COURSE OUTLINE: ELR326 - AUTO NETWORKING II

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Course Code: Title	ELR326: INDUSTRIAL AUTOMATION NETWORKING II
Program Number: Name	4029: ELECTRICAL TY-PROCES
Department:	ELECT./INSTRUMENTATION PS
Academic Year:	2024-2025
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 several 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, as well as other industrial networks as time permits.
Total Credits:	4
Hours/Week:	4
Total Hours:	56
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.

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, the lab portion, and demonstrate all projects 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 Reynders, Steve Mackay, Edwin Wright Publisher: Elsevier ISBN: 9780750663953

Course Outcomes and Learning Objectives:

Course Outcome 1	Learning Objectives for Course Outcome 1
1. Understand and describe basic terminology and concepts associated with industrial networked systems.	1.1 List the advantages of industrial networked computing relative to standalone 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 and distinguish between different data communications standards such as RS-232 interface standard and RS-485 interface standard. 1.7 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 components and operation of industrial Ethernet networks.	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 Describe the advantages and disadvantages of wireless technology compared to wired networks. 2.6 Identify and describe various industrial Ethernet network components and their purpose. 2.7 Identify and describe industrial Ethernet physical media types and uses. 2.8 Understand industrial Ethernet network troubleshooting techniques. 2.9 Describe the terms electrical coupling, grounding, and shielding as they apply to industrial networks.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. Analyze and discuss the components and operation of ControlNet networks.	3.1 Understand and identify the application of ControlNet networks and their place in in a typical plant network hierarchy. 3.2 Identify ControlNet frame format and network characteristics. 3.3 Understand and explain ControlNet network configuration, addressing and topologies. 3.4 Identify and describe various ControlNet network components and their purpose. 3.5 Identify the types of ControlNet physical media and their characteristics. 3.6 Discuss installation, commissioning, and troubleshooting techniques used in ControlNet networks. 3.7 Describe the use of computer-based software to configure a ControlNet network.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. Analyze and discuss the components and operation of DeviceNet networks.	4.1 Understand and identify the application of DeviceNet networks and their place in in a typical plant network hierarchy. 4.2 Identify DeviceNet frame format and network

	characteristics. 4.3 Understand and explain DeviceNet network configuration, addressing and topologies. 4.4 Identify and describe various DeviceNet network components and their purpose. 4.5 Identify the types of DeviceNet physical media and their characteristics. 4.6 Discuss installation, commissioning, and troubleshooting techniques used in DeviceNet networks. 4.7 Describe the use of computer-based software to configure a DeviceNet network.
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5. Analyze and discuss the components and operation of Profibus networks.	5.1 Understand and identify the application of various Profibus networks and their place in in a typical plant network hierarchy. 5.2 Identify Profibus frame format and network characteristics. 5.3 Understand and explain Profibus network configuration, addressing and topologies. 5.4 Identify and describe various Profibus network components and their purpose. 5.5 Identify the types of Profibus physical media and their characteristics. 5.6 Identify and explain the similarities and differences between a Profibus DP and Profibus PA network. 5.7 Discuss installation, commissioning, and troubleshooting techniques used in Profibus networks.
Course Outcome 6	**Learning Objectives for Course Outcome 6**
6. Understand the components and operation of other common industrial networks.	6.1 Identify different industrial networks such as DH+, Modbus, Hart, Foundation Fieldbus, etc. as time permits. 6.2 Understand and identify the application of these other common industrial networks and their place in in a typical plant network hierarchy. 6.3 Understand and explain configurations, addressing methods and topologies for each network. 6.4 Identify and describe network components and their purpose for each network. 6.5 Identify the types of physical media and their characteristics for each network. 6.6 Discuss installation, commissioning, and troubleshooting techniques used in these networks.
Course Outcome 7	**Learning Objectives for Course Outcome 7**
7. Demonstrate the ability to configure, use and produce technical documentation of industrial networks and networked devices.	7.1 Identify various industrial networks, components, and physical topologies by analyzing network physical media and the hardware used to create an industrial network. 7.2 Apply various methods to identify types of devices communicating on industrial networks. 7.3 Configure various industrial networks and devices using both hardware and software-based configuration techniques. 7.4 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, troubleshooting, and accurately documenting industrial networks and their components for projects assigned. 7.5 Communicate information between two or more industrial networked devices over available industrial networks such as Ethernet/IP, ControlNet, DeviceNet, and DH+. 7.6 Communicate information effectively by producing and maintaining current, clear, and accurate documentation of industrial networking systems using reports, drawings, and other related documentation. 7.7 Use computers to produce graphics such as network diagrams, etc. as necessary to convey technical information for the assigned networking projects using CAD software.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments and Quizzes	10%
Project Demonstration	10%
Projects Final Report	15%
Written Test 1	15%
Written Test 2	25%
Written Test 3	25%

Date: August 9, 2024

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