LONDON CAPITAL COMPUTER COLLEGE

Advanced Diploma in Routing & Switching (112) – Advanced LAN, WAN & Switching Configuration

Prerequisites: Networking knowledge.	**Corequisites:** A pass or higher in Diploma in IP Routing or equivalence.

Aim: This course is divided into two sections; Part I (Implementing Complex Internetworks) looks at network design components (access servers, LAN hardware; switches, hubs and cables; WAN technologies; routers and cables. The course also covers LAN and WAN protocols and Interior Gateway Protocols. Part II (Modelling Ethernet Switching, Quality of Service Techniques and Border Gateway Protocol) looks at Exterior Gateway Protocol, Border Gateway Protocol and Ethernet Switching. Also covered is quality of service techniques and VOIP. Learners have to be conversant in configuring hardware, networks and protocols in each topic.

Required Materials: Recommended Learning Resources.	**Supplementary Materials:** Lecture notes and tutor extra reading recommendations.

Special Requirements: The course requires a combination of lectures, demonstrations, discussions, and hands-on labs.

Intended Learning Outcomes:	Assessment Criteria:
Part I **Implementing Complex Internetworks**	**Part I** **Implementing Complex Internetworks**
1 Outline how internetwork model provide functionality. Demonstrate the assembling and configuring of all the necessary hardware and software components required in an internetwork.	1.1 Describe access server, LAN switches, hubs and cables, WAN connection cables and routers 1.2 Outline the application used in a LAN 1.3 Explore the Cisco IOS software and memory requirements 1.4 Demonstrate the configuration of a Frame Relay switch 1.5 Be able to perform password recovery on (i) router (ii) catalyst switch 1.6 Be able to upgrade and restore IOS 1.7 Demonstrate how to configure an access server
2 Explore the LAN technology Ethernet standards. Outline Spanning Tree, Fast Ethernet, Gigabit Ethernet and Ethernet/Token Switching.	2.1 Outline Ethernet technology 2.2 Explore the Spanning Tree Protocol and its importance in switched Ethernet 2.3 Define Ethernet Switching and analyse the advantages and disadvantages 2.4 Explore Token Ring LAN IEEE 802.5 2.5 Be able to configure an Ethernet switch 2.6 Be able to configure VTP domain throughout a network 2.7 Be able to configure VLANs and VLAN Trunking 2.8 Be able to configure a Token Ring Switched network
3 Explore the purpose of WAN, WAN protocols and technologies. Analyse common WAN protocols and their corresponding OSI layers.	3.1 Define HDLC and describe its characteristics 3.2 Be able to configure a WAN network 3.3 Be able to configure HDLC on DTE/DCE

		3.4	Outline the functions and characteristics of Point-to-Point Protocol (PPP)
		3.5	Demonstrate how to configure and enable PPP
		3.6	Describe and be able to configure PPP Chap
4	Explore Frame Relay network terminology, the overview of Frame Relay, LMI operations and the configuration of Frame Relay.	4.1	Outline common Frame Relay terminology
		4.2	Explore Frame Relay implementation strategies and its advantages
		4.3	Outline the steps and components needed to configure Frame Relay
		4.4	Describe Frame Relay ARP responses
		4.5	Describe Frame Relay traffic shaping and demonstrate its configuration
5	Explore the voice-over technology solutions. Analyse the advantages of voice-over solutions and design implementation, integration and configuration of voice over.	5.1	Describe analogy telephone system
		5.2	Describe digital voice technology
		5.3	Explore Cisco voice-capable routers
		5.4	Demonstrate how to configure voice over frame-relay
		5.5	Demonstrate how to configure voice over IP
		5.6	Demonstrate how to configure voice over ATM
6	Explore the importance of ISDN in the business market. Analyse how ISDN carries a variety of traffic over the network.	6.1	Describe the ISDN development, components and mechanics
		6.2	Demonstrate how to configure a Cisco router to use ISDN
		6.3	Outline ISDN troubleshooting techniques
		6.4	Demonstrate PPP authentication over ISDN configuration
		6.5	Demonstrate callback over ISDN configuration
		6.6	Demonstrate configuration multilink over ISDN configuration
		6.7	Demonstrate configuration of OSPF demand circuits over ISDN
7	Explore the Asynchronous Transfer Mode (ATM) technology and cell format. Outline the objective of ATM internetworking.	7.1	Describe FRC 2684
		7.2	Describe RFC 2225
		7.3	Demonstrate PVC configuration
		7.4	Demonstrate SVC configuration
8	Outline the operation, configuration and tuning of RIP version 1 and 2. Discuss the RIP evolvement from a classful routing protocol to a classless routing protocol.	8.1	Explore the operation of RIP
		8.2	Demonstrate configuration of RIP version 1
		8.3	Demonstrate configuration of RIP version 2
		8.4	Describe RIP parameters for tuning timers, controlling broadcasts and routes
		8.5	Demonstrate configuration of default routes
		8.6	Demonstrate RIP redistribution
		8.7	Demonstrate RIP route filtering
		8.8	Demonstrate controlling RIP route updates

9 Explore Interior Gateway Routing Protocol (IGRP) features and differentiate it from other distance vector protocols.	9.1 Outline IGRP timers, metrics and mechanics 9.2 Demonstrate IGRP configuration 9.3 Describe IGRP parameters for tuning timers, controlling broadcasts, load-sharing and controlling route updates 9.4 Demonstrate configuration of default route 9.5 Demonstrate configuration of route filtering 9.6 Demonstrate configuration of unequal-cost load sharing
10 Outline Enhanced Interior Gateway Routing Protocol (EIGRP) neighbour discovery/recovery; Reliable Transport Protocol (RTP), DUAL finite-state machine and protocol-dependent modules routing technologies.	10.1 Describe the advantages of EIGRP 10.2 Describe EIGRP configuration process 10.3 Explore EIGRP adjustment tuning parameters 10.4 Outline EIGRP route filtering 10.5 Describe redistribution in EIGRP 10.6 Describe EIGRP route summarisation 10.7 Explore EIGRP default route injection 10.8 Describe EIGRP stub routing 10.9 Describe EIGRP equal and unequal-cost load balancing 10.10 Demonstrate EIGRP route redistribution configuration 10.11 Demonstrate EIGRP route summarisation configuration 10.12 Demonstrate EIGRP route stub configuration 10.13 Demonstrate EIGRP default route configuration 10.14 Demonstrate EIGRP route manipulation configuration 10.15 Demonstrate EIGRP route filtering configuration
11 Describe Open Shortest Path (OSPF) and outline OSPF enhancements over distance vector protocols.	11.1 Describe the steps OSPF goes through when building a routing table 11.2 Outline how OSPF operates over the different types of links and the types of LSAs propagated from one area to another 11.3 Explore OSPF design considerations before implementation 11.4 Outline the types of OSPF stub areas 11.5 Analyse OSPF parameters for tuning timers, controlling broadcasts, routing updates and link-state propagation 11.6 Describe OSPF flooding 11.7 Explore OSPF route filtering 11.8 Explore OSPF route redistribution 11.9 Describe OSPF summarisation 11.10 Describe OSPF default routing 11.11 Describe OSPF authentication 11.12 Explore demand circuits and OSPF backup 11.13 Demonstrate OSPF virtual links 11.14 Demonstrate configuration of multiple

	OSPF areas and types, authentication, path manipulation and default routing
	11.15 Demonstrate configuration of OSPF multiple area routing, redistribution and summarisation
12 Explore protocols without explicit network layer addresses. Outline the different ways of transporting non-routable protocols.	12.1 Define transparent bridging and functions of a bridge
	12.2 Describe integrated routing and bridging
	12.3 Describe source route bridging
	12.4 Describe Data Link Switching plus
	12.5 Describe the types of filters for filtering traffic in bridged environments
	12.6 Demonstrate configuration of Transport Bridging, Remote Source-Route Bridging and LSAP filtering
	12.7 Demonstrate configuration of DLSw
13 Explore the controlling of routing updates, traffic paths and protocols. Outline the different types of IP access lists.	13.1 Describe how access lists operate
	13.2 Explore access lists, wildcard masks and binary maths
	13.3 Describe how access lists filter routes and deny network virtual terminal access
	13.4 Describe the implementation of Extended IP Access Lists
	13.5 Describe dynamic access lists
	13.6 Describe named access lists
	13.7 Demonstrate the configuration of access lists and named access lists
	13.8 Demonstrate the configuration of Dynamic Access Lists and Traffic filters using named access lists.
14 Outline how Network Address Translation (NAT) works. Explore the different implementations of NAT.	14.1 Describe NAT translations
	14.2 Explore RFC 1918
	14.3 Outline the different ways of configuring NAT
	14.4 Describe NAT translation time out clearing
	14.5 Explore advantages and disadvantages of NAT
	14.6 Demonstrate configuration of dynamic NAT
	14.7 Demonstrate configuration of NAT using non-standard FTP port numbers
	14.8 Demonstrate configuration of static NAT
15 Explore how Hot Standby Routing Protocol (HSRP) provide redundancy. Illustrate HSRP deployment.	15.1 Describe how HSRP operates
	15.2 Outline the configuration of HSRP
	15.3 Demonstrate configuration of HSRP
	15.4 Demonstrate configuration of tracking on the serial interface
	15.5 Demonstrate configuration of asymmetric routing
16 Outline how NTP provides the use of stratum information. Analyse Simple Network Time Protocol (SNTP)	16.1 Explore the implementation of NTP
	16.2 Outline the implementation of SNTP
	16.3 Demonstrate the configuration of NTP servers, clients and authentication

Part II Modelling Ethernet Switching, Quality of Service Techniques and Border Gateway Protocol.	Part II Modelling Ethernet Switching, Quality of Service Techniques and Border Gateway Protocol.
1 Explore the configuration of advanced switching. Analyse the software configuration of the Cisco Catalyst 3550 Intelligent Ethernet Switch.	1.1 Explore the features of the Catalyst 3550 1.2 Compare broadcast domain and VLAN design rules 1.3 Describe VTP and trunking protocols 1.4 Illustrate Spanning Tree Protocol (STP) 1.5 Analyse the advanced features of Catalyst 3550 Ethernet Switch 1.6 Demonstrate the configuration of EtherChannel, Layer 3 Switching, routed ports and SVI 1.7 Demonstrate the configuration of 802.1w RSTP/802.1s MST, Layer 3 switching and VLAN maps
2 Analyse the different applications of route maps including route filtering, route control, route metric modification (tagging) and Policy Based Routing (PBR). Explore how to configure and use route maps.	2.1 Describe route maps 2.2 Analyse the route-map, match and set commands 2.3 Explore the benefits of policy-based routing 2.4 Examine how policy routing controls traffic in the internetwork 2.5 Demonstrate the configuration of route maps for redistribution 2.6 Demonstrate the configuration of route maps using packet size
3 Outline multicast network design and maintenance. Explore the efficiency of multicasting, advantages and disadvantages	3.1 Describe the IP multicast addressing 3.2 Illustrate the multicast distribution trees 3.3 Describe Protocol Independent Multicasting (PIM) 3.4 Demonstrate configuration of a multicast group 3.5 Demonstrate configuration of frame-relay multicast routing 3.6 Demonstrate configuration of multicast joining group 3.7 Demonstrate how to control rate limit of multicast traffic 3.8 Demonstrate DVMRP multicast routing
4 Describe quality-control issues and troubleshooting resolutions. Explore ATM Quality of Service (QoS) technologies, the different Cisco IOS switching methods and how they can be used to improve network interface performance.	4.1 Outline Cisco IOS software QoS features 4.2 Analyse ATM concepts, differences between ATM and frame-relay, ATM performance management and the application of ATM QoS 4.3 Describe how QoS can be configured to improve network performance 4.4 Outline software compression techniques 4.5 Demonstrate the configuration of ATM QoS
5 Outline QoS techniques provided by integrated and differentiated services. Explore how to provide a guaranteed level of services, mark traffic with priority levels and prioritise traffic.	5.1 Describe the IntServ architecture 5.2 Describe the Resource Reservation Setup Protocol (RSVP) 5.3 Demonstrate the configuration of VoIP and RSVP

		5.4	Describe the DiffServ architecture
		5.5	Demonstrate the configuration of integrated and differentiated services
6	Explore the various queuing methods and their applications including First-In First-Out, Weighted Fair, Priority and Custom. Outline advanced traffic shaping, queuing, policy and marking technologies.	6.1	Describe First-In, First-Out (FIFO) queuing principles
		6.2	Describe the Weighted Fair Queuing
		6.3	Describe the Priority queuing
		6.4	Demonstrate configuration Priority queuing
		6.5	Describe custom queuing
		6.6	Describe traffic shaping
		6.7	Outline prioritisation of real-time traffic
		6.8	Explore the Class-Based Weighted Fair Queuing technology
		6.9	Explore the low latency queuing technique
		6.10	Demonstrate configuration of custom-queuing
		6.11	Demonstrate configuration of management internet traffic with CBWFQ and NBAR
7	Explore the BGP protocol, terminology and operation. Analyse the I-BGP and E-BGP sessions.	7.1	Describe the I-BGP protocol
		7.2	Describe the E-BGP protocol
		7.3	Explore BGP routing tables
		7.4	Analyse BGP messages
		7.5	Explore the BGP finite-state machine operation
		7.6	Analyse BGP path attributes
		7.7	Describe BGP route reflectors and confederations
		7.8	Explore BGP route selection process
8	Outline BGP configuration pre-requisites and processes that run on a cisco router. Analyse BGP neighbour configuration, network advertisement and how to analyse and verify BGP configuration.	8.1	Analyse router's capacity for running BGP
		8.2	Explore the tasks to be completed before BGP configuration
		8.3	Outline how BGP can be configured to support different network topologies
		8.4	Describe the BGP and IGP interaction synchronisation
		8.5	Explore how BGP enables control of advertised networks
		8.6	Demonstrate the configuration of E-BGP and I-BGP
9	Explore ways to use BGP to support larger networks and how to implement advanced routing policies.	9.1	Analyse BGP neighbour authentication
		9.2	Analyse the simplification of larger network configuration with route reflectors and confederations
		9.3	Outline how to effectively use BGP peer groups
		9.4	Explore advanced BGP redistribution methods
		9.5	Analyse route dampening, aggregation and policies
		9.6	Demonstrate how to configure BGP to support different route table sizes and symmetric routing

Recommended Learning Resources: Advanced LAN, WAN & Switching Configuration

Text Books	• Cisco BGP-4 Command and Configuration Handbook by William R. Parkhurst Ph.D. ISBN-10: 1587055732 • Routing TCP/IP Volume 1 (CCIE Professional Development Routing TCP/IP) by Jeff Doyle and Jennifer Carroll. ISBN-10: 1587052024 • Routing TCP/IP Volume 2 (CCIE Professional Development) by Jeff Doyle and Jennifer DeHaven Carroll. ISBN-10: 1578700892 • CCIE Routing and Switching Certification Guide by Wendell Odom, Rus Healy and Denise Donohue. ISBN-10: 1587059800
Study Manuals	BCE produced study packs
CD ROM	Power-point slides
Software	