



## COURSE OUTLINE: RAA202 - PLC AND INTERFACING

Prepared: Ron Chartrand

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	RAA202: PLC AND INTERFACING
<b>Program Number: Name</b>	4068: ROBOTICS AUTOMATION
<b>Department:</b>	ROBOTICS GRADUATE CERTIFICATE
<b>Semesters/Terms:</b>	19W
<b>Course Description:</b>	The student will develop an understanding of PLC in general, understand the hardware and software associated with Allen Bradley 5000 family PLCs. PLC programming techniques using RS logic 5000 software will be used to design, document and commission basic to intermediate PLC lab assignments. The student will learn how to interface a PLC to control a Robot as the final Lab Assignment. Basic control theory associated with PLCs will be introduced to assist with lab assignment implementation. This course will require the student to work independently and / or in groups during lab times. The student will also be required to work independently on assigned work outside of class time and access information from help files, manuals, and internet as necessary to solve PLC related work problems. This is to prepare the student for PLC job related tasks.
<b>Total Credits:</b>	4
<b>Hours/Week:</b>	4
<b>Total Hours:</b>	60
<b>Prerequisites:</b>	RAA100
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>Vocational Learning Outcomes (VLO's) addressed in this course:</b>	<b>4068 - ROBOTICS AUTOMATION</b> VLO 1 Construct and evaluate robotic control programs for various scenarios against which to model the functionality and stability of automation systems. VLO 7 Formulate and use a variety of troubleshooting techniques on new and legacy electromechanical equipment, processes, systems and subsystems.
<b>Essential Employability Skills (EES) addressed in this course:</b>	EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others. EES 9 Interact with others in groups or teams that contribute to effective working



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	relationships and the achievement of goals.								
	EES 10 Manage the use of time and other resources to complete projects.								
	EES 11 Take responsibility for ones own actions, decisions, and consequences.								
<b>Course Evaluation:</b>	Passing Grade: 50%, D								
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>The student must pass both the theory portion, the practical portion and demonstrate all labs in order to pass the course.</p> <p>Smart watches, smart phones and similar devices are not allowed during tests or quizzes and must be removed. Smart phones are not acceptable for use as a calculator during a test or quiz.</p> <p>Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 - 59% 1.00 F (Fail)49% and below 0.00</p> <p>CR (Credit) Credit for diploma requirements has been awarded. S Satisfactory achievement in field /clinical placement or non-graded subject area. U Unsatisfactory achievement in field/clinical placement or non-graded subject area. X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. NR Grade not reported to Registrar's office. W Student has withdrawn from the course without academic penalty.</p>								
<b>Books and Required Resources:</b>	<p>Technicians Guide to Programmable Controllers by Terry Borden, Richard Cox Publisher: Delmar Cengage Learning Edition: Sixth ISBN: 978-1-111-54409-6</p>								
<b>Course Outcomes and Learning Objectives:</b>	<table> <tr> <th>Course Outcome 1</th><th>Learning Objectives for Course Outcome 1</th></tr> <tr> <td>1. Identify basic programmable logic controller (PLC) hardware and software.</td><td> 1.1 State the major advantages of a typical PLC over conventional hardwired relay systems.  1.2 Identify the four major components of a typical PLC and describe the function of each.  1.3 Define the term discrete.  1.4 Define the term analog.  1.5 Identify different types of programming devices.  1.6 Describe the I/O section of a PLC.  1.7 Define the term interposing relay.  1.8 Define the term optical isolation.  1.9 Describe how basic AC and DC input and output modules work. </td></tr> <tr> <th>Course Outcome 2</th><th>Learning Objectives for Course Outcome 2</th></tr> <tr> <td>2. Develop an understanding of basic PLC ladder logic instructions, numbering systems and</td><td> 2.1 Describe the proper wiring connections for input and output devices and their corresponding modules.  2.2 Explain why a hard-wire emergency-stop function is desirable. </td></tr> </table>	Course Outcome 1	Learning Objectives for Course Outcome 1	1. Identify basic programmable logic controller (PLC) hardware and software.	1.1 State the major advantages of a typical PLC over conventional hardwired relay systems. 1.2 Identify the four major components of a typical PLC and describe the function of each. 1.3 Define the term discrete. 1.4 Define the term analog. 1.5 Identify different types of programming devices. 1.6 Describe the I/O section of a PLC. 1.7 Define the term interposing relay. 1.8 Define the term optical isolation. 1.9 Describe how basic AC and DC input and output modules work.	Course Outcome 2	Learning Objectives for Course Outcome 2	2. Develop an understanding of basic PLC ladder logic instructions, numbering systems and	2.1 Describe the proper wiring connections for input and output devices and their corresponding modules. 2.2 Explain why a hard-wire emergency-stop function is desirable.
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demonstrate wiring techniques for Allen Bradley ControlLogix 5000 PLCs.	<p>2.3 Describe the function of the PLC processor.</p> <p>2.4 Identify the two distinct types of memory.</p> <p>2.5 Explain the term on-line programming.</p> <p>2.6 Understand decimal, binary, hexadecimal, binary coded decimal (BCD) numbering systems.</p> <p>2.7 Identify a wiring diagram.</p> <p>2.8 Understand the examine ON, examine OFF, timer, counter, move, limit test, sequencer instructions and use of internal storage bits.</p> <p>2.9 Describe basic programming techniques.</p> <p>2.10 Describe the Force On and Force Off features and the hazards that could be associated with both.</p>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
3. Develop and demonstrate basic programming techniques for Allen Bradley ControlLogix 5000 PLCs using RSLogix software.	<p>3.1 Demonstrate the ability to program and configure basic PLC functions offline.</p> <p>3.2 Demonstrate the ability to program PLCs to control.</p> <p>3.3 Demonstrate the ability to wire PLC inputs and outputs to field equipment.</p> <p>3.4 Demonstrate the ability to add documentation to a PLC program.</p>
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Develop and demonstrate the ability to write basic PLC programs to control various electrical equipment in the lab and run the programs on a PLC in the lab.	<p>4.1 Demonstrate the ability to download a program to a PLC attached to a PC.</p> <p>4.2 Demonstrate the ability to download a program to a PLC from a remote PC over Ethernet.</p> <p>4.3 Demonstrate the ability to edit programs online.</p> <p>4.4 Demonstrate the ability to upload a program to a PC from a PLC.</p> <p>4.5 Demonstrate the ability to program basic PLC functions online.</p> <p>4.6 Demonstrate the ability to write a PLC program to control equipment such as motors, traffic lights, etc.</p> <p>4.7 Demonstrate the ability to download a program to a local PLC and run the program.</p> <p>4.8 Demonstrate the ability to download a program to a particular remotely located PLC over the Ethernet network and run the program.</p>
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
5. Develop and demonstrate the ability to connect a PLC in the lab to control various electrical equipment then run and troubleshoot the program.	<p>5.1 Demonstrate the ability to wire PLC I/O cards to field equipment.</p> <p>5.2 Use available resources such as internet, manuals, help files, and handbooks to aid in project troubleshooting.</p> <p>5.3 Apply problem-solving techniques and use the knowledge of computer systems and application software to resolve technical problems associated with assigned PLC projects.</p> <p>5.4 Use appropriate application software for programming, communication and troubleshooting projects.</p> <p>5.5 Determine, wire, configure and test the electrical and automation control system equipment such as PLC modules, motor controls, traffic lights, etc. required for assigned projects.</p> <p>5.6 Apply, install, test and troubleshoot PLC project related</p>

	equipment, systems and tasks.																		
<b>Evaluation Process and Grading System:</b>	<table> <tr> <th>Evaluation Type</th><th>Evaluation Weight</th></tr> <tr> <td>Attendance and Quizzes</td><td>5%</td></tr> <tr> <td>Lab Demonstrations</td><td>15%</td></tr> <tr> <td>Practical Test 1</td><td>20%</td></tr> <tr> <td>Practical Test 2</td><td>30%</td></tr> <tr> <td>Take-Home Assignment 1</td><td>2%</td></tr> <tr> <td>Take-Home Assignment 2</td><td>2%</td></tr> <tr> <td>Written Test 1</td><td>13%</td></tr> <tr> <td>Written Test 2</td><td>13%</td></tr> </table>	Evaluation Type	Evaluation Weight	Attendance and Quizzes	5%	Lab Demonstrations	15%	Practical Test 1	20%	Practical Test 2	30%	Take-Home Assignment 1	2%	Take-Home Assignment 2	2%	Written Test 1	13%	Written Test 2	13%
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<b>Date:</b>	August 28, 2019																		
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.																		