



## Course Number and Title: CEN 220 Digital Data Comm w/ Networks

**Campus Location:**

Dover

**Effective Date:**

2018-51

**Prerequisite:**

CEN 120

**Co-Requisites:**

None

**Course Credits and Hours:**

4.00 credits

3.00 lecture hours/week

2.00 lab hours/week

**Course Description:**

A study of computer interfacing and networking. Interface techniques such as RS 232, RS 422, etc. will be covered. UARTs and advanced modem operation are presented. Networking through simulations and observation are included with telephone switching systems.

**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:**

USB flash drive for lab work and broadband internet access

**Schedule Type:**

Classroom Course

Online Course

**Disclaimer:**

None

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

1. Demonstrate a fundamental understanding of data transmission principles, transmission media, signal encoding techniques, digital data communication techniques, data link control protocols, multiplexing techniques, and spread spectrum techniques. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3, 5)
2. Describe a fundamental understanding of wide area networks (WAN), circuit switching and packet switching, asynchronous transfer mode (ATM), routing in switched networks, congestion control in data networks, and cellular wireless networks. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3, 5)
3. Setup local area networks, traditional and high-speed Ethernet, and wireless local area networks (LAN). (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3)
4. Define internetworking and Internet Protocols (IP), internetwork operations, internet quality of service (QoS), multiprotocol label switching (MPLS), and connection-oriented transport protocols. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3, 5)
5. Produce a fundamental understanding of computer and network security threats, encryption, and computer and network security techniques. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3, 5)

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. Demonstrate a fundamental understanding of data transmission principles, transmission media, signal encoding techniques, digital data communication techniques, data link control protocols, multiplexing techniques, and spread spectrum techniques.
  1. Demonstrate a fundamental understanding of data transmission principles.
  2. Demonstrate a fundamental understanding of the characteristics and behavior of data signals propagated through a transmission medium.
  3. Demonstrate a fundamental understanding of digital and analog data and of digital and analog transmissions.
  4. Explain transmission impairments such as attenuation and noise.
  5. Demonstrate a fundamental knowledge of the common types of transmission media.
  6. Demonstrate a fundamental knowledge of the characteristics and behavior of guided transmission-medium such as twisted-pair, coaxial, and optical fiber cables.

7. Demonstrate a fundamental knowledge of the characteristics and behavior of wireless transmission-medium techniques, such as terrestrial- and satellite- microwave, broadcast radio, and directional-infrared.
  8. Demonstrate a fundamental knowledge of signal encoding techniques.
  9. Demonstrate a understanding of the techniques to encode digital data using digital signals, digital data using analog signals, analog data using digital signals, and analog data using analog signals.
  10. Demonstrate a fundamental knowledge of digital data communication techniques.
  11. Demonstrate a fundamental knowledge of transmission errors, and error detection and correction techniques.
  12. Demonstrate a fundamental knowledge of asynchronous and synchronous data communication techniques.
  13. Demonstrate a fundamental knowledge of data link control protocols, including flow and error control.
  14. Explain the operation of the HDLC data link control protocol.
  15. Demonstrate a fundamental knowledge of multiplexing techniques such as frequency-division, synchronous time-division, and statistical time-division multiplexing.
  16. Distinguish between the types of digital subscriber line (xDSL) services.
  17. Demonstrate a fundamental knowledge of spread spectrum techniques including frequency hopping, direct sequence, and code-division multiple access.
2. Describe a fundamental understanding of wide area networks (WAN), circuit switching and packet switching, asynchronous transfer mode (ATM), routing in switched networks, congestion control in data networks, and cellular wireless networks.
    1. Demonstrate a fundamental knowledge of circuit switching and packet switching technology.
    2. Demonstrate a fundamental knowledge of digital switching technology including space and time division switching networks.
    3. Demonstrate a fundamental knowledge of packet switching approaches including analyzing datagram and virtual circuit technologies.
    4. Demonstrate a fundamental knowledge of frame relay technology, protocol and format.
    5. Demonstrate a fundamental knowledge of broadband ISDN and asynchronous transfer mode (ATM) protocol and format.
    6. Demonstrate a fundamental knowledge of routing in switched networks.
    7. Demonstrate a fundamental knowledge of common routing algorithms used in switched data networks, such as frame relay and asynchronous transfer mode networks, and in the Internet.
    8. Demonstrate a fundamental understanding of the nature of congestion in switched networks and the importance of congestion control and traffic management.
    9. Demonstrate a fundamental understanding of the importance of congestion control and traffic management in ATM networks.
    10. Demonstrate a fundamental understanding of the principles of cellular wireless networks including first-generation analog, second-generation CDMA, and third- generation and fourth-generation systems.
3. Setup local area networks, traditional and high-speed Ethernet, and wireless local area networks (LAN).
    1. Demonstrate a fundamental understanding of the principles local area networks.
    2. Demonstrate a fundamental understanding of the essential technology underlying all forms of local area networks.
    3. Demonstrate a fundamental understanding of the common physical network topologies including bus, tree, ring, and star topologies.
    4. Demonstrate a fundamental understanding of the common transmission media used in local area network such as twisted-pair, coaxial cable, optical fiber and wireless.
    5. Demonstrate a fundamental understanding of the essential technology to commonly connect and interconnect local area networks such as hubs and bridges.
    6. Demonstrate a fundamental understanding of the essential technology for traditional and high-speed Ethernet networks.
    7. Demonstrate a fundamental understanding of the principles of logical access methodology for Ethernet networks.
    8. Demonstrate a fundamental understanding of the technology for wireless Ethernet networks including spread-spectrum, narrow-band microwave, and directional- infrared.
    9. Distinguish between the various IEEE wireless standards for local area networks.
4. Define internetworking and Internet Protocols (IP), internetwork operations, internet quality of service (QoS), multiprotocol label switching (MPLS), and connection-oriented transport protocols.
    1. Demonstrate a fundamental understanding of the essential technology for internetworking.
    2. Demonstrate a fundamental understanding of the principles and function of router for internetworking.
    3. Demonstrate a fundamental understanding of the Internet Protocol (IP) including IPv4 and IPv6.
    4. Demonstrate a fundamental understanding of the essential technology for internetwork operations using unicasting and multicasting.
    5. Demonstrate a fundamental understanding of the routing protocols for internetwork operations.
    6. Demonstrate a fundamental understanding of the essential technology for Internet quality of service including integrated services architecture, resource reservation protocol, differentiated services, service level agreements, and IP performance metrics.
    7. Demonstrate a fundamental understanding of the role of multiprotocol label switching (MPLS), its operation and labels.
    8. Demonstrate a fundamental understanding of the role of connection-oriented transport protocol mechanisms such as transport control protocol (TCP), TCP congestion control, and user datagram protocol (UDP).
5. Produce a fundamental understanding of computer and network security threats, encryption, and computer and network security techniques.
    1. Demonstrate a fundamental understanding of computer and network security threats including computer security concepts (threats, attacks, assets, intruders) and malicious software (viruses, worms, bots).
    2. Demonstrate a fundamental understanding of the roll and use of encryption techniques for ensuring confidentiality including conventional and public-key encryption.
    3. Demonstrate a fundamental understanding of the roll and use of encryption algorithms such as AES, RSA, SHA-1.
    4. Demonstrate a fundamental understanding of computer and network security techniques including virtual private networks, IPSec, SSL and TLS, and Wi-Fi protected access.

5. Demonstrate a fundamental understanding of computer and network security technologies including intrusion detection, firewalls, and malware defense.

**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. Apply techniques, skills and usage of modern tools of a Computer Network Engineering Technician.
2. Apply analysis tools and problem-solving methods learned in the mathematics, sciences and electrical/electronics courses to conduct, interpret and analyze experiments.
3. Use critical thinking in the design or improvement of quality systems, components or processes.
4. Employ oral and written communication techniques as an integral member of a multidisciplinary work team.
5. Adhere to professional, ethical, and social issues in a diverse workplace.
6. Perform basic management and leadership skills, which will include time management and organization in the Computer Engineering Technology.

**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.