# Crafton Hills College
# Course Outline

**1. Discipline:** Computer Information Systems

**2. Department:** Information Technology

**3. Course Title:** Networking Basics: Cisco Certified Network Associate (CCNA 1)

**4. Course I.D:** CIS 140

**5. Prerequisite(s):** None

**Corequisite(s):** None

**Departmental Recommendation(s):** CIS 101

**6. Semester Units:** 3.75

**7. Minimum Semester Hours:**

**Lecture:** 48 **Lab:** 36 **Clinic:** 0 **Field:** 0

**8. Need for the Course:**

The growing use of computer networks, specifically networks consisting of Cisco routers, has increased the demand for Cisco Certified Network Associates (CCNA) and Cisco Certified Network Professionals (CCNP). For this reason business people, computer professionals, personal users, as well as our current students and high school students are requesting this course. This course applies to the Associate degree as well as to the certificate requirements for Computer Information Systems.

**9. Goals for the Course:**

CIS 140 enhances the CIS discipline by offering another branch of computer training to the personal user, the business user, and the computer professional. Training in this area will enable our students to be more employable by having an additional area of expertise. This course is appropriate to the college's mission in that it is part of a comprehensive vocational education program leading to employment and/or preparation for transfer to a higher level of educational institution.

**10. Catalog Description:**

First of four courses leading to the Cisco Certified Network Associate (CCNA) designation. Introduces students to the networking field and helps prepare them for employment or further education and/or training. Includes networking terminology, network protocols, Local Area Networks (LANs), Wide Area Networks (WANs), Opens System Interconnection (OSI) model, cabling, cabling tools, routers, router programming, Ethernet, Internet Protocol (IP) addressing, and network standards. Emphasis on the proper care, maintenance, and use of networking software, tools, and equipment.

**11. Schedule Description:**

Hands-on course covering networking terminology, network protocols, Local Area Networks (LANs), Wide Area Networks (WANs), the Open System Interconnection (OSI) model, cabling, cabling tools, routers, router programming, Ethernet, Internet Protocol (IP) addressing, and network standards. First in a four-course sequence in preparation for Cisco Certified Network Associate (CCNA) exam.

**12. Entrance Skills:**

**A. Requisite Skills:**

**B. Recommended Skills:**

**1.** Basic computer literacy and basic web-browser navigation skills

**13. Course Objectives:**

**Upon satisfactory completion of the course, students will be able to:**

**A.** Install and configure the hardware and software required to communicate across a network.
**B.** Demonstrate the mathematical skills required to work with decimal, binary, and hexadecimal numbers.
**C.** Define and describe the structure and technologies of computer networks.
**D.** Compare and contrast network communications using two examples of layered models.
**E.** Describe the physical, electrical, and mechanical properties and standards associated with both copper and optical network media.
**F.** Construct standards-compliant cross-over, straight-though and roll-over cables.
**G.** Describe the topologies and physical issues associated with cabling common Local Area Networks (LANs).
**H.** Describe the physical issues associated with cabling networking equipment to work over a Wide Area Network (WAN) link.
**I.** Explain the fundamental concepts associated with the Ethernet media access technique.
**J.** Explain how collisions are detected, and the concepts associated with auto-negotiation on an Ethernet system.
**K.** Compare and contrast collision and broadcast domains, and describe the process of network segmentation.
**L.** Explain and demonstrate the mechanics associated with Internet Protocol (IP) addressing and subnetting.
**M.** Describe how an IP address is associated with a device interface, and the association between physical and logical addressing.
**N.** Describe the concepts associated with routing and the different methods and protocols used to achieve it.
**O.** Describe how the protocols associated with Transmission Control Protocol/Internet Protocol (TCP/IP) allow host communication to occur.
**P.** Describe the fundamental concepts associated with transport layer protocols and compare connectionless and connection-oriented transport methods.
**Q.** List the major TCP/IP application protocols, and briefly define their features and operation.

**14. Representative Texts and Instructional Materials:**

Cisco On-Line Academy Curriculum

Cisco Press. (2004). *CCNA 1 and 2 Companion Guide 3rd Edition.* Indianapolis: Cisco Press

Cisco Press. (2004). *CCNA 1 and 2 Lab Companion 3rd Edition*. Indianapolis: Cisco Press

Cisco Press. (2004). *CCNA 1 and 2 Engineering Journal and Workbook 3rd Edition*. Indianapolis: Cisco Press

**15. Course Content:**

**A.** Module 1: Introduction to Networking
- **1.** Connecting to the Internet
  - **a.** Requirements for Internet connection
  - **b.** PC basics
  - **c.** Network interface card (NIC)
  - **d.** NIC and modem installation
  - **e.** Overview of high-speed and dial-up connectivity
  - **f.** Transmission Control Protocol/Internet Protocol (TCP/IP) description and configuration
  - **g.** Testing connectivity with ping
  - **h.** Web browser and plug-ins
  - **i.** Troubleshooting Internet connection problems
- **2.** Network Math
  - **a.** Binary presentation of data
  - **b.** Bits and bytes
  - **c.** Base 10 number system
  - **d.** Base 2 number system
  - **e.** Converting decimal numbers to 8-bit binary numbers
  - **f.** Converting 8-bit binary numbers to decimal numbers
  - **g.** Four-octet dotted decimal representation of 32-bit binary numbers
  - **h.** Hexadecimal
  - **i.** Boolean or binary logic
  - **j.** IP addresses and network masks

**B.** Module 2: Networking Fundamentals
- **1.** Networking Terminology
  - **a.** Data networks
  - **b.** Network history
  - **c.** Networking devices
  - **d.** Network topology
  - **e.** Network protocols
  - **f.** Local-area networks (LANs)
  - **g.** Wide-area networks (WANs)
  - **h.** Metropolitan-area networks (MANs)
  - **i.** Storage-area networks (SANs)
  - **j.** Virtual private network (VPN)
  - **k.** Benefits of VPNs
  - **l.** Intranets and extranets
- **2.** Bandwidth
  - **a.** Importance of bandwidth
  - **b.** Analogies
  - **c.** Measurement

**d.** Limitations
**e.** Throughput
**f.** Data transfer calculation
**g.** Digital versus analog

**3.** Networking Models
**a.** Using layers to analyze problems in a flow of materials
**b.** Using layers to describe data communication
**c.** Open System Interconnection (OSI) model
**d.** OSI layers
**e.** Peer-to-peer communications
**f.** TCP/IP model
**g.** Detailed encapsulation process

**C.** Module 3: Networking Media

**1.** Copper Media
**a.** Atoms and electrons
**b.** Voltage
**c.** Resistance and impedance
**d.** Current
**e.** Circuits
**f.** Cable specifications
**g.** Coaxial cable
**h.** Shielded Twisted Pair (STP) cable
**i.** Unshielded Twisted Pair (UTP) cable

**2.** Optical Media
**a.** The electromagnetic spectrum
**b.** Ray model of light
**c.** Reflection
**d.** Refraction
**e.** Total internal reflection
**f.** Multimode fiber
**g.** Single-mode fiber
**h.** Other optical components
**i.** Signals and noise in optical fibers
**j.** Installation, care, and testing of optical fiber

**3.** Wireless Media
**a.** Wireless LAN (WLAN) organizations and standards
**b.** Wireless devices and topologies
**c.** How wireless LANs communicate
**d.** Authentication and association
**e.** The radio wave and microwave spectrums
**f.** Signals and noise on a WLAN
**g.** Wireless security

**D.** Module 4: Cabling Testing

**1.** Background for Studying Frequency-Based Cable Testing
**a.** Waves
**b.** Sine waves and square waves
**c.** Exponents and logarithms
**d.** Decibels
**e.** Viewing signals in time and frequency
**f.** Analog and digital signals in time and frequency
**g.** Noise in time and frequency
**h.** Bandwidth

**2.** Signals and Noise
**a.** Signaling over copper and fiber optic cabling

**b.** Attenuation and insertion loss on copper media
**c.** Sources of noise on copper media
**d.** Types of crosstalk
**e.** Cable testing standards
**f.** Other test parameters
**g.** Time-based parameters
**h.** Testing optical fiber
**i.** A new standard

**E.** Module 5: Cabling LANs and WANs

**1.** Cabling the LAN
**a.** LAN physical layer
**b.** Ethernet in the campus
**c.** Ethernet media and connector requirements
**d.** Connection media
**e.** UTP implementation
**f.** Repeaters
**g.** Hubs
**h.** Wireless
**i.** Bridges
**j.** Switches
**k.** Host connectivity
**l.** Peer-to-peer
**m.** Client/server

**2.** Cabling the WAN
**a.** WAN physical layer
**b.** WAN serial connections
**c.** Routers and serial connections
**d.** Routers and Integrated Services Digital Network Basic Rate Interface (ISDN BRI) connections
**e.** Routers and Digital Subscriber Line (DSL) connections
**f.** Routers and cable connections
**g.** Setting up console connections

**F.** Module 6: Ethernet Fundamentals

**1.** Ethernet Fundamentals
**a.** Introduction to Ethernet
**b.** Institute of Electrical and Electronic Engineers (IEEE) Ethernet naming rules
**c.** Ethernet and the OSI model
**d.** Naming
**e.** Layer 2 framing
**f.** Ethernet frame structure
**g.** Ethernet frame fields

**2.** Ethernet Operation
**a.** Media Access Control (MAC)
**b.** MAC rules and collision detection/backoff
**c.** Ethernet timing
**d.** Interframe spacing and backoff
**e.** Error handling
**f.** Types of collisions
**g.** Ethernet errors
**h.** FCS and beyond
**i.** Ethernet auto-negotiation
**j.** Link establishment and full and half duplex

**G.** Module 7: Ethernet Technologies
- **1.** 10 Megabits per second (Mbps) and 100-Mbps Ethernet
  - **a.** 10-Mbps Ethernet
  - **b.** 10BASE5
  - **c.** 10BASE2
  - **d.** 10BASE-T
  - **e.** 10BASE-T wiring and architecture
  - **f.** 100-Mbps Ethernet
  - **g.** 100BASE-TX
  - **h.** 100BASE-FX
  - **i.** Fast Ethernet architecture
- **2.** Gigabit and 10 Gigabit Ethernet
  - **a.** 1000-Mbps Ethernet
  - **b.** 1000BASE-T
  - **c.** 1000BASE-SX and LX
  - **d.** Gigabit Ethernet architecture
  - **e.** 10-Gigabit Ethernet
  - **f.** 10-Gigabit Ethernet architectures
  - **g.** Future of Ethernet

**H.** Module 8: Ethernet Switching
- **1.** Ethernet Switching
  - **a.** Layer 2 bridging
  - **b.** Layer 2 switching
  - **c.** Switch operation
  - **d.** Latency
  - **e.** Switch modes
  - **f.** Spanning-Tree Protocol
- **2.** Collision Domains and Broadcast Domains
  - **a.** Shared media environments
  - **b.** Collision domains
  - **c.** Segmentation
  - **d.** Layer 2 broadcasts
  - **e.** Broadcast domains
  - **f.** Introduction to data flow
  - **g.** What is a network segment?

**I.** Module 9: TCP/IP Protocol Suite and IP Addressing
- **1.** Introduction to TCP/IP
  - **a.** History and future of TCP/IP
  - **b.** Application layer
  - **c.** Transport layer
  - **d.** Internet layer
  - **e.** Network access layer
  - **f.** Comparing the OSI model and the TCP/IP model
  - **g.** Internet architecture
- **2.** Internet Addresses
  - **a.** IP addressing
  - **b.** Decimal and binary conversion
  - **c.** IPv4 addressing
  - **d.** Class A, B, C, D, and E IP addresses
  - **e.** Reserved IP addresses
  - **f.** Public and private IP addresses
  - **g.** Introduction to subnetting
  - **h.** IPv4 versus IPv6

3. Obtaining an IP Address
    a. Obtaining an Internet address
    b. Static assignment of an IP address
    c. Reverse Address Resolution Protocol (RARP) IP address assignment
    d. BOOTP IP address assignment
    e. Dynamic Host Configuration Protocol (DHCP) IP address management
    f. Problems in address resolution
    g. Address Resolution Protocol (ARP)

J. Module 10: Routing Fundamentals and Subnets
1. Routed Protocol
    a. Routable and routed protocols
    b. IP as a routed protocol
    c. Packet propagation and switching within a router
    d. Internet Protocol (IP)
    e. Anatomy of an IP packet
2. IP Routing Protocols
    a. Routing overview
    b. Routing versus switching
    c. Routed versus routing
    d. Path determination
    e. Routing tables
    f. Routing algorithms and metrics
    g. Interior Gateway Protocol (IGP) and Exterior Gateway Protocol (EGP)
    h. Link state and distance vector
    i. Routing protocols
3. The Mechanics of Subnetting
    a. Classes of network IP addresses
    b. Introduction to and reason for subnetting
    c. Establishing the subnet mask address
    d. Applying the subnet mask
    e. Subnetting Class A and B networks
    f. Calculating the resident subnetwork through ANDing

K. Module 11: TCP/IP Transport and Application Layer
1. TCP/IP Transport Layer
    a. Introduction to transport layer
    b. Flow control
    c. Session establishment, maintenance, and termination overview
    d. Three-way handshake
    e. Windowing
    f. Acknowledgment
    g. Transmission Control Protocol (TCP)
    h. User Datagram Protocol (UDP)
    i. TCP and UDP port numbers
2. The Application Layer
    a. Introduction to the TCP/IP application layer
    b. Domain Name Services (DNS)
    c. File Transfer Protocol (FTP)
    d. Hypertext Transfer Protocol (HTTP)
    e. Simple Mail Transfer Protocol (SMTP)
    f. Simple Network Management Protocol (SNMP)
    g. Telnet

**16. Methods of Instruction:**

The course will combine lecture, class discussion, teacher-led demonstrations, computer-aided presentations, collaborative (group involvement) work, router configuration, and computer lab participation.

**17. Assignments and Methods of Evaluation:**

Students will read appropriate curriculum, complete multi-media presentations, and a variety of network labs, projects and examinations.

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|---|---|
| Homework and Exercises: | 10% - 30% |
| Labs and Skills Demonstrations: | 20% - 40% |
| Examinations: | 30% - 50% |
| Collaborative Group Work: | 10% - 30% |

**18. Distributed Education Method**s: None