Western Technical College

10662140 Data Communications and Networking

Course Outcome Summary

Course Information

Description	This course is an overview of fundamental concepts and technologies used in computer networks and digital communications. Network OSI Model and Internet (TCP/IP) Model and layers will be studied including their function, protocols, and services. Topics regarding network design concepts will be covered including LAN, WLAN, WAN, and Internet topologies and functions along with associated hardware. Students will be familiar with new technologies and applications such as IoT and Cloud-based services. Communication technology and hardware including serial communication, Analog to Digital conversion, modems, routers, switches, multiplexers, and modulation waveforms will be discussed.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	72

Pre/Corequisites

Prerequisite	10660116 DC/AC 2
Prerequisite	10660125 Electronic Devices
Prerequisite	10662137 Digital Electronic Concepts
Pre/Corequisite	10662153 Intro to LabVIEW

Textbooks

Business Data Communications and Networking. 14th Edition. Copyright 2021. Fitzgerald, Jerry, Alan Dennis, and Alexandra Durcikova. Publisher: John Wiley & Sons, Inc. **ISBN-13**: 978-1-119-71368-5. Required. (eBook: **ISBN-13**: 978-1-119-70266-5)

Learner Supplies

Earbuds or headphones. **Vendor:** Campus Shop. Required.

Success Abilities

1.   Cultivate Passion: Expand a Growth-Mindset

2.   Live Responsibly: Embrace Sustainability

3.   Refine Professionalism: Improve Critical Thinking

4.   Refine Professionalism: Participate Collaboratively

Course Competencies

1.   Examine Fundamental Communication and Networking Concepts.

Assessment Strategies
1.1.   Written Objective Test

Criteria

You will know you are successful when
1.1.   you list the elements needed in a communication system.
1.2.   you distinguish between serial and parallel communication systems.
1.3.   you choose the best network topology for a given specific application.

Learning Objectives
1.a.   Describe a fundamental communication link consisting of a transmitter, transmission medium, and receiver.
1.b.   Describe differences between serial and parallel communications.
1.c.   Describe advantages and disadvantages of serial and parallel communications.
1.d.   Define commonly used terms in data communications, networking, and standards.
1.e.   Describe various network topologies (bus, ring, star, and mesh).
1.f.   Differentiate between physical and logical topologies.
1.g.   Select an appropriate network topology for a given application.

2.   Examine Serial Data Interface.

Assessment Strategies
2.1.   Written Objective Test

Criteria

You will know you are successful when
2.1.   you match the characteristics of a hardware serial interface and the associated control signals.

Learning Objectives
2.a.   Describe characteristics of a commonly used serial data interface.
2.b.   Describe interface hardware and operation of data control functions of a typical standardized serial data interface

3.   Examine Open Systems Interconnect (OSI) Model and TCP/IP Layers.

Assessment Strategies
3.1.   Research Paper

Criteria

You will know you are successful when
3.1.   you identify the purpose of each of the 7 layers of the OSI Model.

Learning Objectives

3.a.   Describe peer-to-peer communication processes at each layer of a layered architecture of protocols.
3.b.   Describe the roles of each of the physical, data link, network, and transport layers of the OSI model
3.c.   Categorize commonly used protocols by the appropriate OSI layer.
3.d.   Describe the layers of the TCP/IP protocol suite

4.   Analyze the Physical Layer.

Assessment Strategies
4.1.   Written Objective Test

Criteria

You will know you are successful when

4.1.   you match the proper physical protocols to the topology.
4.2.   you identify signal degradation and frequency components sing test equipment.

Learning Objectives
4.a.   Describe physical layer protocols including network topology (bus, ring, star, and mesh).
4.b.   Describe the concept of frequency content in a signal.
4.c.   Describe transmission impairments associated with signaling on transmission media.
4.d.   Calculate maximum data rate for information through a channel having specified bandwidth and signal-to-noise ratio, using the Shannon capacity equation.
4.e.   Calculate the minimum bandwidth of a cable that uses two signal levels at a specified baud rate to transfer serial information, using the Nyquist limit

5.   Determine Line Coding and Modulation Waveforms.

Assessment Strategies
5.1.   Written Objective Test

Criteria

You will know you are successful when

5.1.   ASK, FSK , PSK and OFDM signals are drawn in proper time reference.
5.2.   Line-coded data are sketched in proper time form.

Learning Objectives
5.a.   Sketch the time waveform of a line-coded data signal given the binary data sequence being transferred and the line coding method (including NRZ, RZ, and Manchester).
5.b.   Describe the time waveform of a digitally modulated signal given the binary data sequence being transferred and the modulation method (including ASK, FSK, PSK, and OFDM)

6.   Analyze A-to-D Conversion.

Assessment Strategies
6.1.   Demonstration

Criteria

You will know you are successful when

6.1.   you construct and analyze an A to D and D to A system correct operation.

Learning Objectives
6.a.   Describe the sampling and quantization processes within A-to-D conversion.
6.b.   Determine the minimum sampling rate required for A-to-D conversion of an analog signal having a specified bandwidth.
6.c.   Determine the signal-to-noise ratio for an analog signal recovered from an A-to-D converted signal, when quantization has a specified number of levels

7.   Examine Modems and Multiplexers.

Assessment Strategies
7.1.   Demonstration

Criteria

You will know you are successful when

7.1.   you construct and verify examples of mux, demux, tdma, and fdma.

Learning Objectives
7.a.   Describe multiplexing.
7.b.   Describe time division multiplexing, frequency division multiplexing, and their differences.
7.c.   Describe typical signal processing functions of a modem.
7.d.   Compare specifications of commonly used broadband technologies

8.   Select Transmission Media for Various Applications.

Assessment Strategies
8.1.   Written Objective Test

Criteria

You will know you are successful when

8.1.   you match various physical transmission lines to their optimal use.
8.2.   you identify types of cable for specific safety considerations.

Learning Objectives
8.a.   Identify various physical transmission media.
8.b.   Describe advantages and disadvantages of various physical transmission media.
8.c.   Identify relevant cabling standards, codes, and safety practices.
8.d.   Select an appropriate transmission medium for an application

9.   Examine Data Link Layer Protocols.

Assessment Strategies
9.1.   Case Study

Criteria

You will know you are successful when

9.1.   you analyze a case.
9.2.   you support case solution.
9.3.   you determine cost to implement.
9.4.   you determine if cost is reasonable.

Learning Objectives
9.a.   Describe the use of error detection and correction methods.
9.b.   Define error control and flow control achieved by commonly used data link layer protocols.
9.c.   Describe the operation of the Stop-and-Wait data link layer protocol.
9.d.   Describe the operation of the Sliding Window data link layer protocol.
9.e.   Describe commonly used network medium access control methods (including random, token, and pre-assigned).
9.f.   Describe Ethernet operation and Ethernet frames.
9.g.   Describe the function of bridges in Ethernet LANs.
9.h.   Interpret information gathered by a network analyzer

10.   Examine Local and Wide Area Networks.

Assessment Strategies
10.1.   Research Paper

Criteria

You will know you are successful when

10.1.   you address characteristics, and special considerations for transmission media, data rates and security.

Learning Objectives
10.a.   Describe local area network (LAN) concepts.
10.b.   Describe commonly used local area network technologies.
10.c.   Identify specifications of commonly used local area network technologies.
10.d.   Describe the use of Ethernet as a LAN multiple access technology.
10.e.   Describe wide area network (WAN) concepts.
10.f.   Identify commonly used wide area network technologies

11.   **Explain Network, Transport, and Higher Layer Devices, Protocols, and Services.**

Assessment Strategies

11.1.   Written Objective Test

Criteria

You will know you are successful when

11.1.   you define router, gateways, and switches with respect for their optimal use.
11.2.   you give an example of how a DNS is obtained.
11.3.   you define the purpose of a routing table.
11.4.   you give an example of when an FTP should be used.

Learning Objectives

11.a.   Describe IP addressing as logical addresses used in TCP/IP networking.
11.b.   Describe the functions of routers, gateways, and switches.
11.c.   Interpret a routing table.
11.d.   Describe the function of transport layer protocols.
11.e.   Describe establishing, maintaining, and terminating sessions
11.f.   Describe the Domain Name System (DNS) used for addressing.
11.g.   Describe commonly used Internet protocols such as Simple Network Management Protocol (SNMP) and File Transfer Protocol (FTP)