CLEVELAND INSTITUTE OF ELECTRONICS SYLLABUS

Course Number: L436

Course Name: Programmable Controllers Lab

Course Credits: 195 Clock Hours

Course Prerequisites: L435A

Course Co-requisites: None

Course Contact Information: **www.cie-wc.edu   faculty@cie-wc.edu**
http://cie-wc.edu/Student-services-policies.aspx 1-800-243-6446   (216) 781-9400 (216) 781-0331 (fax)

Course Description: This course provides students with a practical understanding of logic ladder and PLC through the implementation and use of a software simulation package. The software is called the LogixPro 500 Simulator, and is created by The Learning Pit. The program emulates the Allen-Bradley PLC/SLC style of control logic. The lessons will be a mixture of project based and multiple-choice exams, and will cover the materials in the order presented. The topics include introduction to PLC programming, latches, logic functions, timers, sequencers, counters, controls, and converters (ADC/DAC). The course is intended to be a stepping-stone to more advanced study and implementation of skills and knowledge.

Course Objectives: Upon the completion of this course the student will be able to:
- Understand and program PLCs using a software simulation package
- Simulate real world applications with various practical scenarios
- Analyze how PLCs and ladder logic work
- Troubleshoot applications when results do not meet expectations
- Apply logic to problem statements before designing ladder logic circuits

Course Readings: The topic support material will be drawn from a textbook published by Course Technology/Cengage Learning. The author is Terry Bartelt. The title of the textbook is Industrial Automated Systems – Instrumentation and Motion Control (ISBN 9781435488885). Students should complete the experiments and solve all problems in the exercise sections before continuing to the next topic.

Student Evaluation, Grading and Assessment: Each of the twelve lessons contains experiments, projects and examinations; all examinations are open book. The examinations consist of multiple-choice questions (MCQs) that measure cognitive learning levels. The minimum passing score of 70% must be achieved but if the score is less than 70%, the examination must be retaken to earn a passing score of 70% for the lesson. The twelve examination scores are averaged together and constitute the course grade. Course requirements include maintaining an overall GPA of 78% or better to graduate.

93% - 100%	A	The final grade for this course will be determined as follows:		
86% - 92.9%	B	Two examinations =		10%
78% - 85.9%	C	Ten projects =		90%
70% - 77.9%	D	Total =		100%

Course Schedule: You should complete the following lessons in the order shown in the table. It is best to complete 1-2 lessons per week to maintain your schedule.

Lesson Number	Title of Lesson	Topics Covered
3463A	Latches	• List and describe the functions of the basic symbols used in PLC systems • Interpret typical I/O specifications • Write and enter ladder logic programs
3104A	Logic Gates Part 1	• Construct circuits from Boolean expressions and derive Boolean equations for the AND, OR, and NOT functions • Convert relay ladder schematics to ladder logic programs • Develop elementary programs based on logic gate functions
3464A	Logic Gates Part 2	• Construct circuits from Boolean expressions and derive Boolean equations for the NAND and NOR functions • Convert relay ladder schematics to ladder logic programs • Program instructions that perform logical operations
3465A	Logic Gates Part 3	• Construct circuits from Boolean expressions and derive Boolean equations for the XOR and XNOR functions • Convert relay ladder schematics to ladder logic programs • Develop elementary programs based on logic gate functions
3342A	Timers Part 1	• Analyze and interpret typical PLC timer ladder logic programs • Program the control of outputs using time instruction control bits
3343A	Timers Part 2	• Describe PLC timer instruction and differentiate between a non-retentive and retentive timer • Convert timer relay schematics to PLC ladder logic programs
3466A	Sequencers Part 1	• Interpret and explain information associated with PLC sequencer output • Use and understand the masking data words for sequencer operations
3467A	Counters Part 1	• List and describe the functions of PLC counter instructions • Analyze and interpret typical PLC counter ladder logic diagrams
3468A	Sequencers Part 2	• Compare the operation of an event-driven and time-driven sequencer • Evaluate masking issues on sequencer operation
3220A	Counters Part 2	• Apply the PLC counter function and associated circuitry to control systems • Apply combinations of counters and timers to control systems
3222A	Controls	• State the purpose of program control instructions • Describe the operation of the master control reset instruction and develop an elementary program illustrating its use • Explain the functions of subroutines
3224A	ADC/DAC Converters	• Analyze and interpret ADC/DAC instructions as they apply to a PLC program • Create PLC programs involving ADC/DAC instructions