



## COURSE OUTLINE: ELR315 - AUTO CONTROL SYSTEMS

Prepared: Ron Chartrand

Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	ELR315: AUTOMATIC CONTROL SYSTEMS
<b>Program Number: Name</b>	4029: ELECTRICAL TY-PROCES
<b>Department:</b>	ELECT./INSTRUMENTATION PS
<b>Semesters/Terms:</b>	20W
<b>Course Description:</b>	The student will develop an understanding of control system integration of industrial equipment. The student will interface PLCs to control drives, robotic equipment, process control equipment and other equipment through either analog or direct communication using communication techniques such as serial communication, peer to peer communication and master/slave. The student will use lab industrial networks and their components to interface automated equipment. The student will develop advance HMI programs to run each project including trending and troubleshooting screens. The student will program PLCs using advanced instructions, program files and utilize the trending and troubleshooting features of the software programs. The student will also use ladder, functional block, structured text and SFC programming techniques to program. The student will be required to work independently on assigned work outside of class time and access information from help files, manuals, and the internet.
<b>Total Credits:</b>	6
<b>Hours/Week:</b>	5
<b>Total Hours:</b>	75
<b>Prerequisites:</b>	ELR320, ELR326
<b>Corequisites:</b>	There are no co-requisites for this course.
<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 5 Commission and troubleshoot static and rotating electrical machines and associated control systems 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.
	VLO 9 Create, conduct and recommend modifications to quality assurance procedures under the supervision of a qualified person.



SAULT COLLEGE | 443 NORTHERN AVENUE | SAULT STE. MARIE, ON P6B 4J3, CANADA | 705-759-2554

	<p>VLO 10 Prepare reports and maintain records and documentation systems.</p> <p>VLO 11 Design, install, test, commission and troubleshoot telecommunication systems under the supervision of a qualified person.</p> <p>VLO 12 Apply and monitor health and safety standards and best practices to workplaces.</p> <p>VLO 13 Perform and monitor tasks in accordance with relevant legislation, policies, procedures, standards, regulations, and ethical principles.</p> <p>VLO 14 Configure installation and apply electrical cabling requirements and system grounding and bonding requirements for a variety of applications under the supervision of a qualified person.</p> <p>VLO 16 Select and recommend electrical equipment, systems and components to fulfill the requirements and specifications under the supervision of a qualified person.</p> <p>VLO 17 Apply project management principles to contribute to the planning, implementation, and evaluation of projects.</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>	Passing Grade: 50%, D
<b>Other Course Evaluation &amp; Assessment Requirements:</b>	<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> <p>W Student has withdrawn from the course without academic penalty.</p>

**Course Outcomes and Learning Objectives:**

<p><b>Course Outcome 1</b></p> <p>1. Understand various process automation terminology and concepts of PLC control system networks. Assist in the design of a variety of PLC control systems.</p>	<p><b>Learning Objectives for Course Outcome 1</b></p> <p>1.1 Utilize block diagrams to model basic networked control systems.            1.2 Identify different industrial networks such as DeviceNet, ControlNet, DH+, Industrial Ethernet, etc.            1.3 Describe the purpose and use of these industrial networks.            1.4 Understand the basic installation and configuration of these industrial networks.            1.5 Describe restrictions and imitations of these industrial networks.</p>
<p><b>Course Outcome 2</b></p> <p>2. Develop multi-display HMI programs with animated process control graphical objects.</p>	<p><b>Learning Objectives for Course Outcome 2</b></p> <p>2.1 Demonstrate the ability to design animated graphical displays for a HMI to represent a physical controlled process.            2.2 Demonstrate the ability to program a HMI to represent various variables in both numeric and animated forms.            2.3 Demonstrate the ability to configure animated object functions in a HMI display.            2.4 Demonstrate the ability to program multiple HMI displays and their associated navigation controls.</p>
<p><b>Course Outcome 3</b></p> <p>3. Develop advanced PLC and HMI programs to control various intelligent electrical equipment.</p>	<p><b>Learning Objectives for Course Outcome 3</b></p> <p>3.1 Demonstrate the ability to program the PLC and HMI to control intelligent motor controllers such as drives or soft-starters using both communication networks or discrete and analog I/O.            3.2 Demonstrate the ability to program the PLC and HMI to acquire and display motor control functions and operational data from intelligent motor controllers.            3.3 Demonstrate the ability to program the PLC to control and/or acquire data from intelligent networked industrial devices such as sensors, operator stations, indicator lights, etc.            3.4 Demonstrate the ability to program the PLC to communicate information to and from another PLC using various networking and communication strategies.</p>
<p><b>Course Outcome 4</b></p> <p>4. Assemble and connect a variety of automated equipment to perform process control, develop process control PLC programs and design and develop advanced HMI controls with data acquisition.</p>	<p><b>Learning Objectives for Course Outcome 4</b></p> <p>4.1 Demonstrate the ability to program PLCs to control two and three loop processes (cascading).            4.2 Demonstrate the ability to design and program HMI to control two and three loop process with PLCs.</p>
<p><b>Course Outcome 5</b></p> <p>5. Assemble and connect a variety of electrical automated equipment to perform as integrated systems utilizing task and control through HMI</p>	<p><b>Learning Objectives for Course Outcome 5</b></p> <p>5.1 Demonstrate the ability to program PLCs and HMIs to perform selected tasks over different networks from local and remote locations            5.2 Demonstrate the ability to program, connect PLCs, design HMIs, and control process control loops and intelligent equipment through Ethernet and DH+ Protocols from remote</p>



	software, PLC hardware and intelligent equipment. locations 5.3 Demonstrate the ability to connect and implement basic safety circuits and requirements for control systems. 5.4 Select and connect several different types of electrical equipment such as motor drives, PLCs, process control equipment, and HMIs along with sensing devices and output power devices into a structured unified controlled system to perform simulated tasks.										
<b>Evaluation Process and Grading System:</b>	<table border="1"> <thead> <tr> <th data-bbox="492 348 756 401">Evaluation Type</th> <th data-bbox="756 348 1451 401">Evaluation Weight</th> </tr> </thead> <tbody> <tr> <td data-bbox="492 401 756 435">Project Daily Log</td> <td data-bbox="756 401 1451 435">10%</td> </tr> <tr> <td data-bbox="492 435 756 470">Project Demonstrations</td> <td data-bbox="756 435 1451 470">40%</td> </tr> <tr> <td data-bbox="492 470 756 505">Project Proposal Report</td> <td data-bbox="756 470 1451 505">10%</td> </tr> <tr> <td data-bbox="492 505 756 565">Projects Final Report</td> <td data-bbox="756 505 1451 565">40%</td> </tr> </tbody> </table>	Evaluation Type	Evaluation Weight	Project Daily Log	10%	Project Demonstrations	40%	Project Proposal Report	10%	Projects Final Report	40%
Evaluation Type	Evaluation Weight										
Project Daily Log	10%										
Project Demonstrations	40%										
Project Proposal Report	10%										
Projects Final Report	40%										
<b>Date:</b>	August 29, 2019										
<b>Addendum:</b>	Please refer to the course outline addendum on the Learning Management System for further information.										