COURSE OUTLINE: ELR326 - AUTO NETWORKING II

Prepared: Chris Beauchamp
Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	ELR326: INDUSTRIAL AUTOMATION NETWORKING II
Program Number: Name	4029: ELECTRICAL TY-PROCES
Department:	ELECT./INSTRUMENTATION PS
Semesters/Terms:	21F
Course Description:	The fundamentals of industrial networks as presented in this course are for those who require a basic working knowledge and overview of today`s data communications, industrial networking systems and networking technologies. The objective of this course is to outline the best practices in designing, installing, commissioning and troubleshooting industrial networks. In any given plant, factory or installation, there are a number of different industrial networks and communications standards used and the key to successful implementation is the degree to which the entire system integrates and works together. This course will focus on introducing common Allen Bradley automation networks such as Data Highway+, Ethernet/IP, ControlNet, DeviceNet and other commonly used industrial networks such as Profibus, Modbus, and other industrial networks as time permits.
Total Credits:	4
Hours/Week:	4
Total Hours:	60
Prerequisites:	ELR223
Corequisites:	There are no co-requisites for this course.
Substitutes:	ELR325
This course is a pre-requisite for:	ELR315
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4029 - ELECTRICAL TY-PROCES** 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 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 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 11 Design, install, test, commission and troubleshoot telecommunication systems under the supervision of a qualified person. 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 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 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. W Student has withdrawn from the course without academic penalty.
Books and Required Resources:	Practical Industrial Data Communication Best Practice Techniques by Deon Reynder, Steve Mackay, Edwin Wright Publisher: ELSEVIER ISBN: 9780750663953

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Course Outcomes and Learning Objectives:	**Course Outcome 1**	**Learning Objectives for Course Outcome 1**
	1. Understand various basic terminology, concepts of a computer network and related networking certifications.	1.1 List the advantages of industrial networked computing relative to islands of automation. 1.2 Identify security concerns with modern industrial networks. 1.3 Identify the elements of an industrial network. 1.4 Explain basic industrial network terminology and concepts. 1.5 Describe several specific uses for industrial networks. 1.6 Identify some of the certifications available to industrial networking professionals. 1.7 Identify the kinds of non-technical, or soft, skills that will help you succeed as a industrial networking professional. 1.8 Identify and distinguish between different data communications standards such as RS-232 interface standard and RS-485 interface standard. 1.9 Understand the importance of the ISO OSI model and how it applies to the industrial networks discussed in this course.
	Course Outcome 2	**Learning Objectives for Course Outcome 2**
	2. Analyze and discuss the operation of industrial Ethernet network systems.	2.1 Understand the basics of industrial Ethernet. 2.2 State the application advantages and limitations of industrial Ethernet in today`s modern industries. 2.3 Understand the role of TCP/IP and its associate protocols have in the industrial Ethernet plant application. 2.4 Describe how industrial Ethernet systems operate. 2.5 Compare wired to wireless industrial networking. 2.6 List the advantages and disadvantages of wireless technology. 2.7 List and describe communication medias used in industrial networking systems discussed in this course. 2.8 Identify industrial Ethernet network cable types and uses. 2.9 Identify industrial Ethernet network troubleshooting. 2.10 Describe the terms electrical coupling, grounding and shielding as they applies to industrial networks.
	Course Outcome 3	**Learning Objectives for Course Outcome 3**
	3. Analyze and discuss the operation of ControlNet network systems.	3.1 Understand and identify ControlNet applications and place in in a typical plant hierarchy. 3.2 Identify frame format and network characteristics. 3.3 Understand ControlNet configuration and network components. 3.4 Explain ControlNet addressing and topology. 3.5 Discuss installation, commissioning and troubleshooting. 3.6 Identify the types of media and their characteristics. 3.7 Identify the core protocols of each protocol suite and its functions.
	Course Outcome 4	**Learning Objectives for Course Outcome 4**
	4. Analyze and discuss the operation of DeviceNet network systems.	4.1 Understand and identify DeviceNet applications and place in in a typical plant hierarchy. 4.2 Identify frame format and network characteristics. 4.3 Understand DeviceNet configuration and network

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	Course Outcome 5	Learning Objectives for Course Outcome 5
		components. 4.4 Explain DeviceNet addressing and topology. 4.5 Discuss installation, commissioning and troubleshooting. 4.6 Identify the types of media and their characteristics.
	5. Analyze and discuss the operation of Profibus network systems.	5.1 Understand and identify different types of Profibus networks, their applications and place in in a typical plant hierarchy. 5.2 Identify frame format and network characteristics. 5.3 Understand Profibus networks configurations and network components. 5.4 Explain Profibus networks addressing and topology. 5.5 Discuss installation, commissioning and troubleshooting. 5.6 Identify the types of media and their characteristics.
	Course Outcome 6	Learning Objectives for Course Outcome 6
	6. Understand the basics of other common industrial networks.	6.1 Identify different industrial networks such as Modbus, ASI, Hart, etc. 6.2 Identify basic industrial networks addressing methods. 6.3 Understand the differences between various industrial network types. 6.4 Discuss installation, commissioning and troubleshooting. 6.5 Identify the types of network media and their characteristics. 6.6 Demonstrate the ability to communicate peer to peer information from two or more industrial computerized lab equipment over several AB industrial networks such as Ethernet I/P, ControlNet, DeviceNet, and DH+.
	Course Outcome 7	Learning Objectives for Course Outcome 7
	7. Demonstrate the ability to configure and use various industrial networks and networked devices.	7.1 Identify various industrial networks and physical topologies by observing network media and hardware in use. 7.2 Apply various methods to identify types of devices on industrial networks. 7.3 Configure various industrial networks using appropriate software. 7.4 Communicate information between two or more industrial networked devices over several industrial networks such as Ethernet/IP, ControlNet, DeviceNet, and DH+.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Attendance and Quizzes	5%
Project Demonstration	15%
Projects Final Report	15%
Written Test 1	15%
Written Test 2	25%
Written Test 3	25%

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Date:	July 30, 2021
Addendum:	Please refer to the course outline addendum on the Learning Management System for further information.

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