LAUSD Division of Adult and Career Education

Career Technical Education (CTE) Course Outline

Course Title:	Networking/3
Course Number:	74-65-55
Date:	August 2024
Industry Sector:	Information and Communication Technologies
Pathway:	Networking
CBEDS Title:	Network Engineering
CBEDS Code:	4604
Credits:	5

Hours:

Total
90

Course Description:

This competency-based course is the third 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 review, single-area OSPFv2 concepts and configuration, network security concepts, ACL concepts, ACLs for IPv4 configuration, NAT for IPv4, WAN concepts, VPN and IPsec concepts, QoS concepts, network management, network design, network troubleshooting, network virtualization, network automation, and 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 successful completion of the Networking/2 (74-65-53) course.
NOTE:	For Perkins purposes, this course has been designated as a **capstone** 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. <u>CCNA 200-301 Official Cert Guide, Volume 1, 2nd Edition</u>. Cisco Press, 2024 Odom, Wendall, Hucaby, David, and Gooley, Jason. <u>CCNA 200-301 Official Cert Guide, Volume 2, 2nd Edition</u>. Cisco Press, 2024 Odom, Wendall, Hucaby, David, and Gooley, Jason. <u>CCNA 200-301 Official Cert Guide Library, 2nd Edition</u>. Cisco Press, 2024
Link to Resource Folder	https://bit.ly/network3resources

Approved by: Renny L. Neyra, Executive Director

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. INTRODUCTION REVIEW Understand, apply, and evaluate classroom and workplace policies and procedures. (2 hours)	1. Review the scope and purpose of the course. 2. Review and demonstrate Zoom, Schoology, and basic computer skills. 3. Review classroom policies and procedures. 4. Review, discuss, identify, research, and 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. Review the opportunities available for promoting gender equity and the representation of non-traditional populations in the Information and Communications Technologies industry sector. 6. Review and recognize the importance of 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 REVIEW Understand safety procedures and techniques in the Information and Communication	1. Review classroom and workplace procedures for first aid, emergencies, and accidents/injury prevention. 2. Review 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, 12 **CTE Anchor:** Academics: 1.0 Communications:

Technologies Industry Sector.
 	
(2 hours)
	3. Review the use of the Safety Data Sheet (SDS) as it applies to the Information and Communication Technologies industry sector.
	4. Review personal safety when lifting, bending, or moving equipment and supplies.
	5. Review 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 applying 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. SINGLE-AREA OSPFv2 CONCEPTS
 	
Explain how a single-area OSPFv2 learns the best routing path from source to destination.
 	
(5 hours)
	1. Define and demonstrate the following terms:
	   a. Open Shortest Path First (OSPF)
	   b. Stub Network
	   c. Designated Router/Backup Designated Router (DR/BDR)
	   d. Link-State Routing Protocol
	2. Explain how single-area OSPF operates in both point-to-point and broadcast multiaccess networks.
	3. Describe basic OSPF features and characteristics.
	4. Describe the OSPF packet types used in single-area OSPF.
	5. Explain how single-area OSPF operates.
	6. Pass a single-area OSPFV2 concepts 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, B1.6, B3.1, B4.1, B4.3

D. SINGLE-AREA OSPFv2 CONFIGURATION Configure and troubleshoot single-area OSPFv2 routing. (6 hours)	1. Form teams to design, diagram, and implement single-area OSPFv2 in both point-to-point, and broadcast multiaccess networks. 2. Configure an OSPFv2 router ID. 3. Configure single-area OSPFv2 in a point-to-point network. 4. Configure the OSPF interface priority to influence the DR/BDR election in a multiaccess network. 5. Demonstrate and implement modifications to change the operation of single-area OSPFv2. 6. Configure OSPF to propagate a default route. 7. Verify and troubleshoot a single-area OSPFv2 implementation. 8. Pass a single-area OSPFv2 configuration assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.1, 5.7 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application: 11.1 **CTE Pathway:** B1.6, B3.1, B3.5, B4.1, B4.3, B5.2, B6.3, B7.2

E. NETWORK SECURITY CONCEPTS
 	
Explain how vulnerabilities, threats, and exploits can be mitigated to enhance network security.
	1. Define and demonstrate the following terms:
	  a. threat actors
	  b. malware
	  c. vulnerability
	  d. cryptography
	  e. ethical hacking
	  f. attack surface
	2. Explain how vulnerabilities, threats, and exploits can be mitigated to enhance network security.
	3. Describe the following:
	  a. the current state of cybersecurity
	  b. vectors of data loss
	  c. the threat actors who exploit networks
	  d. malware types
	  e. common network attacks
	4. Explain how threat actors exploit the following:
		Career Ready Practice:
		1, 2, 4, 5, 8, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving & Critical Thinking:
		5.1

	a. IP vulnerabilities and services b. TCP/UDP vulnerabilities 5. Describe best practices for protecting a network. 6. Describe common cryptographic processes used to protect data in transit. 7. Pass a network security concepts assessment with an 80% score or higher.	Ethics & Legal Responsibilities: 8.3, 8.4, 8.7, 8.8 Technical Knowledge & Skills: 10.1, 10.6, 10.8 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B4.5, B4.7, B8.1, B8.2, B8.3, B8.4, B8.5
(5 hours)		
F. ACCESS CONTROL LIST CONCEPTS Explain how ACLs are used as part of a network security policy.	1. Define and demonstrate the following terms: a. Access Control List (ACL) b. wildcard mask c. standard and extended ACLs 2. Explain how ACLs are used: a. as part of network security policy b. to filter traffic c. with wildcard masks 3. Describe and demonstrate how to create ACLs. 4. Compare standard and extended IPv4 ACLs. 5. Pass an ACL concepts 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: 5.8, 5.9, 5.12 Technical Knowledge & Skills: 10.1, 10.8, 10.13 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B3.4, B3.5, B4.1, B8.3, B8.4
(5 hours)		

G. ACLs FOR IPv4 CONFIGURATION
 	
Configure and implement IPv4 ACLs to secure networks.
	1. Define the following terms:
	  a. Virtual Teletype (VTY)
	  b. Telnet
	  c. Secure Shell (SSH)
	2. Form teams to implement IPv4 ACLs to filter traffic and secure administrative access.
	3. Configure and troubleshoot ACLs to filter traffic to meet networking requirements:
	  a. standard IPv4
	  b. extended IPv4
	4. Use sequence numbers to edit existing standard IPv4 ACLs.
	5. Configure a standard ACL to secure VTY access.
	6. Pass an ACLs for IPv4 configuration assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 9
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Problem Solving & Critical Thinking:
		5.1, 5.8
		Leadership & Teamwork:
		9.3, 9.7
		Technical Knowledge & Skills:
		10.1, 10.8
		Demonstration & Application:
		11.1
		
		CTE Pathway:
		B1.1, B3.1, B3.5, B4.1, B8.1, B8.2, B8.4

(6 hours)		

H. NETWORK ADDRESS TRANSLATION FOR IPv4
 	
Describe, explain, and configure network address translation.
	1. Define and demonstrate the following terms:
	  a. Network Address Translation (NAT)
	  b. Port Address Translation (PAT)
	2. Explain the purpose and function of NAT.
	3. Explain the operation of different types of NAT.
	4. Describe the advantages and disadvantages of NAT.
	5. Describe NAT for IPv6.
	6. Configure and troubleshoot NAT services on the edge router to provide IPv4 address scalability.
	7. Form teams to configure the following using the CLI:
	  a. static NAT
	  b. dynamic NAT
	  c. PAT
		Career Ready Practice:
		1, 2, 4, 5, 9, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2

	8. Pass a NAT for IPv4 assessment with an 80% score or higher.	Problem Solving & Critical Thinking: 5.1, 5.3, 5.6, 5.8 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B1.4, B3.2, B3.3, B3.5, B4.1, B4.4, B8.1
(6 hours)		
I. WAN CONCEPTS Describe and explain traditional and modern WAN connectivity options. (5 hours)	1. Explain how WAN access technologies can be used to satisfy business requirements. 2. Explain the purpose of a WAN and how they operate. 3. Compare traditional and modern WAN connectivity options. 4. Compare internet-based WAN connectivity options. 5. Pass a WAN concepts assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 **CTE Pathway:** B1.5, B4.3
J. VIRTUAL PRIVATE NETWORK AND IPsec CONCEPTS Describe and explain VPN and IPsec technology.	1. Define and demonstrate the following terms: a. Virtual Private Network (VPN) b. Internet Protocol Security (IPsec) c. tunnel 2. Explain how VPNs and IPsec secure site-to-site, and remote access connectivity using a diagram. 3. Describe benefits of VPN technology. 4. Describe different types of VPNs.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications:

	5. Explain how the IPsec framework is used to secure network traffic. 6. Form teams to configure and troubleshoot VPN, and IPsec connections. 7. Pass a VPN and IPsec concepts assessment with an 80% score or higher.	2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.1, 5.5, 5.6 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1, 10.8 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B1.4, B3.3, B3.5, B3.7, B5.1, B5.2, B7.2, B8.1, B8.4
(5 hours)		

K. QUALITY OF SERVICE CONCEPTS
 	
Describe and explain the different QoS models.
	1. Define and demonstrate the following terms:
	  a. Quality of Service (QoS)
	  b. jitter
	  c. delay
	  d. voice over IP
	2. Explain how networking devices implement QoS.
	3. Explain how network transmission characteristics impact quality.
	4. Describe minimum network requirements for voice, video, and data traffic.
	5. Describe the queuing algorithms used by networking devices.
	6. Describe the different QoS models.
	7. Explain how QoS uses mechanisms to ensure transmission quality.
	8. Pass a QoS concepts 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, 10.11
		Demonstration &
		Application:
		11.1
		
		CTE Pathway:

		B1.1, B1.3, B4.1, B4.4, B6.1, B7.4
(5 hours)		

L. NETWORK MANAGEMENT
 	
Explain how to implement protocols to manage the network.
	1. Define and demonstrate the following terms:
	  a. Cisco Discovery Protocol (CDP)
	  b. Link Layer Discovery Protocol (LLDP)
	  c. Network Time Protocol (NTP)
	  d. Simple Network Management Protocol (SNMP)
	  e. System Logging Protocol (Syslog)
	2. Form teams to implement and configure protocol to map, and manage a network topology using:
	  a. CDP
	  b. LLDP
	3. Implement NTP between an NTP client and NTP server.
	4. Explain the following operations:
	  a. SNMP
	  b. Syslog
	5. Use commands to back up and restore an IOS configuration file.
	6. Perform an upgrade of an IOS system image.
	7. Pass a network management assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 9, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2
		Leadership & Teamwork:
		9.3, 9.7
		Technical Knowledge & Skills:
		10.1, 10.12
		Demonstration & Application:
		11.1
		
		CTE Pathway:
		B1.1, B3.1, B3.7, B4.3, B4.5, B4.8, B8.2, B8.3

(6 hours)		

M. NETWORK DESIGN
 	
Understand, apply, and design a scalable network architecture.
	1. Define and demonstrate the following terms:
	  a. access layer
	  b. distribution layer
	  c. core layer
	  d. Power over Ethernet (POE)
	2. Explain the characteristics of scalable network architectures.
	3. Explain how data, voice, and video are converged in a switched network.
	4. Explain considerations for designing a scalable network.
	5. Explain how switch hardware features support network requirements.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Academics:
		1.0
		Communications:
		2.1, 2.3, 2.5
		Technology:
		4.2

	6. Diagram and describe the types of routers, and switches available for small-to-medium size business networks to make informed decisions. 7. Pass a network design assessment with an 80% score or higher.	Problem Solving & Critical Thinking: 5.3, 5.4 Technical Knowledge & Skills: 10. 1, 10.3, 10.6 Demonstration & Application: 11.1 **CTE Pathway:** B1.1, B1.5, B1.6, B3.7, B4.4, B4.9, B5.1, B5.2, B7.2, B7.4, B8.5
(6 hours)		

N. NETWORK TROUBLESHOOTING
 	
Understand and troubleshoot a network using various tools.
	1. Define and demonstrate the following terms:
	  a. baseline
	  b. Wireshark
	  c. Network Management System (NMS)
	  d. cable tester
	2. Explain how network documentation is developed and used to troubleshoot network issues.
	3. Describe different networking troubleshooting tools.
	4. Form teams to troubleshoot and solve a network problem using a layered model.
	5. Compare troubleshooting methods that use a systematic, layered approach.
	6. Determine the symptoms and causes of network problems using a layered model.
	7. Pass a network troubleshooting assessment with an 80% score or higher.
		Career Ready Practice:
		1, 2, 4, 5, 9, 10
		
		CTE Anchor:
		Academics: 1.0
		Communications: 2.1, 2.3, 2.5
		Technology: 4.2, 4.3
		Problem Solving & Critical Thinking: 5.1, 5.6
		Leadership & Teamwork: 9.3, 9.7
		Technical Knowledge & Skills: 10.1, 10.5
		Demonstration & Application: 11.1
		
		CTE Pathway:

(6 hours)		B1.1, B2.3, B3.4, B4.1, B8.2

O. NETWORK VIRTUALIZATION
 	
Explain the various services, characteristics, and importance of network virtualization.
 	
(6 hours)
	1. Define and demonstrate the following terms:
	  a. Software as a Service (SaaS)
	  b. Platform as a Service (PaaS)
	  c. Infrastructure as a Service (IaaS)
	  d. Software-Defined Networking (SDN)
	2. Explain and describe the purpose and importance of:
	  a. virtualization
	  b. cloud computing
	  c. Type 1, Type 2 hypervisor
	3. Describe controllers used in network programming.
	4. Pass a network virtualization 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, B1.5, B3.2, B3.7, B6.1, B7.3, B8.5

P. NETWORK AUTOMATION
 	
Explain how network automation is enabled through RESTful APIs and configuration management tools.
	1. Define and demonstrate the following terms:
	  a. Java Script Object Notation (JSON)
	  b. Yet Another Markup Language (YAML)
	  c. Extensible Markup Language (XML)
	  d. Application Programming Interface (API)
	  e. REpresentational State Transfer (REST)
	  f. Digital Networking Architecture (DNA)
	2. Explain how network automation is enabled through RESTful APIs and configuration management tools.
	3. Describe automation.
	4. Compare JSON, YAML, and XML data formats.
	5. Explain how APIs and REST enable computer to computer communications.
	6. Compare the configuration management tools Puppet, Chef, Ansible, and SaltStack.
	7. Explain how Cisco DNA center enables intent-based networking.
		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

	8. Pass a network automation assessment with an 80% score or higher.	**Demonstration & Application:** 11.1
(6 hours)		**CTE Pathway:** B1.1, B1.4, B6.1
Q. EMPLOYABILITY SKILLS AND RESUME PREPARATION REVIEW Understand, apply, and evaluate the desired employability skills and resume preparation for networking technicians.	1. Review 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. Review a career plan that reflects career interests, pathways, and post-secondary options. 3. Revise a resume, cover letter and/or portfolio. 4. Review the role of online job searching platforms and career websites to make informed decisions. 5. Review the importance of assessing social media account content for professionalism. 6. Review and complete and/or review an on-line job application. 7. Review and demonstrate interview skills to get the job: a. do's and don'ts for job interviews b. how to dress for the job	**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 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

(3 hours)	8. Review and create sample follow-up letters.
	9. Review 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
		Demonstration & Application:
		11.1, 11.2, 11.5
		
		CTE Pathway:
		B.4.7

R. ENTREPRENEURIAL SKILLS Understand, apply, and evaluate the process involved in becoming an entrepreneur in the automotive industry. (4 hours)	1. Define entrepreneurship. 2. Identify and research the necessary characteristics of successful entrepreneurs. 3. Examine personal goals prior to starting a business. 4. Evaluate sources of monetary investment in a business opportunity. 5. Explain licensing/permit requirements for a business. 6. Explain how the Small Business Administration (SBA) assists entrepreneurs with lenders and funding to help them plan, start and grow a business. 7. Demonstrate a budget to identify start-up expenses. 8. Pass an entrepreneurial skills assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2, 4.5 Responsibility & Flexibility: 7.1, 7.6 Technical Knowledge & Skills: 10.1, 10.3, 10.4 Demonstration & Application: 11.1, 11.2, 11.3, 11.4 **CTE Pathway:** B4.7

ACKNOWLEDGEMENTS

Thanks to the following individuals for their contributions in developing and editing this curriculum:

Ana Martinez, Trung Le, Silvia Quijada, and Robert Yorgason