Dakota County Technical College

ELEC 2141: Programmable Logic Controllers Lab

A. COURSE DESCRIPTION

Credits: 4

Lecture Hours/Week: *.*

Lab Hours/Week: 4

OJT Hours/Week: *.*

Prerequisites: None

Corequisites: None

MnTC Goals: None

This course work will consist of clearly directed lab exercises with the expectation of exact results, performance evaluations and related assignments. Students will use Allen-Bradley RSLinx, RSLogix 500 and RSLogix 5000 programming software to write, edit, download, and operate control programs for Allen-Bradley MicroLogix 1000, MicroLogix 1100, SLC-500, and CompactLogix PLC hardware. Students will use Allen-Bradley Panelbulder32 programming software to create applications for the Panelview 300 and 600 operator interface terminals. In addition, students will study basic instrumentation and networking strategies associated with automation technologies. The supporting technical information will be provided through a parallel theory course.

B. COURSE EFFECTIVE DATES: 08/21/2006 - Present

C. OUTLINE OF MAJOR CONTENT AREAS

D. LEARNING OUTCOMES (General)

1. Explain the difference between fixed and modular hardware.
2. Create a new program file (project) and document each instruction.
3. Identify symbols commonly used in relay circuit schematic diagram.
4. Explain commonly used programming languages.
5. Describe the PLC program scan sequence.
6. Write and enter programs from a narrative description of the function or process.
7. Identify the common operating modes of a PLC.
8. Explain the operation of inductive and capacitive proximity sensors.
9. Explain the operation of transducers.
10. Identify the major components of a PLC and describe their functions.
11. Outline the basic sequence of operation of a PLC.
12. Identify the memory and program files.
13. Describe the concept of words, bits and addressing data.
14. Address I/O instructions and data.
15. Identify decimal, binary, octal, and hexadecimal numbering systems.
16. Convert values of one numbering system to another.
17. Draw the logic symbols, construct truth tables and state the Boolean equations for AND, OR, and NOT binary gates.
18. Convert relay ladder schematics to ladder logic programs and Boolean equations.
19. Create a new folder on the local drive of your work station to save your program files (projects).
20. Identify and program user type relay-type instructions.
21. Download the program to the Micro Logix and observe the operation.
22. Explain and program internal relay (bit) instructions.
23. Write and enter programs using the branch instruction.
24. Convert conventional relay circuitry to PLC logic.
25. Configure a PLC system by selecting the type of processor, number of racks, size of the racks, and type of I/O modules.
26. Convert BCD to decimal numbers and convert decimal numbers to BCD.
27. Describe how an operator interface (PanelView) terminal can read and write to the data tables.
28. Describe safety considerations built into PLCs and programmed into PLC installations.
29. Describe the advantages of modular hardware over fixed hardware.
30. Describe the difference between ¿offline¿ and ¿online¿ editing of a PLC program.
31. Describe the function of a masked move and clear instruction.
32. Describe the operation and write a program using the jump and label instructions.
33. Describe the operation of TON, TOF, and RTO timer instructions used in a PLC program.
34. Explain start-up and troubleshooting techniques using the force instruction and bit toggle.
35. Explain the function of subroutines and write a program using subroutines to control the same outputs using different control schemes.
36. Explain the function of various PLC compare instructions.
37. Explain the function of various PLC data manipulation and transfer instructions.
38. Explain the function of various PLC math instructions.
39. Explain the operation of photoelectric, flow, and speed sensors.
40. Interpret narrative descriptions of a control scheme, and write and install a properly operating program.
41. List and describe the functions of PLC counter instructions.

42. Program counters and control outputs using counter instruction control bits.
43. Program timers and control outputs using timer instruction control bits.
44. Use a combination of timers and counters to control systems.
45. Write and enter PLC programs using math instructions.
46. Write and enter a PLC program using compare instructions.
47. Write, install, operate, and edit a PLC program while online.
48. Analyze the operation of PLC I/O circuitry.
49. Apply troubleshooting techniques and your working knowledge of PLC operation to determine the cause of a problem.
50. Change the PLC communication protocol.
51. Compare individual, centralized, and distributive control systems.
52. Compare the applications of on/off and proportional, derivative, and integral (PID) controllers.
53. Configure a new driver type and delete an existing driver.
54. Define terminology associated with CompactLogix.
55. Define terminology associated with communication.
56. Describe an Ethernet based, LAN system and addressing.
57. Describe an application, application screens, objects, and other PanelBuilder controls.
58. Describe attributes and tags associated with control components.
59. Describe data communications and network topologies.
60. Describe proper equipment grounding practices.
61. Describe proper grounding practices for shielded cables.
62. Describe the basic operation of RSLinx communication software.
63. Describe the capabilities and limitations of the PanelView Operator Terminal.
64. Describe the difference between a bit shift left (BSL) and a bit shift right (BSR) instruction.
65. Describe the differences of open-loop and closed-loop control systems.
66. Describe the function of PC communication ports.
67. Describe the memory organization and addressing scheme.
68. Describe the operation of an analog output module.
69. Describe the operation of continuous process, batch production, and individual product production.
70. Describe the operation of sequencer instructions.
71. Describe the procedure of commissioning a PLC installation.
72. Describe the purpose and operation of message instructions.
73. Describe the range of timing and counter instructions using a ControlLogix PLC.
74. Detail commonly used driver types.
75. Detail the basic construction of the CompactLogix system components.
76. Detail the information required in programming a sequencer instruction.
77. Discuss the process of reading data from, and writing data to the CPU of another PLC.
78. Explain how an operator interacts with the PanelView Operator Terminal.
79. Explain how data is address using a ControlLogix PLC
80. Explain reading and writing of data.
81. Explain the operation of bit and word shift register instructions.
82. Explain the process of download and uploading programs.
83. Explain the requirements for a PLC enclosure.
84. Identify symptoms of PLC operational and circuitry problems.
85. Place objects such as screen selectors, controls, and background text on the screens.

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86. Set up the communication protocol between the PanelView 300 and the MicroLogix 1100.
87. Upload a program from an existing PLC.
88. Use a move instruction to change the variables in recipe.
89. Write and enter PLC programs using a data transfer instruction to change the variables in an ingredient mixing process.
90. Write, edit, and operate two PLC programs that read and write from each other to control outputs in the other.
91. Write, enter, and operate a program using a sequencer instruction to control a typical industrial process.
92. Write, enter, and operate a program using a shift register instruction to control a typical food processing operation.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

None

F. LEARNER OUTCOMES ASSESSMENT

As noted on course syllabus

G. SPECIAL INFORMATION

None noted