

COURSE ELT2330: OSI MODEL (Open System Interconnection)**Level:** Intermediate**Theme:** Computer Networking Systems**Prerequisite:** None**Description:** Students develop knowledge of the Open System Interconnection (OSI) reference model and its use as a conceptual framework for analyzing network communication tasks. They examine OSI reference model characteristics, the functions of each of its seven layers, and how data moves between layers of the reference model when computers establish a network connection.**Parameters:** Designed to be delivered in conjunction with other intermediate 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.

Primary focus should be placed on the physical, data link, network and transport layers of the OSI reference model, and on the real-world protocols and networking devices that operate at each of these layers. 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.

Supporting Courses: ELT1010: Electro-assembly 1, ELT1060: Digital Technology 1, ELT2070: Computer Technology, INF2010: Workstation Operations, INF2190: Telecommunications 1**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<i>The student will:</i> <ul style="list-style-type: none"> describe the general purpose and structure of the OSI reference model as a conceptual framework for network communication 	<i>Assessment of student achievement should be based on:</i> <ul style="list-style-type: none"> a test, presentation or project designed to address the following topics: <ul style="list-style-type: none"> the general purpose of the OSI reference model as a standard blueprint for designing, implementing and operating network hardware and software the seven layers of the OSI reference model and their functions how data moves between layers of the OSI reference model 	20

COURSE ELT2330: OSI MODEL (Open System Interconnection) (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • demonstrate established laboratory procedures and safe work practices • identify and describe information and communication technology careers within the context of the OSI reference model • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • observed performance in following: <ul style="list-style-type: none"> – established laboratory procedures – safety regulations specific to the networking technologies being used • a project or report identifying technical and professional career opportunities relevant to communication tasks defined at different layers of the OSI reference model <p><i>Assessment Tools</i> <i>Assessment Checklist: OSI Model (ELT2330–1)</i> <i>Assessment Checklist: Laboratory Procedures and Safety Practices, ELTPSP</i></p> <p><i>Standard</i> <i>Performance rating of 2 on each criterion</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>5</p> <p>5</p> <p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>OSI Reference Model</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain the purpose of the OSI reference model as a blueprint for designing, implementing and operating network hardware and software • identify the functions of each of the seven layers of the OSI reference model • explain and diagram data transfer between layers of the OSI reference model • explain processes of data encapsulation and de-encapsulation in the OSI reference model • describe the process of data packet delivery and the function of a data frame 	<p>Each layer of the OSI reference model defines a set of functions, protocols, hardware and procedures used to move information over a network. Students should understand what each layer of the OSI reference model defines and which network elements (e.g., protocols, devices) operate at each layer.</p>

COURSE ELT2330: OSI MODEL (Open System Interconnection) (continued)

Concept	Specific Outcomes	Notes
OSI Reference Model (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • match network components and connectivity devices to the layers of the OSI reference model at which they operate • analyze networking tasks with respect to the OSI reference model. 	
Physical Layer	<ul style="list-style-type: none"> • identify physical layer components and their function; i.e.: <ul style="list-style-type: none"> – cabling – connectors – network interface cards – repeaters – hubs • describe data signaling at the physical layer • identify Ethernet standards for media type and maximum segment length • demonstrate ability to: <ul style="list-style-type: none"> – select appropriate cables and connectors – select, install and configure a network adapter – terminate an Ethernet network – test for connectivity • given specific user requirements: <ul style="list-style-type: none"> – design physical layer topology and components for a small Ethernet network – create a plan for cabling based on Ethernet standards. 	<p>This layer is concerned with the physical nature of a network, which includes cabling, connectors, network interface cards, and the processes that convert bits into signals for sending and signals into bits when receiving.</p> <p>Compare and contrast 802.3 Ethernet media standards for:</p> <ul style="list-style-type: none"> • 10BaseT • 100BaseFX • 1000Basex. <p>Discuss elements of a logical diagram, and create a logical diagram for a network topology.</p>
Data Link Layer	<ul style="list-style-type: none"> • identify data link layer devices and their function; i.e.: <ul style="list-style-type: none"> – bridges – switches • explain the effects of segmentation in switched networks • identify data link sublayers and their function: <ul style="list-style-type: none"> – logical link control (LLC) sublayer – media access control (MAC) sublayer • outline Institute of Electrical and Electronics Engineers (IEEE) standards for the data link layer 	<p>This layer provides context to the physical layer's bits by formatting them into packets, providing error-checking and correction services, and avoiding transmission conflicts on the network. Students should understand the role of the data link layer in packaging data for transmission by the physical layer.</p>

COURSE ELT2330: OSI MODEL (Open System Interconnection) (continued)

Concept	Specific Outcomes	Notes
<p>Data Link Layer (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe connectionless and connection-oriented services associated with the LLC sublayer • explain the nature and limitations of physical addressing associated with the MAC sublayer • explain applications of framing in the transport of data packets • describe and illustrate the structure of a data frame • explain the function of frame addressing and frame relay in the transport of data packets. 	<p>Research the function of switching hardware with respect to:</p> <ul style="list-style-type: none"> • store-and-forward and cut-through data transport • half-duplex and full-duplex network access. <p>Convert between hexadecimal and decimal notation.</p> <p>Compare unicast, multicast and broadcast addressing.</p>
<p>Network Layer</p>	<ul style="list-style-type: none"> • identify network layer devices and their function; i.e.: <ul style="list-style-type: none"> – router – brouter • explain the process of routing and the function of: <ul style="list-style-type: none"> – routing metrics – routing tables • distinguish between: <ul style="list-style-type: none"> – static and dynamic routing – routable and nonroutable protocols • identify common routing protocols and their function; e.g.: <ul style="list-style-type: none"> – Open Shortest Path First (OSPF) – Routing Information Protocol (RIP) – Novell NetWare Link-Service Protocol (NLSP) • compare physical addressing associated with the data link layer and logical addressing associated with the network layer • identify logical addressing protocols and their function; i.e.: <ul style="list-style-type: none"> – Internet Protocol (IP) – Internetwork Packet Exchange (IPX). 	<p>This layer addresses data for delivery and converts network addresses into physical addresses. Routing of messages on the network and internetwork also occurs at the network layer.</p> <p>Identify common routing metrics:</p> <ul style="list-style-type: none"> • maximum transmission units (MTUs) • hop count. <p>Compare static and dynamic routers with respect to:</p> <ul style="list-style-type: none"> • configuration • routing • efficiency • security. <p>Compare logical addressing in a network to addressing schemes used by the postal system.</p>

COURSE ELT2330: OSI MODEL (Open System Interconnection) (continued)

Concept	Specific Outcomes	Notes
Transport Layer	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and explain types of error checking performed at the transport layer: <ul style="list-style-type: none"> – cyclic redundancy checks – parity bits – checksum calculations • provide a rationale for flow control, and identify hardware and software solutions implemented at the transport layer • explain name resolution functions performed at the transport layer • identify common transport layer protocols and their function; e.g.: <ul style="list-style-type: none"> – Transmission Control Protocol (TCP) – User Datagram Protocol (UDP) – Sequenced Packet Exchange (SPX) – AppleTalk Transaction Protocol/Name Binding Protocol (ATP/NBP) – Network Basic Input Output System/NetBIOS Enhanced User Interface (NetBIOS/NetBEUI). 	<p>This layer handles the connection among network computers as they communicate and match messages to the capabilities and restrictions of the network medium. Messages are divided into smaller pieces for transmission and reassembled at their destination. The transport layer supports the delivery of messages as well as error detection and recovery.</p> <p>Distinguish between connection-oriented and connectionless protocols.</p>
Session, Presentation and Application Layers	<ul style="list-style-type: none"> • identify modes for communication associated with the session layer: <ul style="list-style-type: none"> – simplex – half-duplex – full-duplex • describe data compression and encryption processes associated with the presentation layer • identify file formats that serve as standards for the presentation layer • describe network services provided by the application layer: <ul style="list-style-type: none"> – message handling – file transfer – database queries 	<p>These layers are primarily concerned with providing client support.</p> <p>The functions of upper layer application protocols include:</p> <ul style="list-style-type: none"> • transfer of electronic mail • transport of files from one computer to another • monitoring network devices.

COURSE ELT2330: OSI MODEL (Open System Interconnection) (continued)

Concept	Specific Outcomes	Notes
<p>Session, Presentation and Application Layers (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify upper layer application protocols and their function; e.g.: <ul style="list-style-type: none"> – Simple Mail Transfer Protocol (SMTP) – File Transfer Protocol (FTP) – Simple Network Management Protocol (SNMP). 	
<p>Career Paths</p>	<ul style="list-style-type: none"> • research technical and professional career opportunities relevant to communication tasks defined at different layers of the OSI reference model • place networking job titles relevant to one or more layers of the OSI reference model in a progressive sequence • identify training requirements and qualifications associated with one or more employment opportunities • write a detailed job description for a networking position, and explain how duties support communication tasks defined by the OSI reference model. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • salary range. <p>Research available network industry certification tracks.</p>

