

COURSE ELT3320: ROUTING FUNDAMENTALS**Level:** Advanced**Theme:** Computer Networking Systems**Prerequisite:** ELT2310: Network Structures, ELT2320: Network Media & Devices, ELT2330: OSI Model (Open System Interconnection), ELT2340: Network Protocols, ELT2350: Local Area Networks**Description:** Students extend their knowledge of wide area networks (WANs) by examining the process by which information is routed through an internetwork. They examine the major functions and components of a router, develop knowledge of common routing protocols, and gain practical experience in basic router configuration.**Parameters:** Designed to be delivered in conjunction with other advanced level courses in the Computer Networking Systems theme. Schools have the option of delivering courses within this theme in conjunction with one or more Project courses from the Career Transitions theme if they wish to extend learning and/or address other vendor-specific technologies.

Access to a computer work centre equipped with networking hardware, software, tools and consumable supplies, and to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on introductory-level knowledge of the processes used to route information through larger networks, and on the Internet Protocol (IP) addressing scheme. Students model and assume personal responsibility for ethical behaviour in their use of networking technologies and in their access to electronic sources of information. They also demonstrate an understanding of industry-based policies regarding network use and security.

Curriculum and Assessment Standards

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe the process of routing data through an internetwork, and describe the major functions of a router 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a teacher-directed evaluation or project designed to test ability to: <ul style="list-style-type: none"> describe the characteristics of internetworks and the path determination function of a router compare and contrast the functions of bridges, switches, routers and gateways describe and illustrate basic router operation explain and give examples of: <ul style="list-style-type: none"> static and dynamic routing routable and nonroutable protocols construct a physical model of a router topology 	15

COURSE ELT3320: ROUTING FUNDAMENTALS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain and analyze the addressing and routing function of protocols operating at the network layer of the Open System Interconnection (OSI) reference model 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or project designed to: <ul style="list-style-type: none"> – describe and illustrate the function of IP addresses in a routed network – explain and interpret standard conventions for IP addressing – analyze the function of the Address Resolution Protocol (ARP) and interpret an ARP cache – compare local area network (LAN)-to-LAN routing and LAN-to-WAN routing – describe the basic architecture, purpose and function of common routing protocols – explain and give examples of inter-autonomous, intra-autonomous and pass-through routing 	<p>15</p>
<ul style="list-style-type: none"> • demonstrate knowledge of router components, commands and configuration processes 	<ul style="list-style-type: none"> • a series of router configuration projects in which the student demonstrates ability to: <ul style="list-style-type: none"> – explain external configuration sources and internal configuration components – interpret and use basic router commands – perform basic router configuration routines, including: <ul style="list-style-type: none"> • router start-up and log-in procedures • use of command history and editing features • configuration and verification of IP addresses • configuration of routing protocols and interface lists – prepare a flowchart illustrating the router configuration process – configure a router for a standard 5-router topology 	<p>50</p>
<ul style="list-style-type: none"> • describe and explain methods used to manage and monitor network routing 	<ul style="list-style-type: none"> • a presentation or project designed to explain and demonstrate the use of the Simple Network Management Protocol (SNMP) to manage and monitor network routing 	<p>15</p>

COURSE ELT3320: ROUTING FUNDAMENTALS (continued)

Concept	Specific Outcomes	Notes
<p>Addressing and Routing Protocols</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe and illustrate the function of IP addresses in a routed network: <ul style="list-style-type: none"> – host addresses and broadcast addresses – subnetting and default gateways • explain and interpret standard conventions for IP addressing: <ul style="list-style-type: none"> – IP version 4 (Class A, B and C) addresses and their default subnet masks – Classless Inter-Domain Routing (CIDR) and the format for IP version 6 addresses • identify and describe ways in which IP version 6 may affect routing • analyze the function of the Address Resolution Protocol (ARP) and interpret an ARP cache • compare major features of LAN-to-LAN routing and LAN-to-WAN routing • describe and give examples of: <ul style="list-style-type: none"> – distance-vector and link-state routing protocols – interior and exterior routing protocols • explain the basic architecture and operation of common routing protocols; i.e.: <ul style="list-style-type: none"> – Routing Information Protocol (RIP) – Open Shortest Path First (OSPF) – Border Gateway Protocol (BGP) • explain and give examples of inter-autonomous, intra-autonomous and pass-through routing. 	<p>Compare internetwork routing to the postal system's method of routing mail. Explain the function of IP addressing in making limitless connections available on internetworks.</p> <p>Distinguish between open/standardized routing architectures and proprietary (i.e., privately owned) architectures.</p> <p>Identify steps of the Bellman-Ford Distance Vector Algorithm.</p> <p>Investigate the counting to infinity problem and how:</p> <ul style="list-style-type: none"> • RIP resolves the problem • split horizon prevents the problem. <p>Diagram:</p> <ul style="list-style-type: none"> • three OSPF phases • a BGP internetwork.
<p>Router Components, Commands and Configuration</p>	<ul style="list-style-type: none"> • identify and describe external configuration sources and internal configuration components • describe the uses of random-access memory (RAM) for working storage in a router • identify and describe router modes • identify and describe router help functions • interpret and use: <ul style="list-style-type: none"> – router interface and interface modes – basic show and test commands – startup sequence and setup commands – configuration files and modes 	<p>Basic router commands and configuration processes will vary according to the nature of the hardware being used.</p> <p>Compare and contrast user and privileged router modes.</p>

COURSE ELT3320: ROUTING FUNDAMENTALS (continued)

Concept	Specific Outcomes	Notes
<p>Router Components, Commands and Configuration (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • perform basic router configuration routines: <ul style="list-style-type: none"> – demonstrate router startup and log-in procedures – use command history and editing features – configure and verify IP addresses – configure routing protocols and interface – configure standard and extended access lists • demonstrate ability to troubleshoot a routing loop • prepare a flowchart illustrating the router configuration process • configure a router for a standard 5-router topology. 	<p>Identify types of information contained in a router configuration file. Specify files required for successful startup and functioning.</p> <p>Describe the IP route command. Configure a static route between neighbouring routers using the IP route command.</p>
<p>Network Monitoring and Management</p>	<ul style="list-style-type: none"> • describe Simple Network Management Protocol (SNMP) and its purpose in routing • identify SNMP architecture and message formats • describe management information base (MIB) structure and name representation • identify basic SNMP commands and security levels • demonstrate ability to: <ul style="list-style-type: none"> – configure an SNMP community name and access rights – troubleshoot a problem related to community access rights – display and save event logs – send traps to a specific IP station. 	<p>Examine SNMP with respect to:</p> <ul style="list-style-type: none"> • levels, agents and communities • events, traps and trap-directed polling. <p>Diagram MIB structure.</p> <p>Identify generic SNMP traps and types of events that can be trapped.</p> <p>Discuss the function of SNMP thresholds in measuring network performance against established baselines.</p>

