

**LAKE AREA TECHNICAL INSTITUTE  
CISCO NETWORKING ACADEMY PROGRAM**

**Course:** NET 121 – CISCO Networking II

**Credits:** 3

**Books required:** *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, third edition; *Cisco Networking Academy Program CCNA 1 and 2 Lab Companion*, third edition.

**Course Description:** Routers and Routing Basics is the second of four CCNA courses leading to the Cisco Certified Network Associate (CCNA) designation. CCNA 2 focuses on initial router configuration, Cisco IOS Software management, routing protocol configuration, TCP/IP, and access control lists (ACLs). Students will develop skills on how to configure a router, managing Cisco IOS Software, configuring routing protocol on routers, and set the access lists to control the access to routers.

**Course Objectives:** The CCNA certification indicates knowledge of networking for the small-office, home-office (SOHO) market and the ability to work in small businesses or organizations whose networks have fewer than 100 nodes. A CCNA certified individual can:

- Install and configure Cisco switches and routers in multiprotocol internetworks using LAN and WAN interfaces
- Provide Level 1 troubleshooting service
- Improve network performance and security
- Perform entry-level tasks in the planning, design, installation, operation and troubleshooting of Ethernet, TCP/IP Networks.

CCNA 2 is an integral step towards achieving CCNA Certification. Upon completion of this course, students will be able to perform tasks related to:

- Routers and their role in WANs
- Cisco IOS
- Router Configuration
- Router File Management
- RIP and IGRP Routing Protocols
- TCP/IP Error and Control Messages
- Router Troubleshooting
- Intermediate TCP
- Access Control Lists

**Course Overview:** The course has been designed for 70 contact hours. Approximately 35 hours will be designated to lab activities and 35 hours on curriculum content. A case study on structured cabling is required, but format and timing are determined by the Local Academy.

**Grading:** Evaluation will be based on the scores achieved on the chapter tests, the final online test, the successful completion of the lab assignments, and the final skills test. The online chapter tests will be scored on a scale of 0 – 10. The final online test will be scored on a scale of 0 – 100. The lab assignments will be scored as 2 points for each one completed. The skills test will be scored on a scale of 1 – 100.

94 - 100% = A

87 - 93% = B

80 - 86% = C

79% and under = F

Tests 75%

Lab and Skills 25%

Test

Total = 100%

**Attendance:** Attendance is mandatory. Any student absent more than 6 hours will cause an automatic drop slip to be filed. The student may request an appeal and should attend all scheduled classes until the outcome of their appeal is known. Accumulated tardiness or early exits from a class period may count as an hour absent.

**Academic Honesty:** Refer to department policy on cheating and use of other's work.

**Policy and Procedures:** General policies and procedures are outlined in the LATI Student Handbook. Use of the computers is restricted to that necessary to complete CISCO class assignments. Online chapter tests may be retaken only once. The final skills test may be retaken only once. The minimum required score for passing the final online test is 80% on the first try. The minimum required score for passing the final online test on the second try is 85%. The maximum grade that will be recorded for second attempt will be 80%.

## Course Outline

### Module 1 WANs and Routers

#### WANs

- Introduction to wide-area networks (WANs)
- WAN devices
- WAN standards
- Introduction to routers in a WAN
- Router functions
- Academy approach to hands-on labs

#### WAN Technologies

- WAN services
- Circuit switching
- Packet switched services
- Cell switched services
- Other WAN services

#### Routers

- Router internal components
- Router physical characteristics
- Router external connections
- Management port connections
- Connecting console interfaces
- Connecting LAN interfaces
- Connecting WAN interfaces
- Summary

### Module 2 Introduction to Router

#### Operating Cisco IOS

- The purpose of Cisco IOS
- Router user interface
- Router user interface modes
- Cisco IOS features
- Operation of the Cisco IOS

**Starting a Router**

- Initial startup of Cisco routers
- Router LED indicators
- Examining the initial bootup output of the router
- Establishing a HyperTerminal session
- Logging into the router
- Keyboard help in the router CLI
- Enhanced editing commands
- Router command history
- Troubleshooting command line errors
- The show version command
- Summary

**Module 3 Configuring a Router****Configuring a Router**

- Command-line interface command modes
- Configuring name of a router
- Configuring router passwords
- Examining the show commands
- Configuring a serial interface
- Executing adds, moves, and changes
- Configuring an Ethernet interface

**Finishing the Configuration**

- Importance of configuration standards
- Interface descriptions
- Configuring interface descriptions
- Login banners
- Configuring message of the day (MOTD)
- Host name resolutions
- Configuring host tables
- Configuration backup and documentation
- Copying, editing, and pasting configurations
- Summary

**Module 4 Learning About Other Devices****Discovering and Connecting to Neighbors**

- Introduction to CDP
- Information obtained with CDP
- Implementation, monitoring, and maintenance of CDP
- Creating a network map of the environment
- Disabling CDP
- Troubleshooting CDP

**Getting Information about Remote Devices**

- Telnet
- Establishing and verifying a Telnet connection
- Disconnecting Telnet operation
- Advanced Telnet operation
- Alternate connectivity tests
- Troubleshooting IP address issues
- Summary

**Module 5 Managing Cisco IOS****Router Boot Sequence and Verification**

- Stages of the router power-on boot sequence
- How a Cisco device locates and loads IOS
- Using the boot system command
- Configuration register

- Troubleshooting IOS boot failure

### **Managing the Cisco Router File System**

- IOS file system overview
- IOS naming conventions
- Configuration file management using TFTP
- Configuration file management by using cut and paste
- Managing IOS images with TFTP
- Managing IOS images with Xmodem
- File system verification
- Summary

## **Module 6 Routing and Routing Protocols**

### **Overview of Static Routing**

- Introducing routing
- Static route operation
- Configuring static routes
- Configuring default route forwarding
- Verifying static route configuration
- Troubleshooting static route configuration

### **Dynamic Routing Overview**

- Introduction to routing protocols
- Autonomous systems
- Purpose of a routing protocol and autonomous systems
- Identifying the classes of routing protocols
- Distance vector routing protocol features and examples
- Link state routing protocol features and examples
- Hybrid routing protocol features and examples

### **Routing Protocols Overview**

- Route determination
- Routing configuration
- Routing protocols (RIP, IGRP, OSPF, EIGRP, BGP)
- Autonomous systems and IGP versus EGP
- Distance vector routing
- Link state routing
- Summary

## **Module 7 Distance Vector Routing Protocols**

### **Distance Vector Routing**

- Distance vector protocol updates
- Distance vector routing loop issues
- Defining a maximum count to prevent count to infinity
- Eliminating routing loops through split horizon
- Route Poisoning
- Avoiding routing loops with triggered updates
- Preventing routing loops with hold-down timers

### **RIP**

- RIP process
- Configuring RIP
- Using the ip classless command
- Common RIP configuration issues
- Verifying RIP configuration
- Troubleshooting RIP update issues
- Preventing routing updates through an interface
- Load balancing with RIP
- Load balancing across multiple paths
- Integrating static routes with RIP

**IGRP**

- IGRP features
- IGRP metrics
- IGRP routes
- IGRP stability features
- Configuring IGRP
- Migrating RIP to IGRP
- Verifying IGRP configuration
- Troubleshooting IGRP
- Summary

**Module 8 TCP/IP Suite Error and Control Messages****Overview of TCP/IP Error Message**

- Internet Control Message Protocol (ICMP)
- Error reporting and error correction
- ICMP message delivery
- Unreachable network
- Using PING to test destination reachability
- Detecting excessively long routes
- Echo message
- Destination unreachable message
- Miscellaneous error reporting

**Overview of TCP/IP Control Messages**

- Introduction to control messages
- ICMP redirect/change requests
- Clock synchronization and transit time estimation
- Information requests and reply message formats
- Address mask requests
- Router discovery message
- Router solicitation message
- Congestion and flow control messages

**Module 9 Basic Router Troubleshooting****Examining the Routing Table**

- The show ip route command
- Determining the gateway of last resort
- Determining the route source and destination address
- Determining L2 and L3 addresses from the route source to the route destination
- Determining the route administrative distance
- Determining the route metric
- Determining the route next hop
- Determining last route update
- Observe multiple paths to destination

**Network Testing**

- Introduction to network testing
- Using a structured approach to troubleshooting
- Testing by OSI layers
- Layer 1 troubleshooting using indicators
- Layer 3 troubleshooting using ping
- Layer 7 troubleshooting using Telnet

**Troubleshooting Router Issues Overview**

- Troubleshooting Layer 1 using show interface
- Troubleshooting Layer 2 using show interface
- Troubleshooting using show cdp
- Troubleshooting using traceroute
- Troubleshooting routing issues using show ip route and show ip protocol
- Troubleshooting using show controllers serial

- Introduction to debug
- Summary

## **Module 10 Intermediate TCP/IP**

### **TCP Operation**

- TCP operation description
- Synchronization process (3 way handshake)
- Denial-of-service attacks
- Windowing and window size
- Sequencing numbers
- Positive ACK
- UDP operation

### **Overview of Transport Layer Ports**

- Multiple conversations between hosts
- Ports for services
- Ports for clients
- Port numbering and well known ports
- Example of multiple sessions between hosts
- Comparison of MAC addresses, IP addresses, and port numbers
- Summary

## **Module 11 Access Control Lists (ACLs)**

### **Access Control List Fundamentals**

- What are ACLs
- How ACLs work
- Creating ACLs
- The purpose and function of wildcard mask bits
- Verifying ACLs

### **Access Control Lists**

- Standard ACLs
- Extended ACLs
- Named ACLs
- Placing ACLs
- Firewalls
- Restricting virtual terminal access
- Summary