LAUSD Division of Adult and Career Education

Career Technical Education (CTE) Course Outline

Course Title:	Networking/1
Course Number:	74-65-51
Date:	August 2024
Industry Sector:	Information and Communication Technologies
Pathway:	Networking
CBEDS Title:	Network Engineering
CBEDS Code:	4604
Credits:	10

Hours:	Total
	135

Course Description:

This competency-based course is the first in a sequence of three courses designed to prepare students to pass the Cisco Certified Networking Associate (CCNA) examination. Technical instruction includes an introduction, safety, network introduction, basic switch and end device configuration, protocols and models, physical layer, number systems, data line layer, ethernet switching, network layer, address resolution, basic router configuration, IPv4 and IPv6 addressing, ICMP, transport layer, application layer, network security fundamentals, building a small network, employability skills and resume preparation. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

Prerequisites:	Enrollment requires a 6th grade reading level as measured by the CASAS GOALS test.
NOTE:	For Perkins purposes, this course has been designated as an **introductory** course. This course **cannot** be repeated once a student receives a Certificate of Completion.
A-G Approval	N/A
Methods of Instruction:	Lecture and discussion, demonstration and participation, multimedia presentations, individualized instruction, role-playing, guest speakers, field trips and field study experiences, projects
Student Evaluation:	Summative: end of section assessments.
Industry Certification:	N/A
Recommended Texts:	Odom, Wendell. CCNA 200-301 Official Cert Guide, Volume 1, 2nd Edition. Cisco Press, 2024 Odom, Wendall, Hucaby, David, and Gooley, Jason. CCNA 200-301 Official Cert Guide, Volume 2, 2nd Edition. Cisco Press, 2024 Odom, Wendall, Hucaby, David, and Gooley, Jason. CCNA 200-301 Official Cert Guide Library, 2nd Edition. Cisco Press, 2024
Link to Resource Folder	https://bit.ly/network1resources

Approved by: Renny L. Neyra, Executive Director

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. INTRODUCTION Understand, apply, evaluate classroom and workplace policies, and procedures. (2 hours)	1. Describe the scope and purpose of the course. 2. Discuss and demonstrate Zoom, Schoology, and basic computer skills. 3. Identify classroom policies and procedures. 4. Discuss, identify, research, draw conclusions regarding the different career paths, occupations, employment outlook, and career advancements in the Information and Communications Technologies industry sector which have an impact on networking. 5. Describe the opportunities available for promoting gender equity and the representation of non-traditional populations in the Information and Communications Technologies industry sector. 6. Explain and recognize the importance of customer-oriented service, ethics, teamwork, respecting individual and cultural differences, and diversity in the workplace.	**Career Ready Practice:** 1, 2, 3, 4, 8, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5, 2.8 Career Planning & Management: 3.1, 3.3, 3.4, 3.5 Technology: 4.2 Ethics & Legal Responsibilities: 8.4 Leadership & Teamwork: 9.3, 9.6 Demonstration & Application: 11.1 **CTE Pathway:** B2.2
B. SAFETY Understand safety procedures and techniques in the Information and Communication	1. Discuss classroom and workplace procedures for first aid, emergencies, and accidents/injury prevention. 2. Discuss the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for network technicians to maintain a safe and healthy working environment.	**Career Ready Practice:** 1, 2, 10, 12 **CTE Anchor:** Academics: 1.0 Communications:

Technologies Industry Sector.
 	
(2 hours)
	3. Discuss the use of the Safety Data Sheet (SDS) as it applies to the Information and Communication Technologies industry sector.
	4. Practice personal safety when lifting, bending, or moving equipment and supplies.
	5. Explain how each of the following insures a safe workplace:
	   a. employees' rights as they apply to job safety
	   b. employers' obligations as they apply to safety
	   c. safety laws as they to apply to electrical tools
	6. Explain and sign the LAUSD Responsible Use Policy (RUP).
	7. Pass the safety test with 100% accuracy.
		2.1, 2.3, 2.5, 2.6
		Health & Safety:
		6.1, 6.2, 6.3, 6.4, 6.7
		
		CTE Pathway:
		B2.2

C. NETWORK INTRODUCTION
 	
Understand and identify the basic local area and wide area network concepts.
 	
(3 hours)
	1. Define and demonstrate the following terms:
	   a. Local Area Network (LAN)
	   b. Wide Area Network (WAN)
	   c. network topologies
	   d. host
	   e. network devices
	2. Explain the advances in modern network technologies and network media.
	3. Explain how networks affect our daily lives.
	4. Explain how host and network devices are used.
	5. Explain network design components and how they are used in network topologies.
	6. Compare the characteristics of common types of networks.
	7. Explain how LANs and WANs interconnect to the internet.
	8. Identify some basic security threats and solutions for all networks.
	9. Pass a network introduction assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.3, 4.5
		Problem Solving & Critical Thinking:
		5.3
		Technical Knowledge & Skills:
		10.1, 10.5
		Demonstration & Application:
		11.1
		
		CTE Pathway:
		B1.1, B2.1, B3.3, B8.1

D. BASIC SWITCH AND END DEVICE CONFIGURATION
 	
Understand, apply, configure Cisco IOS software and network devices.
	1. Define and demonstrate the following terms:
	  a. end devices
	  b. Cisco Internetwork Operating System (IOS)
	  c. Internet Protocol (IP) addressing
	  d. Command Line Interface (CLI)
	2. Demonstrate and implement initial settings, including passwords, IP addressing, and default gateway parameters on a network switch, and end devices.
	3. Identify and ask significant questions that clarify various points of view to solve problems.
	4. Explain how to access a Cisco IOS device for configuration purposes.
	5. Explain how to navigate Cisco IOS to configure network devices.
	6. Describe the command structure of Cisco IOS software.
	7. Demonstrate and configure a Cisco IOS device using CLI.
	8. Demonstrate how to use IOS commands to save the running configuration.
	9. Explain how devices communicate across network media.
	10. Demonstrate and configure a host device with an IP address.
	11. Interpret information and verify connectivity between two end devices to make informed decisions.
	12. Pass a basic switch and end device configuration assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving & Critical Thinking:
		5.1, 5.4
		Technical Knowledge & Skills:
		10.1, 10.8
		Demonstration & Application:
		11.1
		
		CTE Pathway:
		B1.1, B1.5, B3.5, B4.5, B6.3

(10 hours)		

E. PROTOCOLS AND MODELS
 	
Explain and describe the TCP/IP and OSI model.
	1. Define and demonstrate the following terms:
	  a. Transmission Control Protocol/Internet Protocol (TCP/IP)
	  b. Open Systems Interconnection (OSI)
	2. Explain how network protocols enable devices to access local and remote network resources.
	3. Describe the types of rules that are necessary to successfully communicate.
	4. Explain why protocols are necessary in network communication.
	5. Explain the purpose of adhering to a protocol suite.
	6. Explain the role of standards organizations in establishing protocols for network interoperability.
		Career Ready Practice:
		1, 2, 4, 5, 10, 11
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving & Critical Thinking:

	7. Explain, research, clarify how the TCP/IP model and the OSI model are used to facilitate standardization in the communication process. 8. Explain how data encapsulation allows data to be transported across the network. 9. Explain how local hosts access local resources on a network. 10. Pass a protocols and models assessment with an 80% score or higher.	5.1 Technical Knowledge & Skills: 10.1, 10.5, 10.12 Demonstration & Application: 11.1 **CTE Pathway:** B1.2, B1.4, B3.1, B3.3,
(5 hours)		B7.2

F. PHYSICAL LAYER
 	
Explain and describe the components in the physical layer of the OSI model.
	1. Define and demonstrate the following terms:
	  a. Unshielded Twisted Pair (UTP)
	  b. Ethernet
	  c. fiber optic
	2. Explain how physical layer protocols, services, and network media support communications across data networks.
	3. Describe the purpose and functions of the physical layer in the network.
	4. Describe characteristics of the physical layer.
	5. Identify the basic characteristics of copper cabling.
	6. Explain, create, troubleshoot how UTP cable is used in Ethernet networks to make an informed decision.
	7. Describe fiber optic cabling and its main advantages over other media.
	8. Explain and demonstrate how to connect devices using wired and wireless media.
	9. Pass a physical layer assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving &
		Critical Thinking:
		5.2, 5.4, 5.6
		Technical
		Knowledge & Skills:
		10.1
		Demonstration &
		Application:
		11.1
		
		CTE Pathway:
		B1.1, B2.1, B2.2, B2.3,

(4 hours)		B3.6, B4.1, B7.2

G. NUMBER SYSTEMS	1. Define and demonstrate the following terms:
	  a. decimal
	  b. binary
	  c. hexadecimal
		Career Ready Practice:
		1, 2, 4, 5, 10

Demonstrate understanding of decimal, binary, and hexadecimal calculations.	2. Explain conversions between decimal, binary, and hexadecimal systems.
	 3. Demonstrate the calculation conversion between:
	    a. decimal and binary systems
	    b. decimal and hexadecimal systems
	 4. Pass a number systems assessment with an 80% score or higher.
		CTE Anchor:
		 Academics:
		 1.0
		 Communications:
		 2.1, 2.3, 2.5
		 Technology:
		 4.2
		 Problem Solving & Critical Thinking:
		 5.11
		 Technical Knowledge & Skills:
		 10.1
		 Demonstration & Application:
		 11.1
		
		 CTE Pathway:
		 B1.1

(5 hours)		
H. DATA LINK LAYER Describe the purpose of the data link layer for preparing communication for transmission.	1. Explain how media access control in the data link layer supports communication across networks. 2. Describe the purpose and function of the data link layer in preparing communication for transmission on specific media. 3. Describe, research, and compare the characteristics of media access control methods on WAN and LAN topologies. 4. Describe the characteristics and functions of the data link frame. 5. Pass a data link layer assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2, 4.3 Technical Knowledge & Skills: 10.12 **CTE Pathway:** B1.2, B3.1
(5 hours)		

I. ETHERNET SWITCHING Explain how an Ethernet network switch uses MAC addresses and the MAC address table. (10 hours)	1. Define and demonstrate Media Access Control (MAC). 2. Explain how Ethernet operates in a switched network. 3. Explain how the Ethernet sublayers are related to the frame fields. 4. Describe the Ethernet MAC address. 5. Explain, analyze, research how a switch builds its MAC address table and forwards frames. 6. Describe switch forwarding methods and port settings available on Layer 2 switch ports. 7. Pass an Ethernet switching assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.3 Technical Knowledge & Skills: 10.1, 10.12 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B1.5, B3.1

J. NETWORK LAYER
 	
Explain how routers used protocols and services to enable end-to-end connectivity.
	1. Define and demonstrate the following terms:
	   a. Internet Protocol Version 4 (IPv4)
	   b. Internet Protocol Version 6 (IPv6)
	2. Explain how routers use network layer protocols and services to enable end-to-end connectivity.
	3. Explain how the network layer uses IP protocols for reliable communications.
	4. Explain and discuss the role of the major header fields in the IPv4 and IPv6 packet.
	5. Explain how network devices use routing tables to direct packets to a destination network.
	6. Explain the function of fields in the routing table of a router.
	7. Pass a network layer assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving & Critical Thinking:
		5.1, 5.11

		Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B3.5, B5.2
(5 hours)		

K. ADDRESS RESOLUTION
 	
Explain how ARP and NDP enable communication on a network.
	1. Define the following terms:
	   a. Address Resolution Protocol (ARP)
	   b. Neighbor Discovery Protocol (NDP)
	2. Explain how ARP and NDP enable communication on a network.
	3. Compare the roles of the MAC address and the IP address.
	4. Demonstrate the purpose of ARP.
	5. Demonstrate the operation of IPv6 neighbor discovery.
	6. Pass an address resolution assessment with an 80% score or higher.
		Career Ready Practice: 1, 2, 4, 10
		
		CTE Anchor:
		Academics: 1.0
		Communications: 2.1, 2.3, 2.5
		Technology: 4.2, 4.3
		Technical Knowledge & Skills: 10.1
		Demonstration & Application: 11.1
		
		CTE Pathway: B1.1, B3.1, B4.9

(5 hours)		

L. BASIC ROUTER CONFIGURATION
 	
Demonstrate the initial IOS configuration of Cisco devices.
	1. Define and explain default gateway.
	2. Implement and configure initial setting devices.
	3. Demonstrate the configuration of:
	   a. interfaces on a Cisco IOS router
	   b. a default gateway on network devices
	4. Pass a basic router configuration assessment with an 80% score or higher.
		Career Ready Practice: 1, 2, 4, 10
		
		CTE Anchor:
		Academics: 1.0
		Communications: 2.1, 2.3, 2.5

		Technology: 4.2 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B3.5, B6.3
(10 hours)		
M. IPv4 ADDRESSING Understand IPv4 addressing and subnetting.	1. Explain public, private, and reserved IPv4 addresses. 2. Describe the structure of an IPv4 address including the network portion, the host portion, and the subnet mask. 3. Compare the characteristics and uses of the unicast, broadcast, and multicast IPv4 addresses. 4. Demonstrate and explain how to subnet an IPv4 address. 5. Explain how subnetting segments a network to enable better communication. 6. Define and explain Variable Length Subnet Mask (VLSM) in various size networks. 7. Demonstrate implementation of the VLSM. 8. Pass an IPv4 addressing assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2, 4.3 Problem Solving & Critical Thinking: 5.9, 5.11 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B3.2, B3.5
(20 hours)		
N. IPv6 ADDRESSING Understand IPv6 addressing and rules.	1. Implement an IPv6 addressing scheme. 2. Explain the need for IPv6 addressing. 3. Explain how IPv6 addresses are represented. 4. Compare types of IPv6 network addresses. 5. Demonstrate and explain how to configure static global unicast and link-local IPv6 network addresses. 6. Demonstrate and explain how to configure global unicast addresses dynamically.	**Career Ready Practice:** 1, 2, 4, 5, 10 **CTE Anchor:** Academics: 1.0

	7. Describe and explain link-local addresses. 8. Identify IPv6 addresses. 9. Implement IPv6 addressing scheme. 10. Pass an IPv6 addressing assessment with an 80% score or higher.	Communications: 2.1, 2.3, 2.5 Technology: 4.2, 4.3 Problem Solving & Critical Thinking: 5.9, 5.11 Demonstration & Application: 11.1 **CTE Pathway:**
(20 hours)		B1.1, B3.2, B3.5
O. INTERNET CONTROL MESSAGE PROTOCOL Understand how ICMP is used for testing network connectivity.	1. Define the term Internet Control Message Protocol (ICMP). 2. Explain various tools to test network connectivity. 3. Demonstrate and explain how ping and traceroute command is used for testing network connectivity to make informed decisions. 4. Pass an ICMP assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.4, 5.5 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:**
(5 hours)		B1.1, B2.3, B3.4, B4.1
P. TRANSPORT LAYER	1. Define the following terms: a. Transport Control Protocol (TCP)	**Career Ready Practice:**

Understand the operation of transport layer protocols.	b. User Datagram Protocol (UDP) 2. Compare the operations of transport layer protocols in supporting end-to-end communication. 3. Explain the purpose of the transport layer in managing the transportation of data in end-to-end communication. 4. Explain and apply the characteristics of the TCP and UDP. 5. Demonstrate and research how TCP and UDP use port numbers. 6. Explain how TCP session establishment and termination processes facilitate reliable communication. 7. Explain how TCP protocol data units are transmitted and acknowledged to guarantee delivery. 8. Describe the UDP client processes to establish communication with a server. 9. Pass a transport layer assessment with an 80% score or higher.	1, 2, 4, 5, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2, 4.3 Problem Solving & Critical Thinking: 5.10 Technical Knowledge & Skills: 10.1, 10.12 Demonstration & Application: 11.1 **CTE Pathway:**
(5 hours)		B1.1, B1.2, B3.1, B4.4

Q. APPLICATION LAYER
 	
Understand the application layer protocols.
	1. Define the following terms:
	   a. Hypertext Transfer Protocol (HTTP)
	   b. Simple Mail Transport Protocol (SMTP)
	   c. Domain Name Service (DNS)
	   d. Dynamic Host Configuration Protocol (DHCP)
	   e. File Transfer Protocol (FTP)
	2. Explain and apply the operation of application layer protocols in providing support to end-user applications.
	3. Explain and research how the functions of the application layer, session layer, and presentation layer work together to provide network services to end-user applications.
	4. Explain how end-user applications operate in a peer-to-peer network.
	5. Explain how web and email protocols operate.
	6. Demonstrate how DNS and DHCP operate.
	7. Demonstrate how FTP transfers files.
	8. Pass an application layer assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 10, 11
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.1, 4.2, 4.3
		Problem Solving & Critical Thinking:
		5.10
		Technical Knowledge & Skills:
		10.1, 10.12

		Demonstration & Application: 11.1
(5 hours)		**CTE Pathway:** B1.1, B1.2, B3.1, B4.4
R. NETWORK SECURITY FUNDAMENTALS Describe the basic components of network security and general mitigation techniques.	1. Discuss, identify, and research security vulnerabilities. 2. Explain fundamental security measures on network devices. 3. Explain and describe different mitigation techniques. 4. Demonstrate and apply security configurations on switches, and routers to mitigate security threats. 5. Pass a network security fundamentals assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2 Problem Solving & Critical Thinking: 5.1 Technical Knowledge & Skills: 10.8, 10.12 Demonstration & Application: 11.1 **CTE Pathway:** B1.4, B3.4, B4.1, B4.5, B8.2, B8.4
(5 hours)		
S. BUILD A SMALL NETWORK Demonstrate the use of network components to build a small network.	1. Design a small network using routers, switches, and end devices. 2. Identify the protocols and applications used in a small network. 3. Demonstrate how a small network serves as the basis of larger networks. 4. Demonstrate how to verify connectivity and solve problems.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications:

	5. Form teams to demonstrate how to acquire information about the devices in a network for troubleshooting. 6. Describe common network troubleshooting methodologies. 7. Pass a Build a Small Network assessment with an 80% score or higher.	2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.1, 5.2, 5.5, 5.7, 5.9 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application: 11.1 **CTE Pathway:** B1.2, B1.3, B1.6, B2.1, B3.1, B3.5, B5.1, B5.2, B7.2
(5 hours)		

T. EMPLOYABILITY SKILLS AND RESUME PREPARATION
 	
Understand, apply, and evaluate the desired employability skills and resume preparation for networking technicians.
	1. Understand and define employer requirements for soft skills such as:
	  a. attitude toward work
	  b. communication and collaboration
	  c. critical thinking, problem solving, and decision-making
	  d. customer service
	  e. diversity in the workplace
	  f. flexibility and adaptability
	  g. interpersonal skills
	  h. leadership and responsibility
	  i. punctuality and attendance
	  j. quality of work
	  k. respect, cultural and diversity differences
	  l. teamwork
	  m. time management
	  n. trust and ethical behavior
	  o. work ethic
	2. Develop a career plan that reflects career interests, pathways, and post-secondary options.
		Career Ready Practice:
		1, 2, 3, 4, 5, 7, 8, 9, 10, 11
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.4. 2.5
		Career Planning & Management:
		3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9
		Technology:
		4.1, 4.2, 4.3, 4.5
		Problem Solving & Critical Thinking:
		5.1, 5.4
		Responsibility & Flexibility:
		7.2, 7.3, 7.4, 7.7

	3. Create/revise a resume, cover letter and/or portfolio.
	4. Demonstrate, analyze, research, and review the role of online job searching platforms, and career websites to make informed decisions.
	5. Understand the importance of assessing social media account content for professionalism.
	6. Demonstrate and complete and/or review an on-line job application.
	7. Understand and demonstrate interview skills to get the job:
	   a. do's and don'ts for job interviews
	   b. how to dress for the job
	8. Demonstrate and create sample follow-up letters.
	9. Understand the importance of the continuous upgrading of job skills as it relates to:
	   a. certification, licensure, and/or renewal
	   b. professional organizations/events
	   c. industry associations and/or organized labor
		Ethics & Legal Responsibilities:
		8.3, 8.4, 8.5
		Leadership & Teamwork:
		9.1, 9.2, 9.3, 9.4, 9.6, 9.7
		Technical Knowledge & Skills:
		10.1, 10.3, 10.12
		Demonstration & Application:
		11.1, 11.2, 11.5
		
		CTE Pathway:
		B4.7

(4 hours)		

ACKNOWLEDGEMENTS

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