El Camino College
COURSE OUTLINE OF RECORD - Approved

I. GENERAL COURSE INFORMATION

Subject and Number: **Computer Information Systems 140**
Descriptive Title: **Introduction to Networks Cisco 1**
Course Disciplines: **Computer Information Systems**
Division: **Business**

Catalog Description:
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.

Note: This course is semester one in the Cisco Networking Academy program.
(*Preparation for CCNA Certification)*

Conditions of Enrollment:
Prerequisite : Computer Information Systems 13 with a minimum grade of C or equivalent experience

Recommended Preparation: Computer Information Systems 40

Course Length: [X] Full Term [ ] Other (Specify number of weeks):
Hours Lecture: 2.00 hours per week [ ] TBA
Hours Laboratory: 3.00 hours per week [ ] TBA
Course Units: 3.00

Grading Method: Letter
Credit Status: Associate Degree Credit

Transfer CSU: [X] Effective Date: Prior to July 1992
Transfer UC: [ ] No

General Education:

El Camino College:

CSU GE:

IGETC:

II. OUTCOMES AND OBJECTIVES

COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1.SLO #1 Data Communication Terms Describe and explain data communication terms such as broadband and baseband communications.
2. SLO #2 Modulation Techniques Describe and use different modulation techniques such as time-division and frequency division.
3. SLO #3 Network Systems: Analyze and design network systems using differing transmission methods such as copper wire, fiber optics, microwave and satellite.
4. SLO #4 Communications with the Internet: Use microcomputer hardware and software to facilitate communications with the Internet. Describe how microcomputer hardware relates to data communications. Analyze security issues such as protections, detection and correction.
5. SLO #5 Local and Wide Area Networks: Describe and define the similarities and differences between local area networks and wide area networks
6. SLO #6 Ethical Consideration: Identify ethical considerations such as privacy, hacking, and piracy.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Identify the key components of any data network.
   - Other (specify)
   - Objective exams, lab assignments
2. Analyze the characteristics of network architectures: fault tolerance, scalability, quality of service and security.
   - Other (specify)
   - Objective exams, lab assignments, written assignments
3. Design, install, and use IRC (Internet Relay Chat) clients and a Wiki server.
   - Other (specify)
   - Objective exams, lab assignments
4. Assess rules and processes that govern network communications.
   - Other (specify)
   - Objective exams, lab assignments, written assignments
5. Evaluate tools and commands for constructing and maintaining networks.
   - Other (specify)
   - Objective exams, lab assignments, written assignments
6. Analyze TCP/IP Application Layer protocols and explain how they provide services specified by upper layers of the OSI model
   - Other (specify)

- Objective exams, lab assignments

7. Examine the function of well-known TCP/IP applications such as WWW and email, and their related services (HTTP, DNS, SMB, DHCP, SMPT/POP, and TELNET).
   - Other (specify)
   - Objective exams, lab assignments

8. Evaluate protocols that ensure services running on one kind of device can send to and receive data from many different devices.
   - Other (specify)
   - Objective exams, lab assignments, written assignments

9. Examine the role of two TCP/IP Transport layer protocols (TCP and UDP).
   - Other (specify)
   - Lab assignments, written assignments

10. Design a network segment showing key functions of the Transport layer, including reliability, port addressing, and segmentation.
    - Other (specify)
    - Objective exams, lab assignments

11. Evaluate the results of an output showing the relationship of TCP and UDP to bandwidth.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

12. Examine the most common Network layer protocol, Internet Protocol (IP), and its features for providing connectionless and best-effort service.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

13. Design a network segment that use hierarchical addressing of devices and show how this allows communication between networks.
    - Other (specify)
    - Objective exams, written assignments

14. Explain the structure of IP addressing and demonstrate the ability to convert between 8-bit, 16-bit, and decimal numbers.
    - Other (specify)
    - Objective exams, lab assignments

15. Choose the network portion of a host address and explain the role of the subnet mask in dividing networks.
    - Other (specify)
    - Objective exams, written assignments

16. Construct an IP addressing table showing the appropriate subnetting scheme utilizing VLSM to conserve address space.
    - Other (specify)
    - Objective exams, written assignments

17. Measure the results of common testing utilities to verify and test network connectivity and operational status of the IP protocol stack on a host.
    - Other (specify)
    - Objective exams, lab assignments

18. Explain the role of Data Link layer protocols in data transmission.
    - Other (specify)
    - Lab assignments, written assignments

19. Evaluate several common logical network topologies and describe how the logical topology determines the media access control method for that network.
    - Other (specify)
    - Objective exams, written assignments

20. Assess the role of key frame header and trailer fields, including addressing QoS, type of protocol, and FCS.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

21. Describe the purpose of Physical layer signaling and encoding as they are used in networks.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

22. Compare the basic characteristics of copper, fiber, and wireless network media.
    - Other (specify)
    - Objective exams, lab assignments

23. Design an Ethernet Frame showing the field structure.
    - Other (specify)
    - Objective exams, lab assignments

24. Examine the function and characteristics of the media access control method used by the Ethernet protocol.
    - Other (specify)
    - Lab assignments, written assignments

25. Compare and contrast Ethernet hubs and switches.
    - Other (specify)
    - Objective exams, lab assignments

26. Assemble a straight-through and a cross-over cable utilizing the 568A and 568B pinout standard.
    - Other (specify)
    - Objective exams, written assignments
27. Compare the different cabling types, standards, and ports used for WAN connections.
    - Other (specify)
    - Lab assignments, written assignments

28. Design an addressing scheme for an internetwork and assign ranges for hosts, network devices, and router interfaces.
    - Other (specify)
    - Lab assignments

29. Compare and contrast the importance of network designs.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

30. Define the role of the Internetwork Operating System (IOS).
    - Other (specify)
    - Objective exams, lab assignments, written assignments

31. Explain the purpose of a configuration file as it relates to the IOS.
    - Other (specify)
    - Objective exams, lab assignments, written assignments

32. Contrast the characteristics of several classes of devices that have the IOS embedded.
    - Other (specify)
    - Objective exams, lab assignments

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	3	I	Network-Centric World A. Evolution of current networks B. Explosion of the Internet C. Today's communication tools D. Networks supporting the way we learn and work E. Elements of a network F. Internet protocols G. Converged Networks H. Fault tolerance I. Scalability J. Quality of service K. Network security
Lecture	3	II	Network Communication A. Elements of communication B. Message communication C. Components of the network D. End devices and their role in networking E. Intermediary devices F. Network media G. Local area networks

			H. Wide area networks I. Network protocols J. Layered models K. Protocol Data Units and Encapsulation L. OSI Model M. Network addressing
Lecture	3	III	Application Layer Functionality and Protocols A. Applications: The Interface Between the Networks B. OSI and TCP/IP Model C. Application Layer Software D. Client/Server Model E. Servers F. Application Layer Services and Protocols G. Peer to Peer (P2P) Networks H. DNS services and protocol I. WWW Service and HTTP J. E-Mail Services and SMTP/POP Protocols K. FTP and DHCP L. File-Sharing Services and SMB Protocol M. Telnet Services and Protocol
Lecture	3	IV	OSI Transport Layer A. Purpose of the Transport Layer B. Reliable Communication support C. TCP & UDP D. Port Addressing E. Segmentation & Reassembly F. Conversation reliability G. TCP Server Processes H. TCP Connection Establishment & Termination I. TCP Three-Way Handshake J. TCP Session Termination K. TCP Acknowledgment with Windowing L. TCP Retransmission M. Congestion Control N. UDP Low overhead vs. reliability O. UDP Server processes & requests P. UDP Client Processes
Lecture	3	V	OSI Network Layer A. Network Layer – Communication from host to host B. Network Layer Protocol C. Transport Layer PDU packing D. Packet Header E. Host division into groups on a network F. Why separate hosts

			G. Inter-network division H. Communication support from outside the network I. Gateway – The way out of the Network J. Route – A path to a Network K. Destination Network L. Next hop – Where the packet goes next M. Packet-moving toward the destination with packet forwarding N. Static Routing O. Dynamic Routing P. Routing Protocols
Lecture	3	VI	Network Address A. Anatomy of an IPv4 Address B. Binary-to-decimal conversion C. Decimal-to-binary conversion D. Unicast, Broadcast, and Multicast E. Subnet mask-Define the Network & Host portions of the Address F. Public and addressing G. Static or Dynamic addressing for End-User Devices H. Device Address selection I. IANA (Internet Assigned Numbers Authority) J. ISPs (Internet Service Providers) K. Subnet-Dividing the network in smaller parts M. Ping a loopback address (127.0.0.1) to test the local IP stack N. Traceroute-Testing the path O. ICMP – Protocol Supporting, Testing, and Messaging P. Anatomy of an IPv6 Address
Lecture	3	VII	OSI Data Link Layer A. LLC (Logical Link Control)-Supporting and connecting to upper-layer services B. Control data transfer across local media C. Creation of a frame D. Connection of upper-layer services to the media E. MAC (Media Access Control) for shared media F. MAC for non-shared media G. Logical vs Physical Topology H. Data link layer protocols I. The role of the header in framing J. Where the frame goes (addressing) K. The role of the trailer in framing

Lecture	3	VIII	OSI Physical Layer A. Purpose of the physical layer B. Physical layer operation C. Physical layer standards D. Physical layer fundamentals & principles E. Signal bits for the media F. Encode-Grouping bits G. Capacity to carry data H. Types of physical media I. Media connections
Lecture	6	IX	Ethernet A. Ethernet: Layer 1 & 2 B. Logical Link Control-Connecting to the upper layers C. MAC-Getting data to the media D. Physical implementation of Ethernet E. Historic, Legacy, and Current Ethernet F. 1 gigabit Ethernet and beyond G. Encapsulation of the packet H. Ethernet MAC address I. Hexadecimal Numbering & Addressing J. MAC in Ethernet K. CSMA/CD-The process L. Ethernet timing M. Interframe spacing & the Back=off Algorithm N. Ten, 100, and 1000 Mbps Ethernet O. Legacy Ethernet-Hubs, Ethernet-Switches & selective forwarding P. ARP (Address Resolution Protocol) Q. Resolution of IPv4 Address to MAC Addresses R. ARP Broadcast Issues
Lecture	3	X	Network Cabling and Planning A. Choice of the Appropriate LAN (Local Area Network) device B. Factors for device selection C. LAN connections D. WAN (Wide Area Network) connections E. Addressing scheme F. Hosts and networks determination G. Calculation of addresses for a given network scenario H. Device Interfaces I. Device Management Connection

Lecture	3	XI	Network Configuration and Testing A. Cisco IOS B. Access Methods C. Creation of Configuration Files D. Introduction of Cisco IOS Modes E. Basic IOS command structure F. CLI (Command Line Interface) and the Help facility G. IOS configuration modes H. Device Naming I. Device Access-Passwords and banners limiting J. Configuration files management K. Configuration of Interfaces L. Protocol stack testing M. Local interface and the local network testing N. Remote connectivity and the gateway testing O. Trace and interpret trace results P. Network Monitor and documentation Q. Network node identification
Lab	3	XII	Network Exploration A. Switch initialization B. Switches loading C. Configuration files erasure D. Internet mapping
Lab	3	XIII	Network Communication A. Establish console session B. Display and configure device settings C. Set up the Network D. Configure PC Hosts E. Display interface status
Lab	3	XIV	Network Protocols and Communication A. Network traffic capture B. Local ICMP data capture C. Remote ICMP data analysis
Lab	3	XV	Network Access A. Network Devices B. Network media C. PC wired NIC configuration D. PC wireless NIC configuration

Lab	6	XVI	Ethernet A. Ethernet II frame headers B. Ethernet frames capture C. Ethernet frames analysis D. Windows ARP command E. IOS ARP command F. ARP exchanges
Lab	6	XVII	Network Layer A. Access Host Routing Table B. IPv4 host routing Table analysis C. IPv6 host routing Table analysis D. Router external characteristics E. Router internal characteristics
Lab	6	XVIII	Transport Layer A. Packet Capture B. Packet Location C. Packet Examination D. PC IP configuration E. DNS data capture F. UDP packets capture
Lab	6	XIX	IP Address A. IPv4 addressing conversion B. Bitwise ANDing network addressing C. Network host IP address identification D. IPv addressing classification E. IPv6 addressing configuration F. End-to-end IPv6 connectivity verification
Lab	6	XX	IP Networks Subnet A. IPv4 address subnet determination B. IPv4 address subnet calculation C. VLSM address scheme designing
Lab	6	XXI	Application Layer A. DNS conversion of a URL to IP address B. NSLookup command usage to observe DNS Lookup on a website

			C. NSLookup command usage to observe DNS Lookup on a mail server D. PSP networks identification E. File sharing protocols and applications identification
Lab	6	XXII	Network Management A. Basic device settings configuration B. Basic router security settings configuration C. Basic switch security settings configuration D. Router for SSH access configuration E. Switch for SSH access configuration F. SSH from CLI verification on switch
Total Lecture Hours		36	
Total Laboratory Hours		54	
Total Hours		90	

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. PRIMARY METHOD OF EVALUATION:

Skills demonstrations

B. 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.

C. COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:

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.

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.

D. OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:

Performance exams
Other exams
Laboratory reports
Class Performance
Homework Problems
Multiple Choice
Completion
Matching Items
True/False
Other (specify):

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.

V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Group Activities
Laboratory
Lecture
Multimedia presentations

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. WORK OUTSIDE OF CLASS

Study
Answer questions
Skill practice
Required reading
Problem solving activities
Journal
Other (specify)
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.

Estimated Independent Study Hours per Week: 5

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**

Cisco Networking Academy. Introduction to Networks v6 Companion Guide. - 2017

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Computer Information Systems-13 or	Sequential
Non-Course Prerequisite	Successful completion of this course requires a general understanding of computer networks, basic computer skills, and a conceptual understanding of computer information systems, their design and development.

B. Requisite Skills

Requisite Skills
General understanding of computer networks CIS 13 - Explain the development and use of information systems in business.
Basic computer skills CIS 13 - Solve common business problems using appropriate information technology applications and systems.
Conceptual understanding of systems CIS 13 - Explain the development and use of information systems in business.
System Design and Development CIS 13 - Solve common business problems using appropriate information technology applications and systems.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification
Course Recommended Preparation Computer Information Systems-40	

D. Recommended Skills

Recommended Skills
Basic Networking Concepts CIS 40 - Examine the basic operational concepts of personal computers.
Fundamentals of Operating Systems

CIS 40 - Examine operating systems terminology, functions, and components as they apply to personal computers.

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by William Saichek on 01/05/1990.

BOARD APPROVAL DATE:

LAST BOARD APPROVAL DATE: 07/16/2019

Last Reviewed and/or Revised by Dave Miller on 05/09/2019

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