

**I. CATALOG DESCRIPTION:**

A. Department Information:

Division:	Business and Information Technology
Department:	Computer Information Technology
Course Number:	CIT 095
Course Title:	Advanced Routing, Semester Five (Cisco Networking Academy)
Units:	3
Lecture:	2 Hours
Laboratory:	3 Hours
Prerequisite:	CIT 094

B. Catalog and Schedule Description:

Cisco Semester Five focuses on advanced routing and using Cisco routers connected to local-area networks (LANs) and wide-area networks (WANs) typically found at medium to large network sites where students will be able to select and implement the appropriate Cisco IOS services required to build a scalable routed network. This is a first in a series of four courses recommended for CCNP (Cisco Certified Network Professional) certification. (Formerly MIS 094)

**II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One**

**III. EXPECTED OUTCOMES FOR STUDENTS:**

Upon successful completion of the course, the student will be able to:

- A. Select and configure a scalable IP address solution (including route summarization) for a branch office environment, given a list of specifications.
- B. Select and implement the technologies necessary to redistribute between and to support multiple, advanced, IP routing protocols, given a network specification.
- C. Configure and test edge router connectivity (either single or multihomed connection) into a BGP network, given a network specification.
- D. Configure access lists, given a need to control access to devices and to selectively reduce overhead traffic in the network.
- E. Implement solutions in a laboratory environment given a specification containing multiple routed and routing protocols.

**IV. CONTENT:**

- A. Advanced Routing
  1. Hierarchical Network Design Model
  2. Key Characteristics of Scalable Internetworks
  3. Case Study
  4. Basic Router Configuration Lab Exercises
  5. Load Balancing Lab Exercises
- B. Advanced IP Addressing Management
  1. IPv4 Addressing
  2. IP Addressing Crisis and Solutions
  3. VLSM
  4. Route Summarization
  5. Private Addressing and NAT
  6. IP Unnumbered
  7. DHCP and Easy IP
  8. Helper Addresses

- 9. IPv6
- C. Routing Overview
  - 1. Routing
  - 2. Default Routing
  - 3. Floating Static Routes
  - 4. Convergence
- D. OSPF Operation
  - 1. OSPF Overview
  - 2. OSPF Operation
  - 3. Configuring OSPF
  - 4. Configuring OSPF over NMBA
- E. Verifying OSPF Operation
  - 1. Multiarea OSPF
  - 2. Multiple OSPF Areas
  - 3. Multiarea OSPF Operation
  - 4. Multiarea OSPF Configuration
  - 5. Stub and Totally Stubby Areas
  - 6. Virtual Links
  - 7. Not-So-Stubby Areas
  - 8. Monitoring Multiarea OSPF
- F. EIGRP
  - 1. EIGRP Fundamentals
  - 2. EIGRP Features
  - 3. EIGRP Components
  - 4. Configuring EIGRP
  - 5. Monitoring EIGRP
- G. Route Optimization
  - 1. Controlling Routing Update Traffic
  - 2. Policy Routing
  - 3. Route Redistribution
- H. BGP
  - 1. Autonomous Systems
  - 2. Basic BGP Operations
  - 3. Configuring BGP
  - 4. Monitoring BGP Operation
  - 5. The BGP Routing Process
  - 6. BGP Attributes
  - 7. The BGP Decision Process
- I. Scaling BGP
  - 1. Route Reflectors
  - 2. BGP Route Filtering and Policy Routing
  - 3. The Community Attribute
  - 4. Peer Groups
  - 5. Redundancy, Symmetry, and Load Balancing
  - 6. BGP Redistribution
- J. Security
  - 1. Access Lists
  - 2. Securing Router Access
  - 3. Dynamic Access Lists: Lock-and-Key
  - 4. Session Filtering
  - 5. Context-Based Access Control
  - 6. Using an Alternative to Access Lists

**V. METHODS OF INSTRUCTION:**

- A. Lecture
- B. Web-based Interactive Labs
- C. Discussion
- D. Group Activity

**VI. TYPICAL ASSIGNMENTS:**

- A. Lecture:
  - 1. List and explain the three-Step process to authenticate Point-to-Point Protocol (PPP)
  - 2. According to the principle of the longest match, which of the following routes would a router choose for a packet with a destination address of 10.212.7.144?
    - a. 10.0.0.0/8
    - b. 10.212.17.0/24
    - c. 10.212.16.0/20
    - d. 10.212.17.144/32
- B. Critical thinking and performance
  - 1. Scenario: International Travel Agency (ITA) uses RIPv2 for dynamic routing. You do a performance analysis to determine whether RIPv2 is optimized. A very slow 19.2 Kbps link is used to connect Singapore and Auckland until you can provision a faster link. To reduce traffic, you would like to avoid dynamic routing on this link. You notice that one of the LANs with enterprise servers is near saturation. To reduce traffic, you decide to filter RIPv2 updates from entering SanJose3's 192.168.5.0/24 Ethernet LAN because the updates serve no purpose. ITA has a large research and development division in Singapore. The R&D engineers are on LAN 192.168.232.0 /24. The R&D managers on the 192.168.236.0 /24 LAN need access to this experimental network, but you also want this LAN to be "invisible" to the rest of the company. Also, the two R&D LANs have many UNIX hosts that need to exchange RIPv2 updates with the Singapore router.
    - a. Assignment: Build and configure the network according to the diagram, but do not configure RIPv2 yet. Use ping to verify your work and test connectivity between the serial interfaces. (Note: Auckland should not be able to ping SanJose3 until you have made additional configurations.)
    - b. Configure the AUX port for TCP/IP over PPP. Define a remote connection with the Make New Connection wizard
- C. Discussion and Group Activity
  - 1. As consultants for Carefree Toys, Inc., which is expanding rapidly at its corporate headquarters, you are asked to summarize the routes in their routing tables as much as possible in preparation for the connection of the corporate network to that of Plane Jane Dolls, Inc. with which they just merged. Be prepared to discuss the sort of issues you will expect to encounter summarizing the routes on this network, and what recommendations would your group make to the CEO of Carefree Toys, Inc.
  - 2. Two neighboring routers are not becoming neighbors even though OSPF is running on both routers and activated on both interfaces. What steps can you take in attempting to identify the cause of the problem? Be specific.

**VII. EVALUATION(S):**

- A. Methods of Evaluation
  - 1. Problem Solving and Skills Demonstration
    - a. Based on the handout, configure a dynamic access list for lock-and-key security
    - b. Configure content-based access control (CBAC) to secure an internal network and allow limited outside access to a DMZ.
  - 2. Group Activity
    - a. Configure EBGP between the company's core routers and the two ISP routers, and configure IBGP with peers to create a network that will provide the International Travel Agency with a fully meshed, reliable, and efficient core network.

- b. Configure IBGP routers to use ISP-B as a route reflector to work around IBGP's full-mesh requirements. All routers are already configured for IP and RIP. IBGP peer information has also been configured on all routers.
- 3. Written Assignments
  - a. What key word must be used with a lock-and-key access list?
  - b. Which type of access list examines the packet's data content, inspecting the type of data being exchanged?

**B. Frequency of Evaluation**

- 1. On-line chapter examinations as each chapter is completed; the software provides immediate feedback and review.
- 2. Group-work activity evaluated a minimum of two-times per week
- 3. Weekly Lab Activities
- 4. Skill-based Final Examination

**VIII. TYPICAL TEXT(S):**

Cisco Systems, Inc. CCNP Cisco Network Academy Program: Advanced Routing Companion Guide. Indianapolis, IN: Cisco Press, 2003.

**IX. OTHER SUPPLIES REQUIRED OF STUDENTS:** Zip Disk