



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	CIS
Course Number:	141
Descriptive Title:	Introduction to Networks Cisco 1
Division:	Business
Department:	Computer Information Systems
Course Disciplines:	Computer Information Systems
Catalog Description:	<p>This course introduces students to fundamental networking concepts and technologies. Students will learn the skills necessary to plan and implement small networks across a range of applications. The course uses concepts of both hardware and software in order to understand principles of communication theory. This class is technically oriented and will prepare students for industry certification.</p> <p>Note: This course is semester one in the Cisco Networking Academy program.</p> <p>(Preparation for CCNA Certification)</p>
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Computer Information Systems 40
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	3
Outside Study Hours:	4
Total Course Hours:	90
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to 1995
Transfer UC:	No
Effective Date:	
General Education:	ECC

	Term:
	Other:
	CSU GE:
	Term:
	Other:
	IGETC:
	Term:
	Other:
Student Learning Outcomes:	<p>SLO #1 Data Communication Terms</p> <p>Describe and explain data communication terms such as broadband and baseband communications.</p> <p>SLO #2 Modulation Techniques</p> <p>Describe and use different modulation techniques such as time-division and frequency division.</p> <p>SLO #3 Network Systems</p> <p>Analyze and design network systems using differing transmission methods such as copper wire, fiber optics, microwave and satellite.</p> <p>SLO #4 Local and Wide Area Networks</p> <p>Describe and define the similarities and differences between local area networks and wide area networks</p> <p>SLO #5 Connection and Connection-less Oriented Networks</p> <p>Describe connection-oriented network services and connectionless- oriented network services and identify their key differences.</p> <p>SLO #6 Basic Connectivity Methods</p> <p>Define flow control and describe the media used in connection-oriented networking.</p> <p>SLO #7 Functions of the TCP/IP v4 and TCP/IP v6</p> <p>Identify the functions of the TCP/IP transport-layer protocols.</p>

SLO #8 Comparing Protocols

Compare TCP/IP v4 and TCP/IP v6 protocols to the ISO reference model layer four.

SLO #9 ICMP Functions

Identify the functions performed by ICMP

Course Objectives:

1. Identify the key components of any data network.
2. Analyze the characteristics of network architectures: fault tolerance, scalability, quality of service and security.
3. Design and install both a FTP and Web server.
4. Assess rules and processes that govern network communications.
5. Evaluate tools and commands for constructing and maintaining networks.
6. Analyze TCP/IP Application Layer protocols and explain how they provideservices specified by upper layers of the OSI model.
7. Examine the function of well-known TCP/IP applications such as WWW andemail, and their related services (HTTP, DNS, SMB, DHCP, SMPT/POP, andTELNET). Evaluate protocols that ensure services running on one kind ofdevice can send to and receive data from many different devices.
8. Examine the role of two TCP/IP Transport layer protocols (TCP and UDP).
9. Design a network segment showing key functions of the Transport layer,including reliability, port addressing, and segmentation.
10. Evaluate the results of an output showing the relationship of TCP and UDP to bandwidth.
11. Examine the most common Network layer protocol, Internet Protocol (IP),and its features for providing connectionless and best-effort service.
12. Design a network segment that use hierarchical addressing of devices andshow how this allows communication between networks.
13. Explain the structure of IP addressing and demonstrate the ability to convertbetween 8-bit, 16-bit, and decimal numbers.
14. Choose the network portion of a host address and explain the role of thesubnet mask in dividing networks.
15. Construct an IP addressing table showing the appropriate subnettingscheme utilizing VLSM to conserve address space.
16. Measure the results of common testing utilities to verify and test networkconnectivity and operational status of the IP protocol stack on a host.
17. Explain the role of Data Link layer protocols in data transmission.
18. Evaluate several common logical network topologies and describe how thelogical topology determines the media access control method for thatnetwork.
19. Assess the role of key frame header and trailer fields, including addressingQoS, type of protocol, and FCS.
20. Describe the purpose of Physical layer signaling and encoding as they areused in networks.
21. Compare the basic characteristics of copper, fiber, and wireless networkmedia.
22. Design an Ethernet Frame showing the field structure.
23. Examine the function and characteristics of the media access controlmethod used by the Ethernet protocol.
24. Compare and contrast Ethernet hubs and switches.
25. Assemble a straight-through and a cross-over cable utilizing the 568A and568B pinout standard.

	<ul style="list-style-type: none"> 26. Design an addressing scheme for an internetwork and assign ranges for hosts, network devices, and router interfaces. 27. Compare and contrast the importance of network designs. 28. Define the role of the Internetwork Operating System (IOS). 29. Explain the purpose of a configuration file as it relates to the IOS. 30. Contrast the characteristics of several classes of devices that have the IOS embedded. 31. Compare and contrast classful and classless IP addressing. 32. Evaluate VLSM and explain the benefits of classless IP addressing. 33. Assess the role of the Classless Inter-Domain Routing (CIDR) standard in making efficient use of scarce IPv4 addresses. 34. Evaluate and explain a summary and default route. 35. Given realistic constraints, devise and apply subnetting schemes. 36. Assess the route lookup process. 37. Describe the routing behavior in routed networks. 38. Compare Telnet vs. SSH (Secure Shell). 39. Configure DHCP (Dynamic Host Configuration Protocol) in an Enterprise branch network. This includes being able to explain DHCP features and benefits; the differences between BOOTP (Bootstrap Protocol) and DHCP; DHCP operation; and configuring, verifying, and troubleshooting DHCP.
<p style="text-align: center;">Major Topics:</p>	<ul style="list-style-type: none"> 1. Networking Today (3 hours, Lecture) <ul style="list-style-type: none"> 1. Networks Affect Our Lives 2. Network Components 3. Network Representations and Topologies 4. Common Types of Networks 5. Internet Connections 6. Reliable Networks 7. Network Trends 8. Network Security 9. The IT Professional 2. Basic Switch and End Device Configuration (3 hours, Lecture) <ul style="list-style-type: none"> 1. Cisco IOS Access 2. IOS Navigation 3. The Command Structure 4. Basic Device Configuration 5. Save Configurations 6. Ports and Addresses 7. Configure IP Addressing 8. Verify Connectivity 3. Protocols and Models and Physical Layer (3 hours, Lecture) <ul style="list-style-type: none"> 1. The Rules 2. Protocols 3. Protocol Suites 4. Standards Organizations 5. Reference Models 6. Data Encapsulation 7. Data Access 8. Purpose of the Physical Layer 9. Physical Layer Characteristics

10. Copper Cabling
11. UTP Cabling
12. Fiber-Optic Cabling
13. Wireless Media

4. Number Systems and Data Link Layer (3 hours, Lecture)

1. Binary Number System
2. Hexadecimal Number System
3. Purpose of the Data Link Layer
4. Topologies
5. Data Link Frame
6. Purpose of the Data Link Layer
7. Topologies
8. Data Link Frame

5. Ethernet Switching and Network Layer (3 hours, Lecture)

1. Ethernet Frame
2. Ethernet MAC Address
3. The MAC Address Table
4. Switch Speeds and Forwarding Methods
5. Network Layer Characteristics
6. IPv4 Packet
7. IPv6 Packet
8. How a Host Routes
9. Introduction to Routing

6. Address Resolution IPV4 and IPV6 (3 hours, Lecture)

1. MAC and IP
2. Destination on Same Network
3. Destination on Remote Network
4. ARP
5. ARP Overview
6. ARP Functions
7. Removing Entries from an ARP Table
8. ARP Tables on Networking Devices
9. ARP Issues ARP Broadcasts and ARP Spoofing
10. IPv6 Neighbor Discovery
11. IPv6 Neighbor Discovery Messages
12. IPv6 Neighbor Discovery Address Resolution

7. Basic Router Configuration (3 hours, Lecture)

1. Configure Initial Router Settings
2. Basic Router Configuration Steps
3. Basic Router Configuration Example
4. Configure Interfaces
5. Configure Router Interfaces
6. Configure Router Interfaces Example
7. Verify Interface Configuration
8. Configuration Verification Commands
9. Configure the Default Gateway
10. Default Gateway on a Host
11. Default Gateway on a Switch

8. IPv4 Addressing (3 hours, Lecture)

1. IPv4 Addressing Structure
2. IPv4 Unicast, Broadcast, and Multicast
3. Types of IPv4 Addresses
4. Network Segmentation
5. Subnet an IPv4 Network
6. Subnet a /16 and a /8 Prefix
7. Subnet to Meet Requirements
8. Variable-Length Subnet Masking
9. Structured Design

9. IPv6 Addressing (3 hours, Lecture)

1. IPv4 Issues
2. IPv6 Address Representation
3. IPv6 Address Types
4. GUA and LLA Static Configuration
5. Dynamic Addressing for IPv6 GUAs
6. Dynamic Addressing for IPv6 LLAs
7. IPv6 Multicast Addresses
8. Subnet an IPv6 Network

10. ICMP (3 hours, Lecture)

1. PingTest Connectivity
2. Ping the Loopback
3. Ping the Default Gateway
4. Ping a Remote Host
5. TracerouteTest the Path
6. Round-Trip Time (RTT)
7. IPv4 TTL and IPv6 Hop Limit
8. ICMP Messages
9. Ping and Traceroute Testing

11. Transport Layer & Application Layer (3 hours, Lecture)

1. Transportation of Data
2. TCP Overview
3. UDP Overview
4. Port Numbers
5. TCP Communications Process
6. Reliability and Flow Control
7. UDP Communication
8. Application, Presentation, and Session
9. Peer-to-Peer
10. Web and Email Protocols
11. IP Addressing Services
12. File Sharing Services

12. Network Security Fundamentals & Building a Small Network (3 hours, Lecture)

1. Security Threats and Vulnerabilities
2. Network Attacks
3. Network Attack Mitigation
4. Device Security
5. Devices in a Small Network

6. Small Network Applications and Protocols
7. Scale to Larger Networks
8. Verify Connectivity
9. Host and IOS Commands
10. Troubleshooting Methodologies
11. Troubleshooting Scenarios
- 13. Networking Today (4 hours, Lab)**
 1. Installation of Packet Tracer
 2. Installation of Wireshark
 3. Using Packet Tracer (Simple Demo)
 4. Using Wireshark (Simple Demo)
- 14. Basic Switch and End Device Configuration (4 hours, Lab)**
 1. Cisco IOS Access
 2. IOS Navigation
 3. IOS Command Structure
 4. Basic Device Configuration
- 15. Protocols and Models and Physical Layer (4 hours, Lab)**
 1. Using Wireshark to view the DoD Model
 2. using Wireshark to view the layers of protocols
 3. Packet Capture Analysis
- 16. Number Systems and Data Link Layer (4 hours, Lab)**
 1. Decimal to Hex Conversion
 2. Hex to Binary Conversion
 3. Compare 802.2 to 802.3 (LLC vs MAC)
 4. Cat3/Cat5/Cat6/Cat7 Compare (T568A / T568B)
- 17. Ethernet Switching and Network Layer (4 hours, Lab)**
 1. Ethernet II Frame Header
 2. Ethernet Frame Capture
 3. Ethernet Frame Analysis
- 18. Address Resolution IPV4 and IPV6 (4 hours, Lab)**
 1. Address Resolution Protocol (ARP)
 2. Reverse Address Resolution Protocol (RARP)
 3. Windows ARP
 4. Linux ARP
- 19. Basic Router Configuration (4 hours, Lab)**
 1. Configure Router via SSH
 2. Configure Router Interfaces
 3. Configure Router Security
 4. Configure Router Protocols
- 20. IPv4 Addressing (6 hours, Lab)**
 1. IP Address Network bits vs Host bits
 2. Practice CIDR
 3. Practice VLSM
 4. IP Address Classifications

	<ol style="list-style-type: none"> 1. Class A, Class B, Class C 5. Subnetting <p>21. IPv6 Addressing (4 hours, Lab)</p> <ol style="list-style-type: none"> 1. IPV6 Address Network bits vs. Host bits 2. Public IPV6 Range, Private IPV6 Range 3. IPV6 Autoconfig <p>22. ICMP (4 hours, Lab)</p> <ol style="list-style-type: none"> 1. Working With PING 2. Working With Traceroute 3. Working With Echo Request and Echo Reply 4. Destination Unreachable <p>23. Transport Layer & Application Layer (6 hours, Lab)</p> <ol style="list-style-type: none"> 1. Working with Application Layer Protocols 2. Working with HTTP, SMTP, DNS, DHCP, FTP 3. Working with Sessions, Encoding, Presentation 4. Working with UDP 5. Working to TCP <p>24. Network Security Fundamentals & Building a Small Network (6 hours, Lab)</p> <ol style="list-style-type: none"> 1. Design Topology for a small home network 2. Build the Topolog in Packet Tracer 3. Verify full connectivity 4. Include Network Services: Web/FTP/Streaming/DNS/DHCP
Total Lecture Hours:	36
Total Laboratory Hours:	54
Total Hours:	90
Primary Method of Evaluation:	Skills demonstrations
Typical Assignment Using Primary Method of Evaluation:	Create a peer-to-peer network and select the type of media that is needed to communicate. Choose the proper cable type (straight-through or crossover) to connect two work stations through the NIC (network interface card). Apply proper IP addresses, and subnet mask to each work station. Verify connectivity by pinging the IP address of the other work station. Troubleshoot when needed to solve any communication problems. Document the process you followed to be included in your Cisco journal.
Critical Thinking Assignment 1:	Using Wireshark (a software protocol analyzer) capture PDUs (protocol data units). Analyze the output from Wireshark and explain the encapsulation and individual fields of a PDU and interpret their meaning. Using the Wireshark Packet list and identify what protocol was used by ping. In writing, in your Cisco journal, identify the two types of ping messages that will be returned by the ping operation.
Critical Thinking Assignment 2:	Design and apply an IP addressing scheme for a given topology, given one address block that they subnet to provide a logical addressing scheme for the network. The routers will then be ready for interface address configuration according to their IP addressing scheme. When the configuration is complete, verify that the network is working properly. By using the IP index that is given, determine the number of subnets that will be needed, and the

	number of hosts that will be needed to provide 50% scalability. Document the process you followed, in writing, to be included in your Cisco journal.
Other Evaluation Methods:	<p>Performance exams</p> <p>Other exams</p> <p>Quizzes</p> <p>Laboratory reports</p> <p>Class Performance</p> <p>Homework Problems</p> <p>Multiple Choice</p> <p>Completion</p> <p>Matching Items</p> <p>True/False</p> <p>Other (specify):</p> <ol style="list-style-type: none"> 1. Students create a Technical Journal that is due at the end of each semester. Substantial writing and organization takes place when preparing this journal. 2. Students design networks and are required to do the network topology, subnet the network and apply the appropriate IP addresses. 3. All students are required to pass a Skills Based Assessment Exam which includes hands-on activities in the Cisco lab.
Instructional Methods:	<p>Demonstration</p> <p>Discussion</p> <p>Group Activities</p> <p>Laboratory</p> <p>Lecture</p> <p>Multimedia presentations</p>
If other:	
Work Outside of Class:	<p>Study</p> <p>Answer questions</p> <p>Skill practice</p> <p>Required reading</p>

	<p>Problem solving activities</p> <p>Journal</p> <p>Other (specify)</p> <p>Students have 1 additional hour of outside labs per week to complete by using NetLab which is located in the Cisco lab. Students have remote access to the actual Routers and Switches in the lab. They can complete some of their labs remotely on actual equipment in the lab. They can login from any location that has an Internet connection. In-class lab hours equal 2 instead of the standard 3 hours per week.</p>
If Other:	
Up-To-Date Representative Textbooks:	Cisco Networking Academy, <u>Introduction to Networks CCNAV7 Companion Guide</u> , 2020.
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	equivalent experience
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	CIS 40
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	<p>Basic understanding of computer and networking hardware:</p> <ol style="list-style-type: none"> 1. Examine the basic operational concepts of networked devices such as tablets, routers, switches, access points, printers, and personal computers. 2. Demonstrate an understanding of operating systems terminology, functions, and components as they apply to personal computers and networking devices. <p>Analyze Software and Hardware company needs:</p> <ol style="list-style-type: none"> 3. Analyze how applications software interacts with the operating system and computer system. 4. Analyze various components of network equipment and end devices to assess how these components function together. Components include routers, switches, network

	<p>interface cards, cabling and media, memory, disk drives, input and output devices, printers, and external storage.</p> <p>Manage Operating IT Systems:</p> <ol style="list-style-type: none"> 5. Compare and contrast the current operating systems available on personal computers. 6. Install and configure software such as utility programs used for diagnostic evaluation. 7. Demonstrate the ability to evaluate computer, operating systems, and applications software in relation to installing and configuring software on small networks. 8. Demonstrate the ability to use software tools to troubleshoot and resolve problems. 9. Evaluate the requirements necessary to manage an organization's network and end devices. 10. Examine the professional and ethical responsibilities facing the IT enabled organization including privacy, security and disaster recovery.
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	William Saichek
Date:	10/21/1991
Original Board Approval Date:	04/13/1992
Last Reviewed and/or Revised by:	Jesus Rubio
Date:	03/17/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024