



## COURSE OUTLINE: ELR320 - AUTOMATED ELECT SYS

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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>Semesters/Terms:</b>	21F
<b>Course Description:</b>	The student will develop an understanding of control system equipment integration such as different PLCs, HMIs, analog and discrete I/O, communication interfaces and basic PLC network interfaces. Advanced PLC techniques will be used to connect, commission and document projects. The AB PLC will be introduced for basic discrete and analog PID controls to prepare the student for advance control and integration in the sixth semester. The student will develop programs in multiple languages to enable PLCs to access analog information and to configure and test PID instructions in preparation of integrating into different types of system such as process and drive control 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>	75
<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.
	VLO 10 Prepare reports and maintain records and documentation systems.
	VLO 12 Apply and monitor health and safety standards and best practices to workplaces.

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2021-2022 academic year.



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**Essential Employability Skills (EES) addressed in this course:**

- 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 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.

**Course Evaluation:**

Passing Grade: 50%, D

A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.

**Other Course Evaluation & Assessment Requirements:**

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 in order to pass the course.

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.

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

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.

**Books and Required Resources:**

PROGRAMMING CONTROLLOGIX PROGRAMMABLE AUTOMATION CONTROLLERS by  
Jon Stenerson  
Publisher: Delmar  
ISBN: 9781435419476

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**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 AB PLC 5, 500, and 5000.	1.1 Identify and list the equipment and components that make up a basic automated control system network. 1.2 Integrate a variety of PLCs. 1.3 Use available resources such as internet, manuals, help files and handbooks to aid in selecting, installing, commissioning, testing and troubleshooting the appropriate equipment and components for projects assigned. 1.4 Identify and state the function of components of the PLC 5, 5000 and SLC 500 family PLCs. 1.5 State the function, operation and set-up of analog cards used on PLC 5, 5000 and SLC 500 series PLC. 1.6 Discuss the function, advantages, and limitations of PLCs in Industrial Process Control Loops. 1.7 Discuss the basic communication functions of PLC 5, 5000 and SLC 500 1.8 Discuss the function of PID controls in the PLC software for the PLC 5, 5000 and SLC 500 family PLCs.
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
2. Develop various basic and advanced programs to control PLC functions through different programming structures such as an address based structure and a tag based structure using AB PLC 5, 500, and 5000.	2.1 Develop advance PLC 5, 5000 and SLC 500 programs to control various electrical equipment. 2.2 Analyze and troubleshoot PLC circuits that contain discrete logic, sequential logic and A to D and D to A conversion. 2.3 Apply logic family characteristics in PLC programming design. 2.4 Design and implement solutions to control problems using PLCs. 2.5 Program PLC 5, 5000 and SLC 500 processors using the appropriate programming software. 2.6 Configure PLC analog input and output interface modules. 2.7 Configure PLC PID software and advanced instructions. 2.8 Program a PLC to control a single loop process.
<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 AB PLC 5, 500, and 5000.	3.1 Program and simulate devices using graphical software. 3.2 Develop simple HMI programs for the PLC 5, 500, 5000 to control various electrical equipment. 3.3 Develop simple HMI programs for PLC analog input and output interfacing modules for the PLC 5, 5000 and SLC 500. 3.4 Develop simple HMI programs for PID controls.
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Develop various basic skills to provide accurate and meaningful information with respect to the projects assigned so that they could be reproduced by another group in the future.	4.1 Communicate information effectively and accurately by producing electrical PLC related equipment drawings and other related documentation. 4.2 Apply standards and standard symbols in the production of drawings. 4.3 Use computers and selected tools and equipment to produce or reproduce drawings using CAD.

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4.4 Use and produce graphics such as single line drawings, schematics etc. as necessary to convey technical information for the associated projects assigned.

4.5 Use available resources such as internet, manuals, help files and handbooks to aid in creating accurate project documentation.

4.6 Establish and document procedures required to successfully complete assigned projects.

4.7 Document all work and produce a complete project manual.

4.8 Plan, organize, and deliver presentations including technical documents and projects.

4.9 Use computer software and other technology to produce diagrams, charts, tables, graph and project timelines.

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
Attendance and Quizzes	15%
Practical Test 1	10%
Practical Test 2	20%
Project Demonstration	10%
Projects Final Report	10%
Written Test 1	10%
Written Test 2	10%
Written Test 3	15%

**Date:**

July 30, 2021

**Addendum:**

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

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