NEW ZEALAND INSTITUTES OF TECHNOLOGY AND POLYTECHNIC QUALIFICATIONS IN INFORMATION & COMMUNICATIONS TECHNOLOGY

PRESCRIPTION: NW600 ROUTING PROTOCOLS AND CONCEPTS

AIM OF MODULE:	To provide students with an understanding of routing protocols and the knowledge and skills required to configure and manage networking equipment.
CREDITS:	14
KNOWLEDGE ASSUMED FROM:	NW500 Networking Principals (CCNA Exploration 1)
STUDENT LEARNING HOURS:	140
CONTENT REVISED:	2008
PRESCRIPTION EXPIRY DATE:	Nov 2011
NOTE:	The content of this module is based on Cisco Networking Academy CCNA Exploration 2 V4.0 course content and is cognisant of the Plan for Academy Student Success (PASS)

Level and Assessment Schedule

TOPICS	Highest Skill Level R	C	A	P	Suggested Assessment Percentage
1. Router components and basic configuration			*		5
2. Classful and Classless addressing			*		10
3. Static and Dynamic Routing			*		10
4. Link State routing				*	20
5. Distance Vector routing				*	30
6. Routing table analysis			*		5
7. Routing Case Study				*	20
					100

LEARNING OUTCOMES

The student will:

A	1.	Identify the major internal and external components of a router and configure the router for basic operation
A	2.	Understand and design classful and classless networks
A	3.	Describe and configure static and default routing and describe the features of dynamic routing
P	4.	Describe the general operation and features of Link state routing protocols and investigate the details of the Open Shortest Path First (OSPF) protocol
P	5.	Describe the general operation and features of distance vector routing protocols and investigate the details of Routing Information Protocol (RIP version and version 2) and Enhanced Interior Gateway Routing Protocol (EIGRP)
A	6.	Identify and describe different routing table entries and types of routes
P	7.	Complete a case study on Routing, as prescribed by Cisco

CONTENT

1. Router components and basic configuration

- Identifying the major internal and external router components includes:
  - Identifying management, local area and wide area network (LAN and WAN) interfaces
  - Identify the contents of the Memory components (ROM, RAM, NVRAM and Flash)
  - Purpose of the Cisco Internetwork Operating System (IOS)
  - Physical connections of a router to other devices
  - Description of the Router boot-up process
- Configure router for basic operation includes:
  - Hostname configuration
  - Setting encrypted and unencrypted passwords
  - Configuring the Ethernet, serial and loopback interfaces
  - Creating a login banner
  - Saving configuration changes on a router
  - Verifying basic configuration and router operations

2. Classful and Classless addressing

- Design of Classful networks includes:
  - Identifying the classes of ip addresses (A,B,C,D,E)
  - Designing a network using IPv4 Classful subnetting
- Design of Classless networks includes:
  - A description of Classless Inter-Domain Routing (CIDR) and route summarisation
  - Designing a network using Variable Length subnet masking (VLSM)

3. Static and Dynamic Routing

- A description and configuration of static routes includes:
  - A comparison of static and dynamic routing
  - Identify characteristics of interior and exterior routing protocols
  - Configuring static and default routes
  - Verification and troubleshooting of static and default routes
  - Cisco Discovery Protocol (CDP)

- A description dynamic routing includes:
  - Categorising routing protocols into:
    - Classless or classful, distance vector or link state
  - Administrative Distance for all routes
  - Metric for all dynamic routes
  - Equal and unequal cost paths
  - Convergence

4. Link State routing

- A description of the general operation and features of Link state (LS) routing protocols will include:
  - Applying Dijistra's algorithm
  - The learning of directly connected networks
  - Describing the Hello protocol
  - Build and flood link state packets
  - Investigate LS database
  - Creating a Shortest Path First (SPF) tree
  - Advantages and requirements of LS protocols

- An investigation of OSPF will include:
  - A description of:
    - Message encapsulation
    - Packet types
    - Link State updates
    - OSPF algorithm
    - DR/BDR election process
    - OSPF relationship with Multi-access networks
  - Describing and configuring:
    - Administrative Distance
    - Authentication
    - Metric
    - interface priorities
    - Redistributing OSPF default route
  - Verification and troubleshooting of the OSPF configuration

5. Distance Vector Routing

- A description of the general operation and features of Distance Vector routing protocols will include:
  - Identifying Distance vector routing protocols
  - Operation of Distance Vector routing protocols
- An investigation of RIP version 1 (v1) will include:

- A description of:
  - message format
  - protocol operation
  - boundary routers
  - RIP updates
  - Auto summarization
- Techniques to minimise routing loops:
  - Split horizon
  - Route poisoning
  - Hold down timers
- Router configuration of RIPv1:
  - Network statements
  - Passive interfaces
  - timers

➢ An investigation of RIP version 2 (v2) will include:
- A description of RIPv1 limitations
- relationship of RIPv2 with VLSM/CIDR
- Router configuration of RIPv2
- Description and configuration of RIPv2 authentication

➢ An investigation of EIGRP will include:
- A Description of the EIRP features:
  - Details of the Diffusing Update Algorithm (DUAL) algorithm:
    - Successor and feasibility distance
    - Topology table
    - Finite state machine
- Message format
- Protocol Dependent Modules (PDM)
- Reliability transport protocol (RTP)
- Packet types
- EIGRP configuration of:
  - Authentication
  - Manual and auto summarisation
  - Autonomous systems and process ids
- Verification and Troubleshooting of Ripv1, RIPv2 and EIGRP

6. Routing table analysis

➢ Identify routing table entries includes:
- Identifying static, default and all dynamic routing protocol routes and directly connected networks
- Identifying administrative distances and metrics in entries

➢ A description of route types includes:
- Level 1 and level 2 routes
- Parent child routes
- Router lookup process
- Longest matches

7. Case Study

➢ The completion of a case study on routing will require:
- Planning and designing IP addressing for a specified network topology

- Connecting routers and hosts together in accordance with design specifications
- Configuring the routers to implement the network design

NOTES FOR TUTORS

A typical assessment strategy should include:

- practical skills tests
- laboratory exercises
- group activities
- progressive on-line tests (CISCO Web Portal)
- summative (final) on-line test (CISCO Web Portal)
- kinaesthetic activities

LEARNING RESOURCES

- CISCO Networking Academy Programme:
  - Cisco Press: Routing Protocols and Concepts, CCNA Exploration Companion Guide
  - Cisco Press: Routing Protocols and Concepts, CCNA Exploration Labs and Study Guide
  - Engineering Journal and Workbook Volume 1 4th Edition