:	No
Sustainability (explanation):	
COURSE TOPICS:	The course begins with an orientation to the new platform by reviewing the subjects covered in Introduction to PLCs. Among the advanced topics are PLC real time considerations, various levels of PLC networking, alternate programming languages for PLCs, international standards applied to PLCs, integration of logic and motion control in PLCs, integration of process control in PLCs, advanced human / machine interface (HMI) for PLCs, supervisory control and data acquisition (SCADA) with PLCs, alarm management, batch control, power failure strategies, and process safety.
COURSE OUTCOMES:	1.Demonstrate the ability to use a laptop and desktop computer and appropriate software to configure, connect, monitor, run, stop, and program a PLC 2.Demonstrate the ability to load, save, store, print and edit a PLC program. 3.Demonstrate the ability to implement a PLC job using the appropriate PLCs file or project structure. 4.Convert between binary, decimal, binary coded decimal, octal, two?s complement and hexadecimal number systems. 5.Describe integer, floating point, BCD, signed, unsigned, ASCII, and Boolean data types. 6.Describe the memory organization, the register and image table organization,

the allowable data types, and the creation and use of tags for the appropriate PLC
7.Define insertion delay, output response, scan time, throughput and jitter
8.Describe the PLC processes instructions, inputs, outputs and communications tasks
9.Explain how various processing tasks affect throughput
10.Explain how to select and configure digital, analog and special purpose inputs and outputs
11.Explain how input and output response time affects control of a machine or process
12.Describe the impact of leakage currents and loading on PLC inputs and outputs.
13.Demonstrate the ability to design and implement circuits to interface electronic devices with sinking and sourcing inputs and outputs
14.Create a program to measure processor scan time
15.Create a system to measure processor throughput
16.Compare throughput and jitter for various I/O configurations and programming situations.
17.Explain how scan time, throughput and jitter affect machine and process control
18.Describe the symbols used in both JIC and IEC circuit diagrams.
19.Convert between JIC and IEC circuit diagrams
20.Use both JIC and IEC circuit diagrams to troubleshoot PLC systems
21.Explain how to insure machine and operator safety in the event of a PLC failure, a power failure or an unexpected loss of some or all input signals or output response
22.Describe the conditions and procedures for replacing input and output cards
23.Determine when and how to replace input and output cards under power or during operation.
24.Describe the precautions and use of force functions
25.Explain how to locate forced elements
26.Demonstrate the use of the available software diagnostic troubleshooting aids for the appropriate PLC
27.Describe the use of the available troubleshooting displays and indicators for the appropriate PLC
28.Demonstrate the ability to test, configure and replace PLC inputs, outputs, power supplies, batteries, processors, chassis and cables.
29.Describe the operation of advanced relay ladder logic, timer, counter, and sequencing instructions.
30.Describe the operation of advanced math and data move instructions
31.Describe the operation of advanced program control instructions
32.Describe the programming language options available for the appropriate PLC, the applicability of each and the relationship to international standard IEC61131
33.Develop programs for the appropriate PLC using each of the available programming languages
34.Describe the issues of single and differential input, shielding, sensitivity, resolution, accuracy, sample rate, filtering and scaling associated with the use of analog inputs and outputs

35.Demonstrate the ability to install, configure, program, scale, operate, display and troubleshoot analog input and output devices with the appropriate PLC
36.Describe the options and tradeoffs for implementing PID control in the appropriate PLC
37.Demonstrate the ability to operate and troubleshoot a PID loop in a PLC
38.Describe the operation and function of device level networking
39.Demonstrate the ability to construct, configure, program, operate and troubleshoot a device level network with the appropriate PLC (DeviceNet or Profibus)
40.Describe the operation and function of a control or cell level network.
41.Demonstrate the ability to construct, configure, program operate and troubleshoot a control level network.
42.Describe the application of PLCs and Human Machine Interfaces (HMIs) in one-to-one, one-to-many, many-to-one and many-to-many configurations
43.Program a PC graphical HMI and a PLC to create a one-to-many topography using one graphical display and two PLCs
44.Describe the importance and function of alarm management
45.Describe the use and importance of graphic libraries and display standards when working with PLCs and HMIs.
46.Demonstrate alarm management techniques in a one to many configuration.
47.Describe how control can be affected by display and communications functions.
48.Describe the operation and function of area-wide networking with a PLC.
49.Demonstrate the ability to construct, configure, program, operate and troubleshoot an area-wide network using an Ethernet LAN with the appropriate PLC.
50.Describe the operation and function of integrating single and multi-axis coordinated motion control in a PLC.
51.Describe the purpose and function of a motion network.
52.Demonstrate the ability to operate and troubleshoot a multi-axis motion control application using a PLC and a motion control network.

Proposer: Kenny Keith