CRAFTON HILLS COLLEGE

Course Outline

1. **Discipline:** Computer Information Systems

2. **Department:** Information Technologies

3. **Course Title:** Network Troubleshooting -Cisco Semester VIII (Cisco Networking Academy)

4. **Course ID:** CIS 147

5. **Prerequisite(s):** CIS 144

   Corequisite(s): none

   Departmental recommendations(s): none

6. **Semester Units:** 3.5

7. **Minimum Semester Hours:**

   Lecture: 48 Lab: 24 Clinic: Field:

8. **Need for the Course**:

   The growing use of computer networks, specifically Cisco routers, has increased the demand for certified Cisco Network Professionals. For this reason business people, computer professionals, personal users, as well as our current students and high school students are requesting this course be added to our curriculum. This course applies to the Associate in Science Degree as well as to the Certificate requirements for Computer Information Systems.

9. **Goals for the Course**:

   CIS 147 enhances the CIS discipline offerings by presenting a network troubleshooting Cisco Semester VIII (Cisco Networking Academy) course for both the public sector and business. The addition of this course allows us to bring a highly demanded technology course to our program. This course is appropriate to the college's mission in that it is part of a comprehensive vocational education program leading to employment and preparation for transfer to a higher level of educational institution.

10. **Catalog Description**

    One of four courses in the Cisco Certified Network Professional (CCNP) certification curriculum. CCNP Semester VIII focuses on developing the advanced skills necessary for successfully troubleshooting Cisco routers and Catalyst switches. Students are taught how to baseline and troubleshoot an environment using Cisco routers and switches for multi-protocol client hosts and servers connected with: Ethernet, Fast Ethernet, Token Ring, Serial, Frame Relay, and/or ISDN BRI. Instruction, includes, but is not limited to, OSI Layers 1, 2, and 3, TCP/IP, LAN switching, VLANs, Frame Relay, ISDN, Appletalk, Novell, IEGRP, OSPF, BGP. This course is designed to help prepare students for the CCNP Support exam.

11. Schedule Description

A hands-on course that focuses on advanced network-troubleshooting tasks. Students learn how to baseline and troubleshoot an environment using Cisco routers and switches for multi-protocol client hosts and servers connected with: Ethernet, Fast Ethernet, Token Ring, Serial, Frame Relay, and/or ISDN BRI. This is one of four courses in the CCNP certification sequence.

12. Entrance Skills:

A. Requisite Skills, upon entering students must be able to:

1. Select and configure a scalable IP address solution (including route summarization) for a branch office environment, given a list of specifications.

2. Select and implement the technologies necessary to redistribute between and support multiple, advanced, IP routing protocols, given a network specification.

3. Configure and test edge router connectivity (either single or multihomed connection) into a BGP network, given a network specification.

4. Configure access lists, given a need to control access to devices and to selectively reduce overhead traffic in the network.

5. Given a specification containing multiple routed and routing protocols, implement solutions in a laboratory environment.

13. Course Objectives:
Upon successful completion of the course, students will be able to:

A. Select and implement the technologies necessary to identify and solve problems in a local area network.

B. Select and implement the technologies necessary to identify and solve problems in a wide area network.

C. Develop an action plan for solving computer network trouble.

D. Gather facts, define problem with VLANs, frame relays, ISDN, Appletalk, Novell IPX, and EIGRP.

14. Representative Texts and Instructional Materials:
TEXTS:

Cisco On-Line Course Material

(2000). *Second Year Companion*. Cisco Press. Boston, MA.

(2001). *Engineering Journal and Workbook, Volume I, Second Edition.* Boston,MA.

Lorenz, L., (2001), *Cisco Networking Academy Program Lab Companion: Lab Companion, 2nd Ed.*, San Jose, CA.

15. Course Content:

A. Troubleshooting Methodologies
  1. Course Introduction
    a. Using a systematic troubleshooting method
    b. Complexity of networks
    c. OSI Model Review
    d. Be prepared to troubleshoot
  2. Troubleshooting Model
    a. Problem solving model
    b. Define the problem
    c. Gather facts
    d. List possible problems
    e. Develop an action plan
    f. Implement the action plan
    g. Observe the results
    h. Repeat the process as necessary
    i. Solve the problem

B. Protocol Overview
  1. Legacy Media Types
    a. Connection orientated services
    b. Connectionless services
    c. OSI model
  2. Layer 2 protocols
    a. IEEE 802.3
    b. IEEE 802.5
    c. IEEE 802.2
    d. FDDI
    e. PPP
    f. SDLC and derivatives
    g. X.25
    h. Frame relay
    i. ISDN
  3. Introduction to ATM
    a. ATM switching
    b. ATM devices and interfaces
    c. ATM cell headers
    d. ATM services
    e. ATM reference model
    f. ATM addressing
    g. ATM connection types
    h. LANE

C. Management and Diagnostic Tools
  1. General Testing Equipment
    a. Cable testers
    b. Interface testing tools
    c. Network monitors
    d. Protocol analyzers
    e. Network management systems
  2. Network Management Software

a. Cisco Works
b. Netsys
c. Traffic Director
d. VLAN Director
e. WAN Management

3. Router Diagnostic Commands
    a. Overview
    b. Show buffers command
    c. Show interfaces command
    d. Show controllers command
    e. Show memory command
    f. Show processes command
4. Router Debugging
    a. Debug commands
    b. Error message logging
    c. Error message formats
    d. System logging
5. Interaction with Technical Support
    a. Working with technical support
    b. Show version command
    c. Shot controllers Cxbus command
    d. Show stacks command
    e. Show tech-support command
    f. Core dumps

D. Troubleshooting TCP/IP
1. TCP/IP Basics
    a. TCP/IP Evolution
    b. TCP/IP protocol stack (layer 3)
    c. TCP/IP addressing
    d. ICMP
    e. IRDP
    f. TCP/IP layer 4
    g. TCP/IP upper layers
    h. Problem isolation in TCP/IP
2. TCP/IP Diagnostic Tools
    a. Ping command
    b. Extended ping command
    c. Trace command
    d. Privileged Trace command
    e. Common Trace
    f. Common problems and behaviors
3. TCP/IP show commands
    a. Show ip access-list command
    b. Show ip arp command
    c. Show ip interface command
    d. Show ip protocols command
    e. Show ip route command
    f. Show ip traffic command
4. TCP/IP debug commands
    a. Debug ip icmp command
    b. Debug ip packet command
    c. Debug arp command
5. Troubleshooting a Windows NT environment
    a. Troubleshooting with Windows NT
    b. Windows browsing the network
    c. Common TCP/IP issues

d. Solutions to common problems
e. Verify reachability
f. Verify the path to a host (tracer)
g. Windows arp cache
h. Name resolution in windows
i. Proxy services

E. Troubleshooting LAN Switches
1. LAN Switch Hardware
a. Switch internal architecture
b. Switching technologies
2. Spanning Tree and VLANS
a. STP review
b. VLAN frame tagging
c. VTP
d. Troubleshooting VTP
3. Switch troubleshooting tools
a. CWSI
b. RMON and SwitchProbe
c. Troubleshooting with LEDs
d. CDP
e. SPAN
4. Show commands to verify system settings
a. Show system command
b. Show test command
c. Show interface command
d. Show log command
e. Show MAC command
f. Show module command
g. Show port command
5. Show commands for switch configuration
a. Show config command
b. Show span command
c. Show trunk command
d. Show flash command
e. Show spantree command
f. Show VTP domain command
6. Catalyst symptoms and problems
a. Problem isolation with switches
b. Common symptoms and problems
c. Solutions to command problems

F. Troubleshooting VLANS
1. VLAN Review
a. VLANS on routed and switched networks
b. VLAN switching, Translation and routing
c. Router layer 2 translation function
d. IOS FastEthernet troubleshooting
2. VLAN Troubleshooting
a. VLAN design issues
b. Router functionality
3. Router VLAN show and debug commands
a. Show VLAN
b. Show span
c. Debug VLAN packet
d. Debug span
4. Problem Isolation in VLAN networks
a. VLAN problem isolation
b. VLAN common symptoms and problems

c. Solutions to common VLAN problems

G. Routing and Switching Processes
1. Overview of routing
a. Overview
b. The routing process
c. The router switching process

2. Switching paths
a. Process switching
b. Fast switching
c. Silicon/Autonomous switching
d. Optimum switching
e. Distributed switching
f. Netflow switching
3. Performance issues
a. Queuing
b. RED
c. Compression
d. Filtering
e. Encryption
f. Accounting
4. Troubleshooting the router
a. Process switching
b. System buffers
c. Input/output queues
d. Interface buffers

H. Troubleshooting Frame Relay
1. Troubleshooting Frame-relay
a. Troubleshooting frame relay
b. Frame relay frame format
c. Problem isolation in frame relay
d. Common problems/symptoms in frame relay
e. Solutions to common frame relay problems
2. Troubleshooting commands
a. Show interface serial
b. Show frame-relay IMI
c. Show frame-relay map
d. Show frame-relay PVC
e. Debug serial interface
f. Debug frame-relay IMI
g. Debug frame-relay events
h. Debug frame-relay packet

I. Troubleshooting ISDN
1. ISDN basic troubleshooting
a. ISDN overview
b. Problem isolation with IDSN
c. Common problems/symptoms ISDN
d. Solutions to common ISDN problems
e. ISDN reference points
f. ISDN line framing
g. BRI activation process
2. Troubleshooting commands
a. Show interfaces BRI command
b. Show controllers BRI command

c. Shoe isdn status command
d. Show dialer command
e. Show PPP multilink command

3. ISDN Debugging
    a. Debug BRI command
    b. Debug ISDN Q921 command
    c. Debug PPP negotiation command
    d. Debug PPP authentication command
    e. Debug ISDN Q931 command
    f. Debug dialer command

J. AppleTalk
1. AppleTalk Protocol overview
    a. AppleTalk connection sequence
    b. AppleTalk layer 3
    c. DDP
    d. RTMP
    e. NBP
    f. AppleTalk layer 4
    g. AppleTalk upper layers
2. Configuring AppleTalk
    a. Configuration overview
    b. Enabling AppleTalk routing
    c. Assigning nonextended addresses
    d. Assigning a cable range
    e. Assigning a zone name
    f. Configuration example
    g. Tunneling with AppleTalk
    h. Tunneling example
3. Show commands
    a. Show AppleTalk access-list
    b. Show AppleTalk adjacent-routes
    c. Show AppleTalk ARP
    d. Show AppleTalk globals
    e. Show AppleTalk interface
    f. Show AppleTalk name-cache
    g. Show AppleTalk route
    h. Show AppleTalk zone
    i. Show AppleTalk NBP
4. Debug commands
    a. Debug Apple ARP
    b. Debug Apple errors
    c. Debug Apple events
    d. Debug Apple NPB
    e. Debug Apple packet
    f. Debug Apple routing
    g. Debug Apple zip

5. Problem Isolation with AppleTalk
    a. Problem Isolation
    b. Common symptoms/problems in AppleTalk
    c. Solutions to common problems

K. Novell IPX
1. Novell overview

a. NetWare protocols
b. NetWare connection sequence
c. NetWare layer 3
d. NetWare encapsulation
e. NLSP
f. NetWare layer 4
g. NetWare upper layers

2. Novell configuration
   a. Routing Novell with EIGRP
   b. Tunneling IPX traffic
   c. Example
3. Show commands
   a. Show IPX EIGRP topology
   b. Show IPX interface
   c. Show IPX NLSP database
   d. Show IPX route
   e. Show IPX servers
   f. Show IPX traffic
4. Debug commands
   a. Debug IPX IPXWAN
   b. Debug IPX packet
   c. Debug IPX routing
   d. Debug IPX sap
5. Problem isolation in Novell networks
   a. Common symptoms/problems with Novell
   b. Solutions to common problems

L. Troubleshooting EIGRP
1. EIGRP neighbor stability
   a. Show IP EIGRP neighbors command
   b. Common problems
   c. Layer 1 issues
   d. Holddown timer expiration
   e. Too many retries
   f. Manual configuration changes
   g. Neighbor logging
   h. Layer 3 issues with EIGRP (masks and autosummarization)
2. Stuck in Active
   a. How does SIA occur?
   b. Active process review
   c. Common causes for SIA
   d. Troubleshooting SIA
   e. Troubleshooting the “active” part
   f. Troubleshooting the “stuck” part
   g. Preventative maintenance: Avoiding SIA
3. Troubleshooting commands
   a. Show IP EIGRP topology
   b. Event log
   c. Show IP EIGRP events
   d. Show IP EIGRP SIA
   e. Debug IP EIGRP neighbor
   f. Debug IP EIGRP AS network mask
   g. Debug IP EIGRP
   h. Debug EIGRP packet

M. Troubleshooting OSPF
1. Monitoring OSPF
   a. Monitoring overview
   b. Show IP OSPF command

c. Show IP OSPF interface command
d. Show IP OSPF border-routers
e. Show IP OSPF database
f. Show IP OSPF neighbor
g. Show IP OSPF virtual-links

2. Debugging OSPF
   a. When to debug
   b. How to use debugging commands
   c. Debug IP OSPF adjacency
   d. Debug IP OSPF events
   e. Debug IP OSPF packet
   f. Debug IP routing
3. Logging information
   a. System logging (SYSLOG)
   b. Configuring SYSLOG
   c. Data and time stamping
   d. Logging OSPF neighbor changes
   e. Logging to the routers buffer
   f. Logging to a SYSLOG server
4. Case Study

N. Troubleshooting BGP
1. Monitoring BGP
   a. Show IP BGP
   b. Show IP BGP neighbor
   c. Show IP BGP summary
   d. Debug IP BGP
   e. Debug IP BGP updates
   f. BGP logging
2. Troubleshooting Peer negotiation
   a. Peer establishment process and common problems
   b. Troubleshooting common problems
   c. Using loopbacks to nail down the network
3. Troubleshooting Routing updates
   a. Routing update rules of BGP
   b. Common problems
   c. Troubleshooting steps
   d. Troubleshooting with an access list
   e. Troubleshooting slow convergence
4. Route Selection
   a. Route selections rules of BGP
   b. Common problems
   c. Issue: Best path keeps changing (MED)
   d. Communities

16. Methods of Instruction:

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

17. Assignments and Methods of Evaluation:

Students will complete a variety of exercises, projects, skill demonstrations and examinations.

Projects and/exercises: 10 - 40%

Examinations:	30 - 50%
Lab work and skill demonstrations:	20 – 40%
Collaborative Group Work:	10 – 30%

18. Distributed Education Methods: none