

COURSE NET3010: DIGITAL TECHNOLOGY 3

Level: Advanced

Prerequisite: NET2010: Digital Technology 2

Description: Students demonstrate and apply knowledge of digital principles by using medium-scale transistor–transistor logic (TTL) and complementary metal-oxide semiconductor (CMOS) integrated technology.

Parameters: Access to a digital logic trainer, a logic probe, an oscilloscope, a function generator and related materials.

Outcomes: The student will:

- 1. identify, interface and experiment with medium-scale integrated circuit families**
 - 1.1 explain the difference between typical and complex logic networks
 - 1.2 research and describe examples of typical and complex logic networks
- 2. identify components, construct a prototype and experiment with typical medium-scale logic networks**
 - 2.1 design and fabricate digital circuitry using medium-scale integration
 - 2.2 construct, experiment with and solve real-world applications, using medium-scale integration
 - 2.3 measure and evaluate medium-scale integrated circuits
- 3. demonstrate established laboratory procedures and safe work practices**
 - 3.1 explain and demonstrate how to avoid electrostatic discharges around integrated circuit chips, using static mats and grounding straps
 - 3.2 demonstrate an understanding of grounding, voltage and current rating of various integrated circuit families
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE NET3020: DIGITAL APPLICATIONS

Level: Advanced

Prerequisite: NET2010: Digital Technology 2

Description: Students experiment with large-scale and very large-scale integrated circuits, and demonstrate their applications to practical situations.

Parameters: Access to logic probes, a logic analyzer, a signature analysis, oscilloscope and related materials.

Supporting Course: NET3010: Digital Technology 3

Outcomes: The student will:

- 1. identify applications and develop prototypes of large-scale integrated circuits (LSICs)**
 - 1.1 research and investigate a complex digital system
 - 1.2 identify the function of integrated circuits in a large complex digital circuit
 - 1.3 explain, experiment with and demonstrate the differences among digital memories
 - 1.4 research memory configuration and organization
 - 1.5 construct various memory circuits
 - 1.6 explain and demonstrate the differences among various digital displays and drivers
 - 1.7 explain and demonstrate the differences among various support and advanced support integrated circuits
 - 1.8 identify the application of pinouts and use of complex integrated circuit chips from several manufacturers
 - 1.9 explain and demonstrate the differences among various digital interfacing devices
 - 1.10 construct circuits using LSICs
- 2. troubleshoot a digital system or prototype with digital equipment**
 - 2.1 prototype and troubleshoot a digital system such as a calculator, computer, adder/subtractor, digital clock, frequency counter, alarm and game
 - 2.2 use one or more of the following instruments to analyze a complex digital circuit:
 - 2.2.1 logic probe
 - 2.2.2 pulser
 - 2.2.3 logic analyzer
 - 2.2.4 signature analyzer
 - 2.2.5 oscilloscope
- 3. demonstrate established laboratory procedures and safe work practices**
 - 3.1 demonstrate correct handling and storage of LSIC and very large-scale integrated circuit (VLSIC) chips
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems

- 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
- 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE NET3030: MICROPROCESSORS

Level: Advanced

Prerequisite: NET2010: Digital Technology 2

Description: Students compare the internal architecture of microprocessors and program them using instruction sets.

Parameters: Access to a microprocessor trainer, a computer aided instruction (CAI) program and related materials.

Supporting Courses: NET3010: Digital Technology 3
NET3020: Digital Applications

Outcomes: The student will:

1. compare the internal architecture of various families of microprocessors

- 1.1 compare the difference in internal architecture between different families of microprocessors
- 1.2 explain the differences between machine and assembly language and interpretative and compiled languages
- 1.3 define the following terms:
 - 1.3.1 microprocessor
 - 1.3.2 input/output
 - 1.3.3 instruction set
 - 1.3.4 operand
 - 1.3.5 mnemonic
 - 1.3.6 opcode
 - 1.3.7 data/address
- 1.4 describe and locate the types of microprocessor used in a computer or trainer

2. program a microprocessor, using instruction sets

- 2.1 write and execute a simple straight program using mnemonic and opcodes
- 2.2 demonstrate the uses and characteristics of different addressing modes by writing and analyzing assembly language programs
- 2.3 compute the proper relative address for branching forward or backward from one point to another in a program
- 2.4 write and execute a program that can:
 - 2.4.1 multiply by repeated additions
 - 2.4.2 divide by repeated subtractions
 - 2.4.3 convert binary to binary-coded decimal (BCD)
- 2.5 write and execute simple programs that use indexed and extended addressing
- 2.6 given an instruction, locate the opcode, calculate the number of machine cycles, find the number of bytes and give the final output
- 2.7 write and execute a simple program that can store data in and retrieve data from the stack
- 2.8 write and execute a program that uses the stack and indexing registers to move data between two places

- 3. describe input/output operations in microprocessors**
 - 3.1 identify input/output pins of a microprocessor
 - 3.2 identify erasable programmable read-only memory (EPROMS), random-access memory (RAM), integrated circuits (ICs)
 - 3.3 identify memory read/write address and data pins on a memory chip
 - 3.4 write and execute various programs that use memory, input and output devices
 - 3.5 draw the symbols used in flowcharting and explain the purpose of each
 - 3.6 define and explain how the following are used in programming:
 - 3.6.1 inherent, immediate and direct addressing
 - 3.6.2 conditional and unconditional branching
 - 3.6.3 stack operation/pointer, cascade, pop push/pull instructions
 - 3.6.4 subroutines
 - 3.6.5 carry, negative, zero, overflow, flag operation
 - 3.7 explain the purpose of the following functional sections in a microprocessor:
 - 3.7.1 accumulator
 - 3.7.2 program counter
 - 3.7.3 instruction decoder
 - 3.7.4 controller
 - 3.7.5 data register
 - 3.7.6 address register
 - 3.7.7 stack pointer
 - 3.7.8 index pointer
 - 3.8 explain the evolution of architecture from 8-bit on
 - 3.9 draw a block diagram of an advanced microprocessor showing its internal architecture
 - 3.10 identify differences between data address, instruction, flag registers
 - 3.11 define a machine cycle
 - 3.12 relate clock frequency to microprocessor speed
- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 be aware of potential damage to integrated circuits by static electricity
 - 4.2 be aware of current and voltage requirements of computer trainers
 - 4.3 demonstrate proper safety procedures while testing microprocessor pins
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely
 - 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. create a transitional strategy to accommodate personal changes and build personal values**
 - 6.1 identify short-term and long-term goals
 - 6.2 identify steps to achieve goals

COURSE NET3040: MICROPROCESSOR INTERFACE

Level: Advanced

Prerequisite: NET3030: Microprocessors

Description: Students demonstrate how to interface microprocessors/microcontrollers with real-world applications.

Parameters: Access to a microprocessor trainer, an interfacing trainer, with an accompanying computer aided instruction (CAI) package, and related materials.

Supporting Course: ELT2080: Control Systems 2

Outcomes: The student will:

- 1. describe and explain microprocessor interface output and input circuits and the operation of a serial interface device**
 - 1.1 describe the basic difference between system boards
 - 1.2 outline the memory allocations in a typical microcomputer system using random-access memory (RAM), read-only memory (ROM), erasable programmable read-only memory (EPROM), electrically erasable read-only memory (EEROM) and input/output (I/O)
 - 1.3 define I/O as they apply to microprocessors
 - 1.4 state the two main methods of I/O operation in microprocessors
 - 1.5 describe a simplified microprocessor interface device
 - 1.6 define the term “interrupt”
 - 1.7 explain the bus structure of a typical microprocessor system
 - 1.8 explain three-state logic
 - 1.9 draw a simplified block diagram of an interface device and explain the purpose of the data, control and data direction registers
 - 1.10 write a simple program that will configure an interface device in any I/O combination
 - 1.11 describe how serial data can be represented using both amplitude and frequency modulation techniques
 - 1.12 explain the difference between asynchronous and synchronous serial data transmission
 - 1.13 explain how to interface ROM, EPROM or RAM
 - 1.14 define the difference between a universal asynchronous receiver/transmitter (UART), BSRT and universal synchronous receiver/transmitter (USART) device
 - 1.15 write and execute a program to convert serial data to parallel data and parallel data to serial data
- 2. interface a digital-to-analog (D/A) and analog-to-digital (A/D) converter to a microprocessor**
 - 2.1 research/experiment with some of the following concepts that apply to microprocessors:
 - 2.1.1 interface a D/A converter to a microprocessor system
 - 2.1.2 describe how D/A converters are used to control the direction of rotation, speed and position of DC motors
 - 2.1.3 define the function of a servo amplifier in a motor control circuit
 - 2.1.4 describe and provide an example of a microprocessor-based industrial control system
 - 2.1.5 construct a microprocessor-controlled thermometer
 - 2.1.6 construct a microprocessor-controlled silicon-controlled rectifier (SCR) or bidirectional triode thyristor (TRIAC) circuit

- 2.1.7 explain how a microprocessor can control the effective current to a load using an SCR or TRIAC
- 2.1.8 state the advantages of using an opto-isolator in a microprocessor control circuit
- 2.1.9 design, construct and explain a microprocessor/stepper motor interface and control circuit
- 2.1.10 explain how a microprocessor is used to control exhaust emissions and fuel economy in an automobile
- 2.1.11 explain how microprocessors can be used to control a robot
- 2.2 explain how multiple microprocessors are used in advanced personal computer and business systems
- 2.3 describe several microprocessor applicators in the aviation and medical industries
- 2.4 explain several business applications of microprocessors including computers, word processors, copiers/printers, registers and inventory control
- 2.5 list several other consumer product applications of a microprocessor
- 3. connect a microprocessor to a sensor device used in home, industrial and/or transportation applications**
 - 3.1 construct, connect, interface and operate a microprocessor with devices including:
 - 3.1.1 photo resistive
 - 3.1.2 temperature and optical sensors
 - 3.1.3 photo diodes and photo transistors
 - 3.1.4 optical interrupter and optical reflectors
 - 3.1.5 optocouplers
 - 3.1.6 Hall effect devices
 - 3.1.7 DC motors
 - 3.2 construct a project incorporating a microprocessor/microcontroller to control the operation of:
 - 3.2.1 robots
 - 3.2.2 weather stations
 - 3.2.3 home environment systems
 - 3.2.4 security systems
 - 3.2.5 automotive applications
 - 3.2.6 modems/communication devices
 - 3.3 construct a project using EPROM's memory and various interface devices
- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 describe voltage/current transients in real-world applications that connect to low voltage computers
 - 4.2 safely interface computers to real-world applications
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely

- 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. create a transitional strategy to accommodate personal changes and build personal values**
 - 6.1 identify short-term and long-term goals
 - 6.2 identify steps to achieve goals

COURSE NET3050: NETWORK OPERATING SYSTEMS

Level: Advanced

Prerequisites: NET2030: Network Structures
NET2040: Network Media & Devices
NET2050: Open System Interconnection
NET2060: Network Protocols
NET2070: Local Area Networks

Description: Students examine the features, advantages and disadvantages of major network operating systems and the criteria involved in selecting network operating systems that are appropriate in specific networking environments. They develop the knowledge and skills required to install and configure different network and client operating systems and develop a strategy for troubleshooting problems resulting from the installation of operating system software.

Parameters: Designed to be delivered in conjunction with other advanced level courses in computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on current versions of commonly used network operating systems (e.g., Microsoft Windows, Novell NetWare, Apple Macintosh, UNIX/Linux), and client operating systems (e.g., Microsoft Windows, Apple Macintosh, UNIX/Linux). 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.

Outcomes: The student will:

- 1. identify the generic functions and administrative tasks common to all network operating systems**
 - 1.1 compare and contrast peer-to-peer and server-based networks
 - 1.2 describe the role of a network operating system in server-based networks including:
 - 1.2.1 connect computers and peripheral devices and service requests for resources
 - 1.2.2 manage access to data and shared resources
 - 1.2.3 monitor performance and activities of the network
 - 1.3 identify generic tasks and administrative functions common to all network operating systems including:
 - 1.3.1 file services
 - 1.3.2 print services

- 1.3.3 directory services
 - 1.3.4 security services
 - 1.3.5 messaging services
 - 1.3.6 routing services
 - 1.3.7 network administrative services
- 2. describe and compare the capabilities and functions of network operating systems in common use; e.g., Microsoft Windows, Novell NetWare, MAC OS, UNIX/Linux**
- 2.1 describe and compare the:
 - 2.1.1 evolution and major features
 - 2.1.2 associated protocols and interoperability
 - 2.1.3 client support
 - 2.1.4 authentication and security
 - 2.1.5 file, print and directory services
 - 2.1.6 routing services
- 3. identify and analyze criteria relevant to planning, selecting and implementing a network operating system**
- 3.1 identify criteria involved in network planning including:
 - 3.1.1 the need for and benefits of network planning
 - 3.1.2 specific criteria and steps involved in network planning
 - 3.1.3 interoperability with the installed base and existing network standards
 - 3.2 explain criteria involved in selecting a network operating system including:
 - 3.2.1 client needs/required services
 - 3.2.2 user base and budget
 - 3.2.3 client software and associated protocols
 - 3.2.4 hardware requirements
 - 3.2.5 client licensing
 - 3.3 identify hardware devices and software tools used in network planning
 - 3.4 identify key differences among common network operating systems
 - 3.5 identify network operating systems that are appropriate in specific networking environments
 - 3.6 analyze the needs of a small company and recommend an appropriate network operating system
- 4. demonstrate ability to install and configure two or more network operating systems and compatible network clients**
- 4.1 install and configure two or more different network operating systems including:
 - 4.1.1 partition and format drive
 - 4.1.2 name server and network
 - 4.1.3 install and configure protocol
 - 4.1.4 select network services
 - 4.1.5 establish and confirm licensing
 - 4.1.6 set administrative passwords
 - 4.1.7 install peripherals
 - 4.1.8 share resources and set permissions
 - 4.2 install and configure a network client to interact with and access the resources of each network operating system that is installed including:
 - 4.2.1 configure an appropriate client operating system
 - 4.2.2 install and configure protocol
 - 4.2.3 assign computer/host name and user name
 - 4.2.4 select network services
 - 4.2.5 set an acceptable/secure password

- 4.3 identify the function of and configure common network services including:
 - 4.3.1 dynamic host configuration protocol (DHCP)
 - 4.3.2 bootstrap protocol (BOOTP)
 - 4.3.3 domain name service (DNS)
 - 4.3.4 network address translation/Internet connection sharing (NAT/ICS)
 - 4.3.5 Windows Internet Name Service (WINS)
 - 4.3.6 Simple Network Management Protocol (SNMP)
- 4.4 demonstrate processes for:
 - 4.4.1 sharing and accessing a folder
 - 4.4.2 assigning permissions
 - 4.4.3 sharing a printer
 - 4.4.4 sharing devices
- 5. demonstrate ability to analyze and troubleshoot connectivity problems related to the installation of operating system software**
- 5.1 outline a general strategy for troubleshooting network problems by:
 - 5.1.1 establishing the symptoms
 - 5.1.2 identifying the affected area
 - 5.1.3 establishing what has changed
 - 5.1.4 selecting the most probable cause
 - 5.1.5 implementing a solution
 - 5.1.6 testing the results
 - 5.1.7 recognizing the potential effects of the solution
 - 5.1.8 documenting the solution
- 5.2 analyze and troubleshoot connectivity problems resulting from the installation of a network and/or client operating system by:
 - 5.2.1 using appropriate diagnostic commands and utilities
 - 5.2.2 interpreting visual indicators
 - 5.2.3 predicting the impact of adding, removing and/or modifying network services
- 5.3 use protocol analysis software to analyze basic network utilization and frame statistics
- 6. demonstrate established laboratory procedures and safe work practices**
- 7. demonstrate basic competencies**
- 7.1 demonstrate fundamental skills to:
 - 7.1.1 communicate
 - 7.1.2 manage information
 - 7.1.3 use numbers
 - 7.1.4 think and solve problems
- 7.2 demonstrate personal management skills to:
 - 7.2.1 demonstrate positive attitudes and behaviours
 - 7.2.2 be responsible
 - 7.2.3 be adaptable
 - 7.2.4 learn continuously
 - 7.2.5 work safely
- 7.3 demonstrate teamwork skills to:
 - 7.3.1 work with others
 - 7.3.2 participate in projects and tasks
- 8. create a transitional strategy to accommodate personal changes and build personal values**
- 8.1 identify short-term and long-term goals
- 8.2 identify steps to achieve goals

COURSE NET3060: WIDE AREA NETWORKS

Level: Advanced

Prerequisites: NET2030: Network Structures
NET2040: Network Media & Devices
NET2050: Open System Interconnection
NET2060: Network Protocols
NET2070: Local Area Networks

Description: Students develop basic knowledge of the technologies employed in a wide area network (WAN) and of how a WAN may be used to connect local area networks (LANs) at different locations. Students gain practical experience in using WAN technologies to establish remote network access and they analyze emerging WAN technologies with respect to the impact on global networking.

Parameters: Designed to be delivered in conjunction with other advanced level courses in computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other vendor-specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on introductory level knowledge of WAN concepts, and on the application of WAN technologies. 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.

Outcomes: The student will:

1. describe the general structure, function and communication services provided by a WAN

- 1.1 describe and illustrate the basic structure and function of a WAN
- 1.2 compare and contrast the structure of and communication services provided by:
 - 1.2.1 LANs, metropolitan area networks (MANs) and WANs
 - 1.2.2 public networks, private networks and virtual private networks (VPNs)
- 1.3 describe and give examples of:
 - 1.3.1 analog and digital carrier systems and services
 - 1.3.2 major standards for digital carrier services including: data signaling standards, T- and E-carrier standards
- 1.4 describe basic processes of modulation, synchronization and multiplexing in a WAN

- 1.5 describe and compare:
 - 1.5.1 dial-up and dedicated connections
 - 1.5.2 asynchronous and synchronous modems
 - 1.5.3 new technologies for WAN connections including: Bluetooth, wireless, ultra wideband
- 1.6 identify common types of lease lines and the advantages and disadvantages associated with dedicated lease lines
- 2. explain, compare and contrast how typical circuit-switching and packet-switching sessions work**
 - 2.1 explain and illustrate how a typical circuit-switching and packet-switching session works
 - 2.2 compare design features of switched virtual circuits and permanent virtual circuits
 - 2.3 describe the physical characteristics (i.e., speed, capacity, media, basic functions and user services) including:
 - 2.3.1 common circuit-switching technologies; e.g., integrated services digital network (ISDN), digital subscriber line (DSL), wireless, new network technology
 - 2.3.2 common packet-switching technologies such as: x.25, frame relay, asynchronous transfer mode (ATM), synchronous optical network/synchronous digital hierarchy (SONET/SDH), new packet technology
 - 2.4 define the concept of quality of service
 - 2.5 compare the quality of service offered by selected circuit-switching and packet-switching technologies
 - 2.6 explain WAN design considerations related to:
 - 2.6.1 committed information rate
 - 2.6.2 error rate and packet loss
- 3. demonstrate applications of WAN technology in providing network users with remote access**
 - 3.1 describe and compare different approaches used to provide network users with remote access including:
 - 3.1.1 dial-up connections
 - 3.1.2 VPN connections
 - 3.1.3 wireless
 - 3.1.4 new technologies
 - 3.2 explain the function of a remote access server and common remote access protocols and services including:
 - 3.2.1 Serial Line Internet Protocol (SLIP)
 - 3.2.2 Point-to-Point Protocol (PPP)
 - 3.2.3 Point-to-Point Tunnelling Protocol (PPTP)
 - 3.2.4 Independent Computing Architecture (ICA)
 - 3.2.5 Multi-protocol Label Switching (MPLS)
 - 3.2.6 new protocols
 - 3.3 recommend a remote access connectivity solution and select a remote access protocol/service, given a need for remote connectivity in a small office or home office scenario

- 4. identify and describe security issues in a WAN and the function of network security protocols and methods**
 - 4.1 identify internal and external security issues in a WAN
 - 4.2 identify the purpose and components of a network security policy
 - 4.3 describe/illustrate the purpose and function of the following common security protocols:
 - 4.3.1 Internet Protocol Security (IPSec)
 - 4.3.2 Kerberos
 - 4.3.3 Layer 2 Tunnelling Protocol (L2TP)
 - 4.3.4 Secure Sockets Layer (SSL)
 - 4.3.5 new protocols
 - 4.4 explain the purpose, characteristics and benefits of a:
 - 4.4.1 firewall
 - 4.4.2 proxy server
 - 4.5 predict the impact of implementing a particular security strategy on network functionality
- 5. analyze emerging WAN technologies with respect to design, evolution and impact on global networking**
 - 5.1 identify and briefly describe five or more emerging WAN technologies
 - 5.2 analyze three or more emerging WAN technologies, including any of the following, with respect to elements of design, historical evolution and benefits to global networking:
 - 5.2.1 plain old telephone system (POTS), xDSL, Integrated Service Digital Network (ISDN) and cable, as examples of last mile solutions
 - 5.2.2 technologies designed to address bandwidth requirements
 - 5.2.3 Internet Protocol (IP) version 6
 - 5.2.4 tunnelling protocols
 - 5.2.5 VPN solutions
 - 5.2.6 wireless/satellite networks
 - 5.2.7 Internet telephony
 - 5.2.8 voice-over-Internet protocol
 - 5.2.9 ultra wideband networking
 - 5.2.10 emerging networking technologies
- 6. demonstrate established laboratory procedures and safe work practices**
- 7. demonstrate basic competencies**
 - 7.1 demonstrate fundamental skills to:
 - 7.1.1 communicate
 - 7.1.2 manage information
 - 7.1.3 use numbers
 - 7.1.4 think and solve problems
 - 7.2 demonstrate personal management skills to:
 - 7.2.1 demonstrate positive attitudes and behaviours
 - 7.2.2 be responsible
 - 7.2.3 be adaptable
 - 7.2.4 learn continuously
 - 7.2.5 work safely
 - 7.3 demonstrate teamwork skills to:
 - 7.3.1 work with others
 - 7.3.2 participate in projects and tasks
- 8. create a transitional strategy to accommodate personal changes and build personal values**
 - 8.1 identify short-term and long-term goals
 - 8.2 identify steps to achieve goals

COURSE NET3070: ROUTING FUNDAMENTALS

Level: Advanced

Prerequisites: NET2030: Network Structures
NET2040: Network Media & Devices
NET2050: Open System Interconnection
NET2060: Network Protocols
NET2070: Local Area Networks

Description: Students extend their knowledge of wide area networks (WANs) by examining the process used to route information 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 computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access 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.

Outcomes: The student will:

- 1. describe the process of routing data through an internetwork, and describe the major functions of a router**
 - 1.1 describe the characteristics of internetworks and the path determination function of a router
 - 1.2 compare and contrast the functions of bridges, switches, routers and gateways
 - 1.3 describe and illustrate basic router operations including:
 - 1.3.1 the routing of data packets from source to destination
 - 1.3.2 the sequence of encapsulation during routing
 - 1.3.3 functions of a routing information table
 - 1.3.4 the nature of commonly used routing metrics
 - 1.4 explain and give examples of:
 - 1.4.1 static and dynamic routing
 - 1.4.2 routable and nonroutable protocols
 - 1.5 construct a model of a router topology

2. **explain and analyze the addressing and routing function of protocols operating at the network layer of the open system interconnection (OSI) reference model**
 - 2.1 describe and illustrate the function of IP addresses in a routed network including:
 - 2.1.1 host addresses and broadcast addresses
 - 2.1.2 subnetting and default gateways
 - 2.2 explain and interpret standard conventions for IP addressing:
 - 2.2.1 IP version 4 (Class A, B and C) addresses and their default subnet masks
 - 2.2.2 classless inter-domain routing (CIDR) and the format for IP versions and addressing
 - 2.3 identify and describe ways in which new IP versions may affect routing
 - 2.4 explain and interpret the process of address resolution including:
 - 2.4.1 analyze the function of the address resolution protocol (ARP) and interpret an ARP cache
 - 2.4.2 describe the function and purpose of the reverse address resolution protocol (RARP)
 - 2.5 compare major features of local area network (LAN)-to-LAN routing and LAN-to-WAN routing
 - 2.6 describe and give examples of:
 - 2.6.1 distance-vector and link-state routing protocols
 - 2.6.2 interior and exterior routing protocols
 - 2.7 explain the basic architecture and operation of the following common routing protocols:
 - 2.7.1 Routing Information Protocol (RIP)
 - 2.7.2 Open Shortest Path First (OSPF)
 - 2.7.3 Border Gateway Protocol (BGP)
 - 2.8 explain and give examples of inter-autonomous, intra-autonomous and pass-through routing
3. **demonstrate knowledge of router components, commands and configuration processes**
 - 3.1 identify and describe external configuration sources and internal configuration components
 - 3.2 describe the uses of random-access memory (RAM) for working storage in a router
 - 3.3 identify and describe router modes
 - 3.4 identify and describe router help functions
 - 3.5 interpret and use:
 - 3.5.1 basic show and test commands
 - 3.5.2 startup sequence and setup commands
 - 3.5.3 configuration files and modes
 - 3.6 identify and describe the following routing protocols
 - 3.6.1 RIP
 - 3.6.2 OSPF
 - 3.6.3 Interior Gateway Routing Protocol (IGRP)/Enhanced Interior Gateway Routing Protocol (EIGRP)
 - 3.6.4 BGP
 - 3.6.5 Cisco Discovery Protocol (CDP)
 - 3.6.6 other protocols
 - 3.7 describe and configure access control lists (ACLs) including:
 - 3.7.1 standard and extended ACLs
 - 3.8 perform basic router configuration routines by:
 - 3.8.1 demonstrating router startup and login procedures
 - 3.8.2 using command history and editing features
 - 3.8.3 configuring and verifying IP addresses
 - 3.8.4 configuring RIPv4s
 - 3.8.5 configuring and modifying standard and extended ACLs
 - 3.9 demonstrate the ability to troubleshoot a routing loop

- 3.10 prepare a flowchart illustrating the router configuration process
- 3.11 configure a router for a standard five-router topology
- 4. describe and explain methods used to manage and monitor network routing**
 - 4.1 describe Simple Network Management Protocol (SNMP) and its purpose in routing
 - 4.2 identify SNMP architecture and message formats
 - 4.3 describe management information base structure and name representation
 - 4.4 identify basic SNMP commands and security levels
- 5. demonstrate established laboratory procedures and safe work practices**
- 6. demonstrate basic competencies**
 - 6.1 demonstrate fundamental skills to:
 - 6.1.1 communicate
 - 6.1.2 manage information
 - 6.1.3 use numbers
 - 6.1.4 think and solve problems
 - 6.2 demonstrate personal management skills to:
 - 6.2.1 demonstrate positive attitudes and behaviours
 - 6.2.2 be responsible
 - 6.2.3 be adaptable
 - 6.2.4 learn continuously
 - 6.2.5 work safely
 - 6.3 demonstrate teamwork skills to:
 - 6.3.1 work with others
 - 6.3.2 participate in projects and tasks
- 7. create a transitional strategy to accommodate personal changes and build personal values**
 - 7.1 identify short-term and long-term goals
 - 7.2 identify steps to achieve goals

COURSE NET3080: INTERNET PROCESSES

Level: Advanced

Prerequisites: NET2030: Network Structures
NET2040: Network Media & Devices
NET2050: Open System Interconnection
NET2060: Network Protocols
NET2070: Local Area Networks

Description: Students apply their knowledge of Wide Area Network (WAN) technologies to an Internet environment. Course content focuses on the significance and utility of Internet Protocol (IP) addressing schemes in Internet communication and on the function of WAN protocols and services in providing Internet access. Students develop knowledge of internetworking career paths and related educational opportunities.

Parameters: Designed to be delivered in conjunction with other advanced level courses in computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on reinforcing and applying previously developed knowledge and skills in an Internet environment and on explaining how and why particular technologies are employed. 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.

Outcomes: The student will:

- 1. describe and analyze the historical roots, basic architecture and functions of the Internet in global communication**
 - 1.1 describe the origin and evolution of the Internet
 - 1.2 describe and illustrate the basic architecture of the Internet
 - 1.3 explain the nature and function of services provided by the Internet
 - 1.4 analyze the impact of the Internet on economic, social and political systems
 - 1.5 identify and explain contributions of emerging wired or wireless technologies in global Internet communication
- 2. develop a rationale for, and demonstrate the use of, IP addressing schemes, subnets and subnet masks in Internet communication**
 - 2.1 explain the function of IP addressing, subnets and subnet masks in Internet communication
 - 2.2 describe methods for assigning an IP address

- 2.3 identify classes of IP addresses and the purpose of reserved address space
- 2.4 subnet a Class A, B or C address into a given number of subnetworks
- 2.5 determine the subnet mask for a subnetted network
- 2.6 optimize a host/subnet scheme
- 2.7 compare connectionless and connection-oriented networking processes
- 2.8 identify problems and solutions associated with traditional IP addressing
- 2.9 identify advantages of new IP
- 3. explain and compare the function of selected WAN protocols and services and their utility in providing access to the Internet**
 - 3.1 explain the significance of the Transmission Control Protocol/Internet Protocol (TCP/IP) suite within an Internet environment
 - 3.2 describe common WAN protocols and services, including Dynamic Host Configuration Protocol (DHCP), Address Resolution Protocol (ARP), Domain Name Service (DNS), integrated Services Digital Network (ISDN), and Point-to-Point Protocol (PPP), with respect to:
 - 3.2.1 function
 - 3.2.2 architecture
 - 3.2.3 configuration
 - 3.2.4 benefits
 - 3.2.5 possible design issues
- 4. identify and assess methods for connecting a local network infrastructure with the Internet**
 - 4.1 identify criteria involved in network planning
 - 4.2 identify and assess options for connecting a network to the Internet
 - 4.3 describe current and investigate new methods for securing IP traffic between a local network and a service provider
 - 4.4 explain applications of network address translation (NAT) in sharing an Internet connection
 - 4.5 plan a strategy for Internet connectivity, given needs within a local network for access to the Internet
- 5. demonstrate established laboratory procedures and safe work practices**
- 6. demonstrate basic competencies**
 - 6.1 demonstrate fundamental skills to:
 - 6.1.1 communicate
 - 6.1.2 manage information
 - 6.1.3 use numbers
 - 6.1.4 think and solve problems
 - 6.2 demonstrate personal management skills to:
 - 6.2.1 demonstrate positive attitudes and behaviours
 - 6.2.2 be responsible
 - 6.2.3 be adaptable
 - 6.2.4 learn continuously
 - 6.2.5 work safely
 - 6.3 demonstrate teamwork skills to:
 - 6.3.1 work with others
 - 6.3.2 participate in projects and tasks
- 7. create a transitional strategy to accommodate personal changes and build personal values**
 - 7.1 identify short-term and long-term goals
 - 7.2 identify steps to achieve goals

COURSE NET3090: NETWORK MANAGEMENT

Level: Advanced

Prerequisites: NET2030: Network Structures
NET2040: Network Media & Devices
NET2050: Open System Interconnection
NET2060: Network Protocols
NET2070: Local Area Networks

Description: Students acquire knowledge of internal and external risks to a network and develop strategies for protecting network data and securing a network. They also develop and apply a general strategy for troubleshooting network problems and acquire knowledge of the basic roles and responsibilities associated with network maintenance and support.

Parameters: Designed to be delivered in conjunction with other advanced level courses in computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on risks and problems most common to a small network and on the ability to apply troubleshooting strategies, tools and commands in specific situations. 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.

Outcomes: The student will:

- 1. provide a rationale for protecting network data and describe major components of a data backup strategy**
 - 1.1 give reasons for protecting data in a local area network (LAN)
 - 1.2 describe the nature, scope and source of potential risks to data in a LAN
 - 1.3 identify and describe major components of a data backup strategy including:
 - 1.3.1 redundancy
 - 1.3.2 fault-tolerance
 - 1.3.3 data backup
 - 1.3.4 uninterruptible power supply
 - 1.4 design an appropriate data backup strategy, given a small office or home office network scenario

- 2. analyze security risks in a LAN and describe steps that can be taken to secure a network**
 - 2.1 give reasons for network security
 - 2.2 describe the nature, scope and source of internal and external security risks in a LAN environment
 - 2.3 identify the characteristics of threats imposed by:
 - 2.3.1 viruses, worms, Trojan horses and other new attack technologies
 - 2.3.2 direct attacks such as:
 - 2.3.2.1 eavesdropping
 - 2.3.2.2 password attacks
 - 2.3.3 Internet Protocol (IP) address spoofing
 - 2.4 identify and describe strategies for protecting a LAN from internal and external risks including:
 - 2.4.1 user authentication, access permissions and account options
 - 2.4.2 share permissions and user group access rights
 - 2.4.3 virus protection
 - 2.4.4 firewalls
 - 2.4.5 data encryption
 - 2.5 design an appropriate security plan, given a small office or home office network scenario
- 3. demonstrate an understanding of the functions and key roles of network maintenance and support in an organization**
 - 3.1 outline considerations that are required to maintain and support an operating network including:
 - 3.1.1 anticipated activities
 - 3.1.2 data integrity
 - 3.1.3 hardware and software standards
 - 3.1.4 repair policies
 - 3.1.5 system monitoring
 - 3.1.6 training
 - 3.2 identify benefits associated with network maintenance and support
 - 3.3 identify and describe key functions and roles related to network maintenance and support activities including:
 - 3.3.1 network maintenance policies
 - 3.3.2 network documentation
 - 3.3.3 vendor upgrades
 - 3.3.4 system backup
 - 3.4 identify hardware devices/software tools used to gather information to assist network maintenance and support activities
 - 3.5 develop a plan to maintain and support an operating network
- 4. use appropriate strategies, tools and commands to troubleshoot common network problems**
 - 4.1 describe the most common sources of network problems in a LAN including:
 - 4.1.1 user error
 - 4.1.2 software
 - 4.1.3 physical connectivity
 - 4.2 demonstrate the safe use of troubleshooting tools
 - 4.3 demonstrate the use of the following appropriate software commands to check configuration or connectivity:
 - 4.3.1 Internet Protocol configuration (IPCONFIG)
 - 4.3.2 Packet Internet Groper (PING)
 - 4.3.3 traceroute (TRACERT)

- 4.4 outline a general strategy for troubleshooting network problems that:
 - 4.4.1 establishes the symptoms
 - 4.4.2 identifies the affected area
 - 4.4.3 establishes what has changed
 - 4.4.4 selects the most probable cause
 - 4.4.5 implements a solution
 - 4.4.6 tests the results
 - 4.4.7 recognizes the potential effects of the solution
 - 4.4.8 documents the solution
- 4.5 use appropriate strategies, tools and commands, given a small office or home office network scenario, to troubleshoot common network problems related to:
 - 4.5.1 a particular physical topology
 - 4.5.2 client connectivity
 - 4.5.3 wiring and/or infrastructure
 - 4.5.4 remote connectivity
- 5. demonstrate established laboratory procedures and safe work practices**
- 6. demonstrate basic competencies**
 - 6.1 demonstrate fundamental skills to:
 - 6.1.1 communicate
 - 6.1.2 manage information
 - 6.1.3 use numbers
 - 6.1.4 think and solve problems
 - 6.2 demonstrate personal management skills to:
 - 6.2.1 demonstrate positive attitudes and behaviours
 - 6.2.2 be responsible
 - 6.2.3 be adaptable
 - 6.2.4 learn continuously
 - 6.2.5 work safely
 - 6.3 demonstrate teamwork skills to:
 - 6.3.1 work with others
 - 6.3.2 participate in projects and tasks
- 7. create a transitional strategy to accommodate personal changes and build personal values**
 - 7.1 identify short-term and long-term goals
 - 7.2 identify steps to achieve goals

COURSE NET3100: NETWORK MEDIA & DEVICES, SECURITY

Level: Advanced

Prerequisite: None

Description: Students develop an understanding of different connectivity strategies for linking computers and security devices in a local area network (LAN). They acquire knowledge of industry standards for network cables and gain practical experience through installing cabling, connectors and other hardware components.

Parameters: Designed to be delivered in conjunction with other intermediate and advanced level courses in computer networking systems. Schools have the option of delivering courses in conjunction with one or more project courses if they wish to extend learning and/or address other specific technologies.

Access to an appropriate computer work station, the Internet, networking hardware, software and tools, and consumable supplies.

Access to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on Institute of Electrical and Electronics Engineers (IEEE) standards for cabling, and on safe procedures for preparing and connecting network media and devices. 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 Course: NET2020: Workstation Technology & Operations

Outcomes: The student will:

1. identify and describe the characteristics, standard names and applications for common network media and connectors

- 1.1 identify and describe the structural components and uses of major types of network cables including:
 - 1.1.1 coaxial; e.g., thick, thin
 - 1.1.2 twisted pair; e.g., unshielded, shielded
 - 1.1.3 fibre optic
- 1.2 identify and describe the characteristics and uses of common media connectors including:
 - 1.2.1 registered jack 11 (RJ-11)
 - 1.2.2 registered jack 45 (RJ-45)
 - 1.2.3 attachment unit interface (AUI)
 - 1.2.4 British naval connector (BNC)
 - 1.2.5 small computer system interface (SCSI)
 - 1.2.6 single mode fibre optic connector; e.g., SC-type, ST-type

- 1.3 identify IEEE standards for Ethernet cabling including:
 - 1.3.1 bandwidth/speed
 - 1.3.2 transmission mode
 - 1.3.3 maximum segment length
 - 1.3.4 cable type
- 1.4 identify and describe categories for unshielded twisted pair cable defined by the Electronics Industries Alliance and the Telecommunications Industry Association
- 1.5 describe the media and function of network backbones and segments
- 1.6 explain the relationship between media type, connector and topology in a network environment
- 1.7 choose an appropriate cable type and connector to add a client, given a practical network scenario
- 2. identify and explain the purpose, features and basic operation of network hardware components**
 - 2.1 explain the purpose of hardware components in:
 - 2.1.1 connecting network devices
 - 2.1.2 boosting data signals
 - 2.1.3 determining data flow
 - 2.2 demonstrate an understanding of the features, functionality and performance of basic hardware components including:
 - 2.2.1 network interface card
 - 2.2.2 hub
 - 2.2.3 repeater
 - 2.2.4 switch
 - 2.2.5 bridge
 - 2.2.6 router
 - 2.2.7 gateway
 - 2.2.8 wireless access point
 - 2.2.9 modem
- 3. demonstrate knowledge of cabling tools and demonstrate the ability to install network cabling, connectors and hardware components**
 - 3.1 identify layers of the open system interconnection (OSI) reference model at which specific hardware components operate
 - 3.2 describe the features and functionality of power fault-tolerance hardware such as:
 - 3.2.1 surge suppressor
 - 3.2.2 power line conditioner
 - 3.2.3 uninterruptible power supply
 - 3.3 choose an appropriate hardware component to use or replace an existing device, given a practical network scenario
 - 3.4 physically install a network interface card and verify that the card is operational
 - 3.5 demonstrate the correct use of cabling tools; e.g., wire crimper, punch down tool
 - 3.6 demonstrate the appropriate use of basic test equipment including:
 - 3.6.1 media testers/certifiers
 - 3.6.2 crossover cables
 - 3.6.3 tone generators and probes; e.g., fox and hound
 - 3.6.4 optical testers
 - 3.7 demonstrate the proper sequence of steps to crimp and test Ethernet cable
 - 3.8 select the appropriate cabling tool and test equipment, given a practical cabling task

- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 demonstrate procedures for compliant installation of:
 - 4.1.1 jacks and outlets
 - 4.1.2 cable and structured cable runs
 - 4.1.3 patch panels and patch cords
 - 4.1.4 network cards
 - 4.1.5 a wired or wireless connection
 - 4.2 demonstrate the appropriate use of test equipment in checking for:
 - 4.2.1 continuity
 - 4.2.2 proper grounding
 - 4.2.3 correct cable termination
 - 4.3 create a proposal for a new or refit cabling project
 - 4.4 design, build and troubleshoot a small Ethernet network
- 5. identify the fundamental principles of networks**
 - 5.1 describe basic networking concepts including:
 - 5.1.1 addressing
 - 5.1.2 bandwidth
 - 5.1.3 status indicators
 - 5.1.4 protocols; e.g., Internet Protocol Suite (TCP/IP) including Internet Protocol (IP), classful subnet, Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX) including network basic input/output system
 - 5.1.5 full-duplex, half-duplex
 - 5.1.6 cabling; e.g. twisted pair, coaxial cable, fibre optic, RS-232, USB, IEEE 1394/Firewire
 - 5.1.7 networking models including peer-to-peer and client/server
 - 5.2 identify names, purposes and characteristics of the common network cables including:
 - 5.2.1 plenum/PVC
 - 5.2.2 unshielded twisted pair (UTP); e.g., CAT3, CAT5/5e, CAT6
 - 5.2.3 shielded twisted pair (STP)
 - 5.2.4 fibre; e.g., single-mode and multi-mode
 - 5.3 identify names, purposes and characteristics of network connectors; e.g., RJ-45, RJ-11, ST/SC/LC, MT-RJ
 - 5.4 identify names, purposes and characteristics (e.g., definition, speed, connections) of the following technologies for establishing connectivity:
 - 5.4.1 LAN/Wide Area Network (WAN)
 - 5.4.2 Integrated Services Digital Network (ISDN)
 - 5.4.3 broadband; e.g., Digital Subscriber Line (DSL), cable, satellite
 - 5.4.4 dial-up
 - 5.4.5 wireless standards, all 802.11
 - 5.4.6 infrared
 - 5.4.7 Bluetooth
 - 5.4.8 cellular
 - 5.4.9 Voice over Internet Protocol (VoIP)
- 6. identify the fundamental principles of security**
 - 6.1 identify names, purposes and characteristics of hardware and software security including:
 - 6.1.1 hardware deconstruction/recycling
 - 6.1.2 smart cards/biometrics; e.g., key fobs, cards, chips, scans
 - 6.1.3 authentication technologies; e.g., password, biometrics, smart cards
 - 6.1.4 malicious software protection; e.g., viruses, Trojans, worms, spam, spyware, adware, grayware

- 6.1.5 software firewalls
- 6.1.6 file system security; e.g., file allocation table (FAT)32 and Windows NT File System (NTFS)
- 6.2 identify names, purposes and characteristics of wireless security including:
 - 6.2.1 wireless encryption; e.g., Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA), client configuration
 - 6.2.2 access points; e.g. disable Dynamic Host Configuration Protocol (DHCP)/use static IP, change service set identifiers (SSID) from default, disable SSID broadcast, Media Access Control (MAC) filtering, change default user name and password, update firmware, firewall
- 6.3 identify names, purposes and characteristics of data and physical security
 - 6.3.1 data access; e.g., basic local security policy
 - 6.3.2 encryption technologies
 - 6.3.3 backups
 - 6.3.4 data migration
 - 6.3.5 data/remnant removal
 - 6.3.6 password management
 - 6.3.7 locking work station; e.g., hardware, operating system
- 6.4 describe the importance and process of incidence reporting
- 6.5 recognize and respond appropriately to social engineering situations
- 6.6 install, configure, upgrade and optimize hardware, software and data security including:
 - 6.6.1 Basic Input/Output System (BIOS)
 - 6.6.2 smart cards
 - 6.6.3 authentication technologies
 - 6.6.4 malicious software protection
 - 6.6.5 data access; e.g., basic local security policy
 - 6.6.6 backup procedures and access to backups
 - 6.6.7 data migration
 - 6.6.8 data/remnant removal
- 6.7 implement software security preventive maintenance techniques such as installing service packs and patches and training users about malicious software prevention technologies
- 6.8 diagnose and troubleshoot hardware, software and data security issues including:
 - 6.8.1 BIOS
 - 6.8.2 smart cards, biometrics
 - 6.8.3 authentication technologies
 - 6.8.4 malicious software
 - 6.8.5 file system; e.g., FAT32, NTFS
 - 6.8.6 data access; e.g., basic local security policy
 - 6.8.7 backup
 - 6.8.8 data migration

7. demonstrate basic competencies

- 7.1 demonstrate fundamental skills to:
 - 7.1.1 communicate
 - 7.1.2 manage information
 - 7.1.3 use numbers
 - 7.1.4 think and solve problems

- 7.2 demonstrate personal management skills to:
 - 7.2.1 demonstrate positive attitudes and behaviours
 - 7.2.2 be responsible
 - 7.2.3 be adaptable
 - 7.2.4 learn continuously
 - 7.2.5 work safely
- 7.3 demonstrate teamwork skills to:
 - 7.3.1 work with others
 - 7.3.2 participate in projects and tasks
- 8. create a transitional strategy to accommodate personal changes and build personal values**
 - 8.1 identify short-term and long-term goals
 - 8.2 identify steps to achieve goals

COURSE NET3110: TELECOMMUNICATIONS 2

Level: Advanced

Prerequisite: NET2110: Telecommunications 1

Description: Students demonstrate knowledge of telecommunication systems by designing a new system. They use the Internet in researching and developing their design and for comparing and contrasting various telecommunication initiatives. Students analyze the effect this is having on the individual and society.

Parameters: Access to an appropriate computer work station, utility software, the Internet and support materials.

Outcomes: The student will:

- 1. use appropriate telecommunication systems, protocols and techniques to transfer messages and manage research**
 - 1.1 create a telecommunication solution that improves communication options for individuals, business and society
 - 1.2 compare and contrast various types of transmission systems including:
 - 1.2.1 type of information that can be transmitted
 - 1.2.2 present installation base
 - 1.2.3 ability to connect with other systems
 - 1.2.4 future and potential in the telecommunication industry
 - 1.2.5 cost-benefit
 - 1.3 describe how common standards allow telecommunication systems to merge and connect
 - 1.4 identify the types of transmission protocols and common languages used in telecommunication systems and describe how and when they are used
- 2. describe how telecommunication systems are evolving, merging and connecting**
 - 2.1 compare and contrast key elements of an effective computer infrastructure in two or more applications including:
 - 2.1.1 transmission systems
 - 2.1.2 information and interactive applications/services
 - 2.1.3 software applications
 - 2.1.4 standards and protocols
 - 2.1.5 people and expertise
 - 2.2 identify and analyze key challenges facing computer-mediated communications; e.g., regulation versus open systems, equity of access
 - 2.3 describe cost implications to establish and maintain a telecommunication system
- 3. design a telecommunication solution that improves communication for an individual, a business or society**
 - 3.1 identify key social challenges in managing telecommunication technologies in our society including:
 - 3.1.1 regulation versus open systems
 - 3.1.2 personal privacy
 - 3.1.3 ease and equity of access; e.g., usability, costs
 - 3.1.4 legal/ethical considerations

- 3.1.5 courtesies/protocols
- 3.1.6 viruses
- 3.2 describe economic challenges and benefits of a growing telecommunication industry
- 4. demonstrate established laboratory procedures and safe work practices**
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely
 - 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. create a transitional strategy to accommodate personal changes and build personal values**
 - 6.1 identify short-term and long-term goals
 - 6.2 identify steps to achieve goals

COURSE NET3910: NET PROJECT D

Level: Advanced

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

- 1. identify the connection between this project course and two or more CTS courses**
 - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
 - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
- 2. propose the project and/or performance**
 - 2.1 identify the project and/or performance by:
 - 2.1.1 preparing a plan
 - 2.1.2 clarifying the purposes
 - 2.1.3 defining the deliverables
 - 2.1.4 specifying time lines
 - 2.1.5 explaining terminology, tools and processes
 - 2.1.6 defining resources; e.g., materials, costs, staffing
 - 2.2 identify and comply with all related health and safety standards
 - 2.3 define assessment standards (indicators for success)
 - 2.4 present the proposal and obtain necessary approvals

The student will:

- 3. meet goals as defined within the plan**
 - 3.1 complete the project and/or performance as outlined
 - 3.2 monitor the project and/or performance and make necessary adjustments
 - 3.3 present the project and/or performance, indicating the:
 - 3.3.1 outcomes attained
 - 3.3.2 relationship of outcomes to goals originally set

- 3.4 evaluate the project and/or performance, indicating the:
 - 3.4.1 processes and strategies used
 - 3.4.2 recommendations on how the project and/or performance could have been improved
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE NET3920: NET PROJECT E

Level: Advanced

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

- 1. identify the connection between this project course and two or more CTS courses**
 - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
 - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
- 2. propose the project and/or performance**
 - 2.1 identify the project and/or performance by:
 - 2.1.1 preparing a plan
 - 2.1.2 clarifying the purposes
 - 2.1.3 defining the deliverables
 - 2.1.4 specifying time lines
 - 2.1.5 explaining terminology, tools and processes
 - 2.1.6 defining resources; e.g., materials, costs, staffing
 - 2.2 identify and comply with all related health and safety standards
 - 2.3 define assessment standards (indicators for success)
 - 2.4 present the proposal and obtain necessary approvals

The student will:

- 3. meet goals as defined within the plan**
 - 3.1 complete the project and/or performance as outlined
 - 3.2 monitor the project and/or performance and make necessary adjustments
 - 3.3 present the project and/or performance, indicating the:
 - 3.3.1 outcomes attained
 - 3.3.2 relationship of outcomes to goals originally set

- 3.4 evaluate the project and/or performance, indicating the:
 - 3.4.1 processes and strategies used
 - 3.4.2 recommendations on how the project and/or performance could have been improved
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE NET3950: NET ADVANCED PRACTICUM

Level: Advanced

Prerequisite: None

Description: Students apply prior learning and demonstrate the attitudes, skills and knowledge required by an external organization to achieve a credential/credentials or an articulation.

Parameters: This practicum course, which may be delivered on- or off-campus, should be accessed only by students continuing to work toward attaining a recognized credential/credentials or an articulation offered by an external organization. This course must be connected to at least one CTS course from the same occupational area and cannot be used in conjunction with any introductory (1XXX) level course. A practicum course cannot be delivered as a stand-alone course, cannot be combined with a CTS project course and cannot be used in conjunction with the Registered Apprenticeship Program or the Green Certificate Program.

Outcomes: The student will:

1. perform assigned tasks and responsibilities, as required by the organization granting the credential(s) or articulation

- 1.1 identify regulations and regulatory bodies related to the credential(s) or articulation
- 1.2 describe personal roles and responsibilities, including:
 - 1.2.1 key responsibilities
 - 1.2.2 support functions/responsibilities/expectations
 - 1.2.3 code of ethics and/or conduct
- 1.3 describe personal work responsibilities and categorize them as:
 - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
 - 1.3.2 non-routine tasks; e.g., emergencies
 - 1.3.3 tasks requiring personal judgement
 - 1.3.4 tasks requiring approval of a supervisor
- 1.4 demonstrate basic employability skills and perform assigned tasks and responsibilities related to the credential(s) or articulation

2. analyze personal performance in relation to established standards

- 2.1 evaluate application of the attitudes, skills and knowledge developed in related CTS courses
- 2.2 evaluate standards of performance in terms of:
 - 2.2.1 quality of work
 - 2.2.2 quantity of work
- 2.3 evaluate adherence to workplace legislation related to health and safety
- 2.4 evaluate the performance requirements of an individual who is trained, experienced and employed in a related occupation in terms of:
 - 2.4.1 training and certification
 - 2.4.2 interpersonal skills
 - 2.4.3 technical skills
 - 2.4.4 ethics

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:

- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:

- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:

- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. create a transitional strategy to accommodate personal changes and build personal values

- 4.1 identify short-term and long-term goals
- 4.2 identify steps to achieve goals