



## Course Number and Title: CEN 126 Industrial Networks

**Campus Location:**

Dover

**Effective Date:**

2018-51

**Prerequisite:**

MAT 010, ENG 090 or ENG 091, SSC 100 or concurrent

**Co-Requisites:**

None

**Course Credits and Hours:**

3.00 credits

2.00 lecture hours/week

2.00 lab hours/week

**Course Description:**

This course introduces students to the network devices, standards, protocols, and security requirements used to connect industry and medical field devices.

**Required Text(s):**

Obtain current textbook information by viewing the [campus bookstore - https://www.dtcc.edu/bookstores](https://www.dtcc.edu/bookstores) online or visit a campus bookstore.

Check your course schedule for the course number and section.

**Additional Materials:**

None

**Schedule Type:**

Classroom Course

**Disclaimer:**

None

**Core Course Performance Objectives (CCPOs):**

1. Recognize common terms used in industrial networks. (CCC 1, 2, 3; PGC 1, 2)
2. Explain the open systems interconnection (OSI) and transmission control protocol/Internet protocol (TCP/IP) reference models. (CCC 1, 2, 3; PGC 1, 2)
3. Describe the hierarchy of industrial networks. (CCC 1, 2, 3; PGC 1, 2)
4. Summarize different topologies used in industrial networks. (CCC 1, 2, 3; PGC 1, 2)
5. List types of hardware and backbone devices used to transmit data signals and power. (CCC 1, 2, 3; PGC 1, 2)
6. Differentiate between industrial communication protocols. (CCC 1, 2, 3; PGC 1, 2)
7. Construct a network composed of common industrial devices. (CCC 1, 2, 3; PGC 1, 2, 3)
8. Summarize security requirements and trends in industrial networking environments. (CCC 1, 2, 3; PGC 1, 2, 3)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

## Measurable Performance Objectives (MPOs):

Upon completion of this course, the student will:

1. Recognize common terms used in industrial networks.
  1. Define the following terms:
    1. Protocol
    2. Fieldbus
    3. Interoperability
    4. American Standard Code for Information Interchange (ASCII)
    5. Bus
    6. Segments
    7. Master-slave
    8. Source-destination
    9. Full-duplexing
    10. Token-passing
    11. Carrier sense multiple access (CSMA)
    12. Unicast
    13. Subnets
2. Explain the open systems interconnection (OSI) and transmission control protocol/Internet protocol (TCP/IP) reference models.
  1. Define the OSI reference model and its uses.
  2. Define the TCP/IP reference models and its uses.
  3. Identify the layers at which the networking components like hubs, switches, bridges, routers, network interface card (NICs), and wireless access point (WAPs) operate.
  4. Explain applications of the OSI and TCP/IP reference models.
3. Describe the hierarchy of industrial networks.
  1. Recognize and define a sensor bus network.
  2. Recognize and define a device bus network.
  3. Recognize and define a control bus network.
  4. Recognize and define an enterprise network.
4. Summarize different topologies used in industrial networks.
  1. Recognize and define a bus topology.
  2. Recognize and define a star topology.
  3. Recognize and define a ring topology.
  4. Recognize and define a combination topology.
5. List types of hardware and backbone devices used to transmit data signals and power.
  1. Explain the purpose and operation of a hub.
  2. Explain the purpose and operation of a bridge.
  3. Explain the purpose and operation of a switch.
  4. Explain the purpose and operation of a gateway.
6. Differentiate between industrial communication protocols.
  1. Describe the following industrial communication protocols and explain their primary function:
    1. Modbus
    2. Highway addressable remote transducer (HART)
    3. Profibus
    4. ProfiNet
    5. DeviceNet
    6. ControlNet
    7. Ethernet/IP
    8. Actuator sensor (AS-i) interface
    9. Building automation and control networking (BACNet)
    10. Short message service (SMS) for medical telemetry
7. Construct a network composed of common industrial devices.
  1. Design a network solution for a typical industrial environment as provided by the instructor.
  2. Configure a network of industrial devices.
  3. Configure networking devices like hubs, switches, and routers.
8. Summarize security requirements and trends in industrial networking environments.
  1. Describe industrial network security concerns.
  2. Discuss an effective security policy.
  3. Discuss industrial network security management techniques.

**Evaluation Criteria/Policies:**

Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	-	100	=	A
83	-	91	=	B
75	-	82	=	C
0	-	74	=	F

Students should refer to the [Student Handbook - https://www.dtcc.edu/handbook](https://www.dtcc.edu/handbook) for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

**Core Curriculum Competencies (CCCs are the competencies every graduate will develop):**

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

**Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):**

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Design or improve electrical/electronics systems using critical thinking, theoretical knowledge, and practical understanding.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Demonstrate basic management, organizational, and leadership skills.
5. Explain the importance of engaging in self-directed continuing professional development.

**Disabilities Support Statement:**

The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the [disabilities services - https://www.dtcc.edu/disabilitysupport](https://www.dtcc.edu/disabilitysupport) web page or visit the campus Advising Center.