



## COURSE OUTLINE: ELR320 - AUTOMATED ELECT SYS

Prepared: Chris Beauchamp

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	ELR320: AUTOMATED ELECTRICAL SYSTEMS
<b>Program Number: Name</b>	4029: ELECTRICAL TY-PROCES
<b>Department:</b>	ELECT./INSTRUMENTATION PS
<b>Academic Year:</b>	2022-2023
<b>Course Description:</b>	Students will develop an understanding of integrating automated control system equipment using various PLCs, HMIs, analog and discrete I/O, and communication interfaces. Advanced PLC hardware configuration and programming techniques will be used to connect, commission, troubleshoot and document projects. Various PLCs will be introduced using discrete, analog, local, and remote I/O, as well as PID control and multiple programming languages. Students will use and interpret various information resources to understand the functioning of various hardware, software, and PLC instructions. The student will develop basic HMI control programs to interact with automated control systems to provide control and information feedback to a person. Students will develop PLC programs using these techniques in the lab environment to prepare them for advanced control integration in the sixth semester. This course will require the student to work independently and/or in groups (teams).
<b>Total Credits:</b>	7
<b>Hours/Week:</b>	5
<b>Total Hours:</b>	70
<b>Prerequisites:</b>	ELN229, ELR223, ELR236
<b>Corequisites:</b>	There are no co-requisites for this course.
<b>This course is a pre-requisite for:</b>	ELR311, ELR315
<b>Vocational Learning Outcomes (VLO's) addressed in this course:</b>	<b>4029 - ELECTRICAL TY-PROCES</b>
<b>Please refer to program web page for a complete listing of program outcomes where applicable.</b>	VLO 1 Analyze, interpret, and produce electrical and electronics drawings, technical reports including other related documents and graphics.
	VLO 2 Analyze and solve complex technical problems related to electrical systems by applying mathematics and science principles.
	VLO 3 Design, use, verify, and maintain instrumentation equipment and systems.
	VLO 4 Design, assemble, test, modify, maintain and commission electrical equipment and systems to fulfill requirements and specifications under the supervision of a qualified person.
	VLO 6 Design, assemble, analyze, and troubleshoot electrical and electronic circuits, components, equipment and systems under the supervision of a qualified person.
	VLO 7 Design, install, analyze, assemble and troubleshoot control systems under the supervision of a qualified person.
	VLO 8 Use computer skills and tools to solve a range of electrical related problems.



	<p>VLO 10 Prepare reports and maintain records and documentation systems.</p> <p>VLO 12 Apply and monitor health and safety standards and best practices to workplaces.</p>
<b>Essential Employability Skills (EES) addressed in this course:</b>	<p>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.</p> <p>EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication.</p> <p>EES 3 Execute mathematical operations accurately.</p> <p>EES 4 Apply a systematic approach to solve problems.</p> <p>EES 5 Use a variety of thinking skills to anticipate and solve problems.</p> <p>EES 6 Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>EES 7 Analyze, evaluate, and apply relevant information from a variety of sources.</p> <p>EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others.</p> <p>EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</p> <p>EES 10 Manage the use of time and other resources to complete projects.</p> <p>EES 11 Take responsibility for ones own actions, decisions, and consequences.</p>
<b>Course Evaluation:</b>	<p>Passing Grade: 50%, D</p> <p>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</p>
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<p>The student must pass both the theory portion, the lab portion, pass a minimum of one of the two practical tests, and demonstrate all projects 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</p> <p>A+ 90 - 100% 4.00</p> <p>A 80 - 89%</p> <p>B 70 - 79% 3.00</p> <p>C 60 - 69% 2.00</p> <p>D 50 - 59% 1.00</p> <p>F (Fail)49% and below 0.00</p> <p>CR (Credit) Credit for diploma requirements has been awarded.</p> <p>S Satisfactory achievement in field /clinical placement or non-graded subject area.</p> <p>U Unsatisfactory achievement in field/clinical placement or non-graded subject area.</p> <p>X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.</p> <p>NR Grade not reported to Registrar`s office.</p>
<b>Books and Required</b>	PROGRAMMING CONTROLLOGIX PROGRAMMABLE AUTOMATION CONTROLLERS by



**Resources:**

Jon Stenerson  
 Publisher: Delmar  
 ISBN: 9781435419476

**Course Outcomes and Learning Objectives:**

<b>Course Outcome 1</b>	<b>Learning Objectives for Course Outcome 1</b>
1. State and Discuss various basic terminology, concepts of PLC controls and functions of the Allen Bradley PLC 5, SLC 500, and CLX 5000 series of PLCs.	1.1 Identify and state the function of components of the PLC 5, SLC 500 and CLX 5000 series of PLCs. 1.2 State the function, operation and set-up of analog cards used on PLC 5, SLC 500 and CLX 5000 series of PLCs. 1.3 Discuss the function, advantages, and limitations of PLCs in Industrial Process Control Loops. 1.4 Discuss the function of PID controls in the PLC software for the PLC 5, SLC 500 and CLX 5000 series of PLCs. 1.5 Identify and list the equipment and components that make up a basic automated control system network. 1.6 Discuss the basic communication functions of the PLC 5, SLC 500 and CLX 5000 series of PLCs. 1.7 Discuss the integration a variety of PLCs and their associated hardware/software. 1.8 Research using available information resources such the internet, reference manuals, handbooks, quick start guides, knowledge bases and help files to aid in selecting, installing, programming, commissioning, testing, and troubleshooting the appropriate equipment and components for projects assigned.
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
2. Develop various basic and advanced PLC programs to control functions using different programming languages and memory structures, such as an address-based and tag-based, using the Allen Bradley PLC 5, SLC 500, and CLX 5000 series of PLCs.	2.1 Design and implement solutions to control problems using a PLC using the Logix family characteristics in PLC programming design. 2.2 Develop basic and advanced PLC 5, SLC 500 and CLX 5000 programs to control various electrical equipment using various programming languages. 2.3 Configure PLC analog input and output interface modules. 2.4 Configure PLC local and remote I/O modules. 2.5 Configure PLC PID software and advanced instructions. 2.6 Program a PLC to control a single loop process. 2.7 Analyze and troubleshoot PLC circuits and programs that contain discrete logic, sequential logic, analog to digital converters and digital to analog converters.
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
3. Develop various simple HMI programs to interface with and control PLCs functions for the Allen Bradley PLC 5, SLC 500, and CLX 5000 series of PLCs.	3.1 Design and configure simple HMI programs to interface with the PLC 5, SLC 500 and CLX 5000 series of PLCs to control various electrical equipment. 3.2 Design and troubleshoot simple HMI programs for discrete process controls. 3.3 Design and troubleshoot simple HMI programs for analog and PID process controls. 3.4 Design HMIs to present various forms of control and feedback such as using textual, numerical, and graphical representation.



	<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
	4. Create technical documentation using various computer skills and resources to provide accurate and meaningful documentation of assigned projects so that they may be understood and reproduced by another person.	4.1 Communicate information effectively by producing and maintaining current, clear, and accurate documentation of electrical PLC related equipment using reports, drawings, and other related documentation. 4.2 Use available resources such as internet, manuals, help files and handbooks to aid in creating accurate project documentation. 4.3 Use computers to document the design, commissioning, testing, modification, and implementation of electrical systems to produce a complete project manual. 4.4 Use computers to produce graphics such as single line drawings, schematic drawings, chassis layouts, etc. as necessary to convey technical information for the assigned projects using CAD software. 4.5 Use computer software and other technology to produce diagrams, charts, tables, graphs, and project timelines. 4.6 Apply drawing standards and standard symbols in the production of drawings. 4.7 Plan, organize, and deliver presentations including technical documents and projects.

**Evaluation Process and Grading System:**

<b>Evaluation Type</b>	<b>Evaluation Weight</b>
Assignments and Quizzes	10%
Practical Test 1	10%
Practical Test 2	20%
Project Demonstration	10%
Projects Final Report	15%
Written Test 1	10%
Written Test 2	10%
Written Test 3	15%

**Date:** June 1, 2022

**Addendum:** Please refer to the course outline addendum on the Learning Management System for further information.