

Course Information Form (CIF)

Course Code: ELT 293

Course Title: Industrial Control Networks

Department: Applied Sciences and Technologies

Effective Date: Summer 2026

PCS Code: 1.2 - Occupational/Technical Instruction

CIP Code: 47.0104

Repeatability: 0

Credit Hours

Catalog Notation: 2-2-3

Credit Hour Distribution:

Lecture: 2

Lab: 2

Clinical: 0

Total: 3

General Course Information

Catalog Description

Control networks used in industry; devices, media, protocols, and equipment used to control devices and acquire data. Serial, DH485, Controller Area Network (CAN), and Ethernet.

General Course Objectives

Acquire educational foundation for understanding data communications and networking as it applies to industrial environments.

Minimum Placement Levels

English

None

Reading

None

Math

None

Prerequisites

Sophomore standing

Methods of Evaluation

Students will be given a minimum of 4 quizzes, 1 midterm, 1 final, 8 labs, and 1 lab practical.

Instructional Materials and Additional Supplies

There is no textbook needed for this course. Any printed materials will be provided by the instructor.

Safety glasses

Course Content

General Learning Outcomes (GLOs)

- Reasoning and Inquiry: Students will demonstrate the ability to solve problems using deductive reasoning and logic, quantitative reasoning, or the scientific method.

Course Segments and Student Learning Outcomes

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Introduction to Data Communications and Networking	1. Describe data communications protocols. 2. Describe serial and parallel data transmission and disadvantages of each.	2	0	0
Signals, Noise, Modulation, and Demodulation	1. Define analog and digital signals and describe the difference between them. 2. Describe the difference between digital modulation and digital transmission. 3. Define amplitude, frequency, and phase. 4. Describe the difference between the time and frequency domain, frequency spectrum, and bandwidth. 5. Define electrical noise and signal-to-noise ratio. 6. Define modulation, list types of modulation, and explain how the information is imparted onto the carrier wave.	2	2	0
Metallic Cable Transmission Media	1. Define general categories of metallic transmission lines. 2. Describe the characteristics of electromagnetic waves; open wire, twin lead, twisted pair, unshielded twisted pair, shielded twisted pair, and coax. 3. Define and describe characteristic impedance and propagation constant. 4. List and explain types of signal losses associated with metallic transmission lines. 5. Construct and test data communication cables using metallic media.	2	2	0
Optical Fiber Transmission	1. Define optical communications. 2. Compare and contrast optical and metallic transmission media. 3. Describe the electromagnetic frequency spectrum and wavelength spectrum. 4. Describe single mode and multi-mode graded index. 5. List and describe losses associated with optical fibers. 6. Compare and contrast different light sources.	1	0	0
Multiplexing	1. Define multiplexing. 2. Describe time-division multiplexing. 3. Define line encoding, duty cycle, bandwidth, and error detection. 4. Explain statistical time-division multiplexing, frequency-division multiplexing, and wavelength division multiplexing.	1	0	0
Wireless Communications Systems	1. Define the following: free space propagation, electromagnetic polarization, and electromagnetic radiation. 2. Describe wave attenuation and absorption. 3. Define current wireless protocols in use for industrial systems. 4. Connect and test a wireless transmitter/receiver system.	2	2	0
Codes, Error Controls, and Data Formats	1. Define error detection. 2. Explain the differences between asynchronous and synchronous data formats.	2	0	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Serial Data Communications Hardware and Equipment	1. List and describe three basic elements of a data communications system. 2. Describe the terms Data Terminal Equipment (DTE) and Data Communications Equipment (DCE) and give several examples of each type of equipment. 3. List the parameters for the RS-232, RS-422, and RS-485 interfaces. 4. Compare and contrast the RS-232, RS-422, and RS-485 serial interfaces. 5. Create a serial connection between two computers and verify proper operation. 6. Utilize test equipment to verify connections between devices to check signal activity and Flow Control. 7. Connect Human Machine Interfaces (HMIs) to Programmable Logic Controllers (PLCs) to create a software control panel.	4	6	0
DH485 Industrial Local Area Network Allen-Bradley (AB) Rockwell Protocol	1. Describe the DH485 protocol from AB. 2. Connect, configure, and test a personal computer (PC) and AB equipment for communication and control.	2	2	0
CAN	1. Describe the CAN protocol. 2. Connect and control Variable Frequency Drives (VFDs) with a PLC using serial protocols.	2	4	0
Network Topologies and Connectivity Devices	1. Define the following: local area network (LAN), transmission formats, collision domain, broadcast domain, and connectivity device. 2. Describe the LAN topologies: star, bus, tree bus, and ring. 3. Construct a LAN using switches. 4. Connect HMIs to a PLC to monitor and control application programs.	2	2	0
Local Area Network (LAN)	1. Describe the advantages of using a LAN. 2. Describe medium access methods and control for different technologies. 3. Describe the differences between a connectionless and connection-oriented service. 4. Describe the difference between acknowledged and unacknowledged service. 5. Describe a data protocol unit.	2	4	0
Transmission Control Protocol-Internet Protocol (TCP-IP) Suite and Internet Protocol Addressing	1. Explain the function of each of the layers in the Open Systems Interconnection (OSI) seven layer protocol hierarchy. 2. Explain the number systems used to represent Internet Protocol (IP) addresses. 3. Describe how to determine the IP class, network, and hosts associated with an IP network address. 4. Describe the purpose of reserved and special IP address. 5. Explain address masking to determine networks and hosts. 6. Troubleshoot and repair a network.	6	6	0

Total Contact Hours

Lecture Hours	Lab Hours	Clinical Hours
30	30	0