



## COURSE OUTLINE: ELR315 - AUTO CONTROL SYSTEMS

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<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>Academic Year:</b>	2022-2023
<b>Course Description:</b>	Students will develop an understanding of control system integration of various industrial equipment. The student will interface PLCs to control motor drives, process control elements, intelligent controllers, sensors, and HMIs using both discrete/analog control and industrial communication interfaces. 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>	70
<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



	<p>under the supervision of a qualified person.</p> <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>	<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 complete and demonstrate all assigned projects to pass the course.</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>

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.

**Course Outcomes and Learning Objectives:**

<b>Course Outcome 1</b>	<b>Learning Objectives for Course Outcome 1</b>
1. Understand various process automation terminology and concepts of PLC control system networks. Assist in the design of a variety of PLC control systems.	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.
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
2. Develop multi-display HMI programs with animated process control graphical objects.	2.1 Demonstrate the ability to design animated graphical displays for an 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 an HMI display. 2.4 Demonstrate the ability to program multiple HMI displays and their associated navigation controls.
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
3. Develop advanced PLC and HMI programs to control various intelligent electrical equipment.	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.
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Assemble and connect a variety of automated equipment to perform process control, develop process control PLC programs and design and	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



	develop advanced HMI controls with data acquisition.	control two and three loop process with PLCs.
	<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
	5. Assemble and connect a variety of electrical automated equipment to perform as integrated systems utilizing task and control through HMI software, PLC hardware and intelligent equipment.	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 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>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>
	6. 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.	6.1 Communicate information effectively by producing and maintaining current, clear, and accurate documentation of electrical PLC related equipment using reports, drawings, and other related documentation. 6.2 Use available resources such as internet, manuals, help files and handbooks to aid in creating accurate project documentation. 6.3 Use computers to document the design, commissioning, testing, modification, and implementation of electrical systems to produce a complete project manual. 6.4 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. 6.5 Use computer software and other technology to produce diagrams, charts, tables, graphs, and project timelines. 6.6 Apply drawing standards and standard symbols in the production of drawings. 6.7 Plan, organize, and deliver presentations including technical documents and projects.

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
Project Daily Log Book	10%
Project Demonstrations	40%
Project Proposals	10%
Project Reports	40%

**Date:**

June 1, 2022



**Addendum:**

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

