

ILLINOIS VALLEY COMMUNITY COLLEGE



COURSE OUTLINE

DIVISION: Workforce Development

COURSE: ELE 1204; Programmable Logic Controllers I

Date: Spring 2013

Credit Hours: 3.0

Prerequisite(s): ELE 1200 or ELT 1204

Delivery Method: **Lecture** **2 Contact Hours** (1 contact = 1 credit hour)
 Seminar **0 Contact Hours** (1 contact = 1 credit hour)
 Lab **2 Contact Hours** (2 contact = 1 credit hour)
 Clinical **0 Contact Hours** (3 contact = 1 credit hour)
 Online
 Blended

Offered: **Fall** **Spring** **Summer**

IAI Equivalent –**Only for Transfer Courses**–go to <http://www.itransfer.org>.

CATALOG DESCRIPTION:

This course introduces students to Programmable Logic Controllers (PLCs). Course content includes; PLC logic concepts, basic PLC programming, and PLC hardware components and their installation, application, and maintenance. Troubleshooting techniques will be emphasized throughout this course.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page of this form for more information.]

Upon completion of the course, the student will be able:

[Choose those goals that apply to this course.]

- To apply analytical and problem solving skills to personal, social and professional issues and situations.
- To communicate orally and in writing, socially and interpersonally.
- To develop an awareness of the contributions made to civilization by the diverse cultures of the world.
- To understand and use contemporary technology effectively and to understand its impact on the individual and society.
- To work and study effectively both individually and in collaboration with others.
- To understand what it means to act ethically and responsibly as an individual in one's career and as a member of society.
- To develop and maintain a healthy lifestyle physically, mentally, and spiritually.
- To appreciate the ongoing values of learning, self-improvement, and career planning.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals.]

Upon completion of the course, the student will be able to:

1. Explain Programmable Controller uses, advantages, and components.
 - Competency 1.1. State why use PLC's at all.
 - Competency 1.2. Explain advantages to using.
 - Competency 1.3. Calculate monetary advantages to PLC use over Relay Logic.
 - Competency 1.4. Correctly Identify and state uses for each component of a PLC system.
 - Competency 1.5. Initialize a PLC.
2. Understand differences in Programmable Controller CPU and numbering systems.
 - Competency 2.1. Define types of memory.
 - Competency 2.2. Tell when each type of memory could and should be used.
 - Competency 2.3. Choose the appropriate processor for the PLC application.
 - Competency 2.4. Convert between decimal, octal, hex, binary and BCD numbers.
3. Use the correct I/O Systems.
 - Competency 3.1. Identify Input and output modules.
 - Competency 3.2. State uses for each module.
 - Competency 3.3. Correctly use modules in a lab setting.
 - Competency 3.4. Swap modules in an approved manner.
4. Properly use Programming Terminals and Peripheral Devices.
 - Competency 4.1. Define smart and dumb terminals.
 - Competency 4.2. State different types of programming devices.
 - Competency 4.3. Choose the appropriate terminal for a system.

5. Design Installation and Maintenance procedures for a PLC system.
 - Competency 5.1. Choose the correct system for a job.
 - Competency 5.2. Choose the correct wiring for the system.
 - Competency 5.3. Troubleshoot some common problems.
 - Competency 5.4. Develop a maintenance checklist.
 - Competency 5.5. Correctly enter and run a program.

6. Read Relay Logic and Ladder Logic Programs.
 - Competency 6.1. Correctly interpret relay symbols
 - Competency 6.2. Use relay symbols to develop a simple program.
 - Competency 6.3. Correctly interpret ladder logic symbols
 - Competency 6.4. Convert a relay logic program into a ladder logic program.

7. Utilize Timers and Counters.
 - Competency 7.1. Define timers and counters.
 - Competency 7.2. Show uses for counters and timers.
 - Competency 7.3. Enter programs using counters and timers
 - Competency 7.4. Edit programs using counters and timers.
 - Competency 7.5. Correctly use ONE SHOTS.

8. Correctly use MCR's, ZCL's, and Jump Instructions.
 - Competency 8.1. Enter programs using MCR, ZCL and Jump instructions.
 - Competency 8.2. Explain PLC actions in a file control program.
 - Competency 8.3. Use the jump subroutine commands.
 - Competency 8.4. Use and explain uses for each command.

COURSE TOPICS AND CONTENT REQUIREMENTS:

- 1) An overview
 - a) PLC's
 - b) Parts of a PLC
 - c) Principles of operation
 - d) PLC Application
- 2) PLC Hardware
 - a) Discrete I/O
 - b) Analog I/O
 - c) I/O Specifications
 - d) The CPU
 - e) Memory types
 - f) Programming devices
- 3) Number Systems
 - a) Decimal
 - b) Binary
 - c) Octal
 - d) Hexadecimal
 - e) BCD
 - f) Encoding and Decoding
- 4) Fundamentals of Logic
 - a) The binary concept
 - b) Logic Gates

- c) Boolean Algebra
 - d) Hard-wired logic verses Soft logic
 - e) Programming
- 5) PLC Programming
- a) Memory organization
 - b) Scan times
 - c) Languages
 - d) Relay instructions
 - e) Addressing
 - f) Branching
 - g) Internal relays
 - h) Ladder logic
 - i) Entering a program
 - j) Modes of operation
- 6) PLC Installation and Maintenance
- a) Enclosures
 - b) Noise and Surges
 - c) Grounding
 - d) Editing and monitoring
 - e) Troubleshooting and Maintenance
- 7) Wiring diagrams
- a) Relays
 - b) Starters
 - c) Seal-in circuits
 - d) Latching circuits
 - e) Circuit Conversion
- 8) Programming Timers
- a) Timer instructions
 - b) Time on delay
 - c) Time off delay
 - d) Retentive timers
 - e) Timer bits
 - f) Cascading timers
- 9) Programming Counters
- a) Counter instructions
 - b) Up-counter
 - c) Down-counter
 - d) Cascading counters
 - e) Combining timers and counters
 - f) One shots
- 10) Program Control
- a) Jumps
 - b) Jump subroutines

- c) Forcing
 - d) Faults
 - e) Master control resets
- 11) Zone control

INSTRUCTIONAL METHODS:

Laboratory work
 Demonstrations
 Lecture - discussion
 Reading assignments
 Homework
 Quizzes
 Tests
 Socratic method

INSTRUCTIONAL MATERIALS:

Text: Programmable Logic Controllers. Petruzella

Allen-Bradley SLC-500 Trainers
 Rockwell Automation Software (Windows NT)
 Pics for DH-485

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

The student must meet the objectives of the course stated previously.

Laboratory reports must be completed as directed and receive an evaluation for accuracy of 70% or more using criteria set forth in the laboratory directions.

Required assignments:

Mandatory lab attendance
 Weekly lab assignments
 Short quizzes
 Assigned reading
 Assigned homework
 Midterm exams
 Lab practical exams
 Final exam
 Tests

Methods of Evaluation:

A students' grade will be based on multiple measures of performance:
 Completion of lab assignments
 Quizzes based on lab and text assignments
 Completion of homework assignments
 Midterm, final, and lab final exams

90% - 100% A
 80% - 89.9% B
 70% - 79.9% C
 60% - 69.9% D
 below 60% F

Lab 30%
 Quizzes and Tests 40%
 Midterm and Final 30%

OTHER REFERENCES

Allen-Bradley Manuals

Rockwell Automation Manuals

“This workforce solution was funded by a grant awarded by the U.S. Department of Labor’s Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use, by an organization and/or personal use by an individual for non-commercial purposes, is permissible. All other uses require the prior authorization of the copyright holder.”

Course Competency/Assessment Methods Matrix

ELE 1204; Programmable Logic Controllers I	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment	
	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D								
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.																																	
Competency 1.1. State why use PLC's at all.																																	
Competency 1.2. Explain advantages to using.									X																								
Competency 1.3. Calculate monetary advantages to PLC use over Relay Logic.																																	
Competency 1.4. Correctly Identify and state uses for each component of a PLC system.				X					X																								
Competency 1.5. Initialize a PLC.				X																													
Competency 2.1. Define types of memory.						X	X																										
Competency 2.2. Tell when each type of memory could and should be used.																																	
Competency 2.3. Choose the appropriate processor for the PLC application.			X	X																													

ELE 1204; Programmable Logic Controllers I	Assessment Options																																				
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning																																				
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D													
Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment						
Competency 2.4. Convert between decimal, octal, hex, binary and BCD numbers.				X				X																													
Competency 3.1. Identify Input and output modules.				X																																	
Competency 3.2. State uses for each module.				X																								X									
Competency 3.3. Correctly use modules in a lab setting.				X																																	
Competency 3.4. Swap modules in an approved manner.				X																																	
Competency 4.1. Define swart and dumb terminals.																																					
Competency 4.2. State different types of programming devices.																																					
Competency 4.3. Choose the appropriate terminal for a system.																																					
Competency 5.1. Choose the correct system for a job.			X	X																																	

ELE 1204; Programmable Logic Controllers I	Assessment Options																																					
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment						
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D													
Competency 5.2. Choose the correct wiring for the system.					X																																	
Competency 5.3. Troubleshoot some common problems.					X																																	
Competency 5.4. Develop a maintenance checklist.				X	X																																	
Competency 5.5. Correctly enter and run a program.					X																																	
Competency 6.1. Correctly interpret relay symbols				X	X			X	X																													
Competency 6.2. Use relay symbols to develop a simple program.					X																																	
Competency 6.3. Correctly interpret ladder logic symbols				X	X			X	X																													
Competency 6.4. Convert a relay logic program into a ladder logic program.					X																																X	
Competency 7.1. Define timers and counters.									X																													
Competency 7.2. Show uses for counters and timers.			X	X				X	X																													

ELE 1204; Programmable Logic Controllers I	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment	
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D								
Competency 7.3. Enter programs using counters and timers					X																												
Competency 7.4. Edit programs using counters and timers.				X			X																										
Competency 7.5. Correctly use ONE SHOTS.			X	X																													
Competency 8.1. Enter programs using MCR, ZCL and Jump instructions.				X																							X	X					
Competency 8.2. Explain PLC actions in a file control program.																											X	X					
Competency 8.3. Use the jump subroutine commands.				X																													
Competency 8.4. Use and explain uses for each command.				X																					X								