Apprenticeship Curriculum Standard
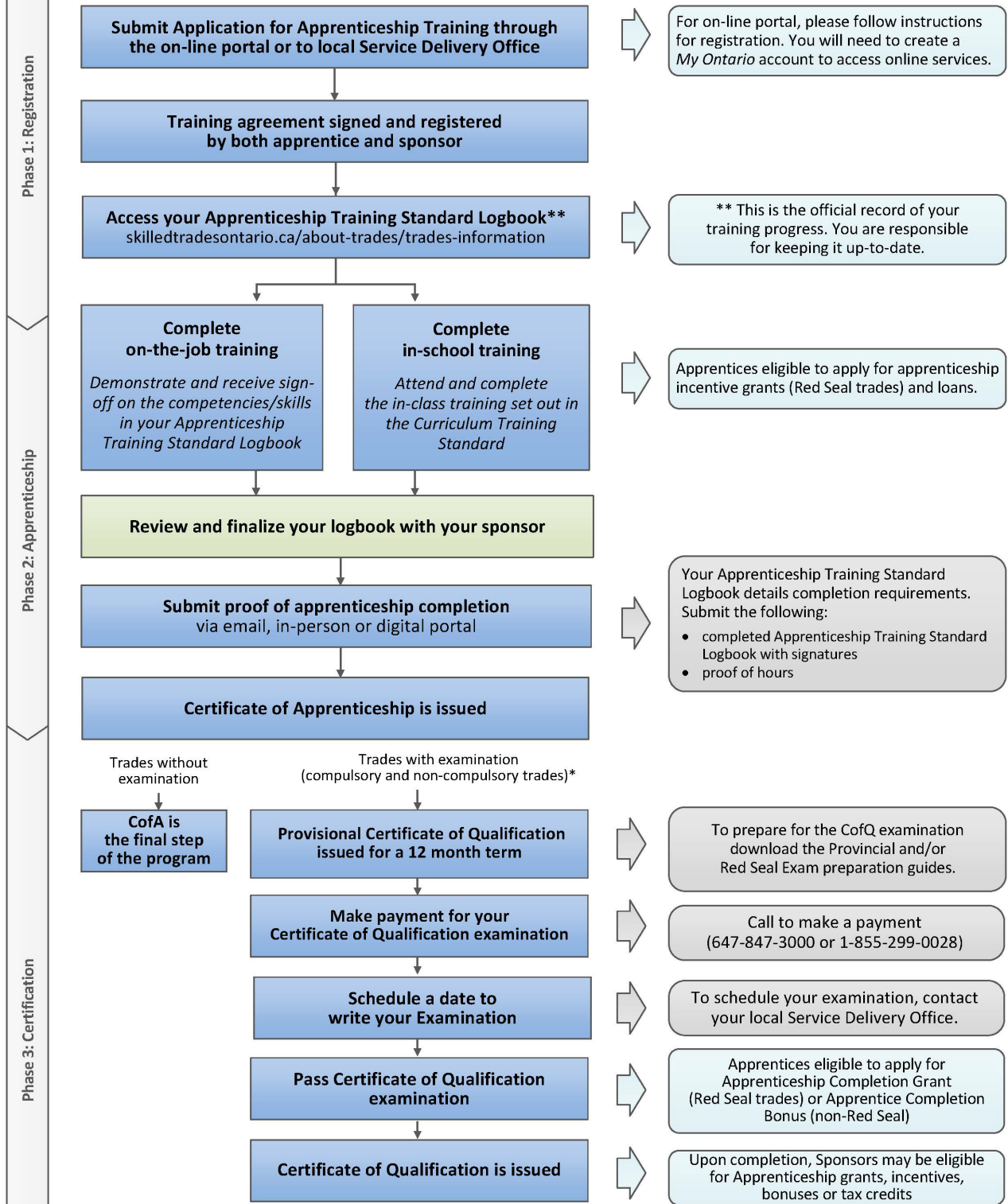
Information Technology — Network Technician

Levels 1 & 2

634C

2007

Apprenticeship Pathway to a Certificate of Qualification

Phase 1: Registration

Submit Application for Apprenticeship Training through the on-line portal or to local Service Delivery Office

For on-line portal, please follow instructions for registration. You will need to create a *My Ontario* account to access online services.

Training agreement signed and registered by both apprentice and sponsor

Access your Apprenticeship Training Standard Logbook**
skilledtradesontario.ca/about-trades/trades-information

** This is the official record of your training progress. You are responsible for keeping it up-to-date.

Phase 2: Apprenticeship

Complete on-the-job training

Demonstrate and receive sign-off on the competencies/skills in your Apprenticeship Training Standard Logbook

Complete in-school training

Attend and complete the in-class training set out in the Curriculum Training Standard

Apprentices eligible to apply for apprenticeship incentive grants (Red Seal trades) and loans.

Review and finalize your logbook with your sponsor

Submit proof of apprenticeship completion
via email, in-person or digital portal

Your Apprenticeship Training Standard Logbook details completion requirements. Submit the following:
- completed Apprenticeship Training Standard Logbook with signatures
- proof of hours

Certificate of Apprenticeship is issued

Trades without examination

Trades with examination (compulsory and non-compulsory trades)*

Phase 3: Certification

CofA is the final step of the program

Provisional Certificate of Qualification issued for a 12 month term

To prepare for the CofQ examination download the Provincial and/or Red Seal Exam preparation guides.

Make payment for your Certificate of Qualification examination

Call to make a payment (647-847-3000 or 1-855-299-0028)

Schedule a date to write your Examination

To schedule your examination, contact your local Service Delivery Office.

Pass Certificate of Qualification examination

Apprentices eligible to apply for Apprenticeship Completion Grant (Red Seal trades) or Apprentice Completion Bonus (non-Red Seal)

Certificate of Qualification is issued

Upon completion, Sponsors may be eligible for Apprenticeship grants, incentives, bonuses or tax credits

* For a list of trades subject to a certification examination, visit: skilledtradesontario.ca

Draft version: 2022-03-16

Table of Contents

<u>Please Note:</u> This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant and accurate based on the original date of publishing.

Please refer to STO's website: **skilledtradesontario.ca** for the most accurate and up to date information. For information about BOSTA and its regulations, please visit ***Building Opportunities in the Skilled Trades Act, 2021* (BOSTA).**

Any updates to this publication are available on-line; to download this document in PDF format, please follow the link: Skilled Trades Ontario.ca.

Maintained with transfer to Skilled Trades Ontario 2007 (V100)

Preface

This curriculum standard for the Information Technology — Network Technician trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 2 levels of training. The Reportable Subjects Summary chart (located on page 4) summarizes the training hours for each reportable subject.

The curriculum identifies the learning that takes place in-school. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards.

Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on a work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to verify that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Please refer to Skilled Trades Ontario website (www.skilledtradesontario.ca) for the most accurate and up-to-date information about Skilled Trades Ontario. For information on *Building Opportunities in the Skilled Trades Act, 2021 (BOSTA)*) and its regulations, please visit Building Opportunities in the Skilled Trades Act, 2021, S.O. 2021, c. 28 - Bill 288 (ontario.ca)

Pre-requisites

In order to advance to Level 2 of the apprenticeship program, an individual must have completed all of the units outlined in Level 1. Similarly, in order to advance to Level 3 of the program, an individual must have completed all of the units outlined in Level 1 and 2.

Hours Disclaimer (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed practical and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

Suggested Equipment for Training Delivery Agencies

Personal and Safety Equipment: Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

Introduction

The Information Technology — Network Technician curriculum has been developed in keeping with the prescribed Ministry of Labour, Immigration, Training and Skills Development (MLITSD) Training Standards. The curriculum design provides an opportunity to cross-reference the in-school learning outcomes to the specific workplace Training Standards.

For easy reference, a time allocation has been included for each reportable subject and unit, along with the Theory/Practical breakdown for the delivery of the Learning Content. More detailed time allocations for the instructor have been provided for each topic area to assure consistency for each apprentice intake.

The continual introduction of innovative techniques and more complex equipment is resulting in increasing demands for persons who are not only skilled in the practical aspects of the trade, but who also have a sound theoretical knowledge of the inspecting, diagnosing, repair, and servicing requirements. The curriculum has been developed to provide this theoretical knowledge and to offer some practical applications to complement the on-the-job work experiences of the Information Technology — Network Technician apprentices.

The objectives of the curriculum, therefore, are to provide a basis for:

a. Sound theoretical training to meet the challenges presented by the increasingly more complex designs and testing techniques.
b. A reinforcement of fundamental skills of the trade through the exposure to practical applications.
c. Developing in the apprentices high standards of craftsmanship, problem-solving skills and personal pride in their trade.
d. Developing desirable work attitudes and a keen sense of responsibility, particularly concerning public and personal safety.

The curriculum has been designed to give the instructor every reasonable opportunity for flexibility and innovation without deviating to any significant degree from the subject requirements, as determined by the Steering Committee. Since the scope of the prescribed curriculum is quite extensive, the apprentices must be expected to reinforce the acquired knowledge through regular independent out-of-classroom assignments. The curriculum has been presented in a chronological sequence in keeping with sound teaching methodologies. However, the actual application of the sequence may differ somewhat between colleges because of scheduling, staffing, and facilities utilization.

The curriculum has been designed to give the instructor every reasonable opportunity for flexibility and innovation without deviating to any significant degree from the subject requirements, as determined by the Steering Committee. Since the scope of the prescribed curriculum is quite extensive, the apprentices must be expected to reinforce the acquired knowledge through regular independent out-of-classroom assignments. The curriculum has been presented in a chronological sequence in keeping with sound teaching methodologies. However, the actual application of the sequence may differ somewhat between colleges because of scheduling, staffing, and facilities utilization.

To ensure that apprentices will be able to successfully demonstrate the learning outcomes according to performance criteria, specific times have been allocated in the respective areas to To ensure that apprentices will be able to successfully demonstrate the learning outcomes according to performance criteria, specific times have been allocated in the respective areas to allow for some applications enhancement. It is of utmost importance that all application assignments relate to prescribed experiences only. Time constraints will not permit engaging apprentices in tasks of limited learning benefit that are unrelated to the curriculum outcomes. In the Learning Content section, whenever an assigned operation for an applied test or repair procedure indicates that a demonstration should be performed, there is only enough time allocated for the instructor to perform the activity. If the statement in the assigned operations begins with "perform," "outline," "describe," or "explain," the apprentice is expected to complete the activity.

Regular evaluations of the apprentices' learning achievements must be performed in both theory and practical applications throughout the program to ensure consistency with learning outcome expectations. Testing of apprentice knowledge and skills will take place during the allotted delivery hours for each unit. In addition to providing an evaluation of apprentice competency, the review of test question answers is considered to be a valuable learning opportunity.

In all practical activities, the apprentices will observe the Occupational Health and Safety Act and the applicable regulations including use of personal protective equipment. Institutional regulations and policies may also apply.

Participation by Stakeholders
A consortium of five colleges of applied arts and technology, working in collaboration with the Ministry of Labour, Immigration, Training and Skills Development and industry stakeholders, participated in the development of this document. The development and subsequent revisions were based on the new training standards. The development was completed using a process and format approved by MLITSD.

The first step in the development process was to assemble a Project Steering Committee (PSC), consisting of both industry representatives and apprenticeship in-school deliverers. The PSC initiated the plan for the project development that followed. The PSC established a working team, responsible for the development of the in-school apprenticeship curriculum document.

The working team worked with advisory groups during the development of the curriculum. The advisory groups were industry representatives who ensured content validity. During various stages of the process, the PSC and participating industry advisory groups evaluated the draft curriculum documents and provided feedback and recommendations for revisions.

Implementation Date:
2007

Summary of Total Program In-School Training Hours

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Level 1 Common Core				
1	Introduction to Microcomputers	24	15	9
2	Health and Safety Practices	12	10	2
3	Operating Systems	42	24	18
4	Microcomputer Applications	36	12	24
5	Basic Electrical/Electronics	36	18	18
6	Desktop Platforms	42	18	24
7	Mobile Platforms	24	12	12
8	Customer Service and Professionalism in the Workplace	24	4	20
9	Basic Network Systems	51	24	27
10	Documentation	24	10	14
11	Troubleshooting	45	9	36
Level 1 Totals		**360**	**156**	**204**
Level 2 Network Technician				
1	Introduction to Advanced Networking	72	63	9
2	Disaster Recovery	18	12	6
3	Network Infrastructure Design	114	78	36
4	Installation and Configuration	84	36	48
5	Network Repair	36	15	21
6	Network Maintenance and Optimization	36	18	18
Level 2 Totals		**360**	**222**	**138**
Totals		**720**	**378**	**342**

Level 1

Common Core

Summary Of Total In-School Training Hours Level 1 Common Core

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1	Introduction to Microcomputers	24	15	9
2	Health and Safety Practices	12	10	2
3	Operating Systems	42	24	18
4	Microcomputer Applications	36	12	24
5	Basic Electrical/Electronics	36	18	18
6	Desktop Platforms	42	18	24
7	Mobile Platforms	24	12	12
8	Customer Service and Professionalism in the Workplace	24	4	20
9	Basic Network Systems	51	24	27
10	Documentation	24	10	14
11	Troubleshooting	45	9	36
	Totals	**360**	**156**	**204**

Number: 634A1.01

Title: **Introduction to Microcomputers**

Duration: Total Hours: 24 Theory: 15 Practical: 9

Prerequisites: None

Co-requisites: None

Cross-reference to Training Standard: 6270, 6273.01, 6273.02, 6274.01, 6275.01, 6278.01

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to identify and describe microcomputer technologies as a foundation for supporting, servicing, and troubleshooting microcomputer systems.

Learning Outcomes

Upon successful completion, the apprentice is able to:

1.1 Outline the evolution of the microcomputer.

1.1.1 Identify early and current families of processors.

- 8086
- 80286-80486
- Pentium
- Current processors

1.1.2 Identify various microcomputer platforms.

1.1.3 Describe differences among PC models.

- Desktops
- Laptops
- Tablets
- PDAs
- Current models

1.2   Demonstrate a variety of input techniques.

    1.2.1   Identify various keyboards and other input devices.

- QWERTY
- Dvorak
- Scripting tools
- Digitizing pens
- Voice recognition
- Mouse
- Barcode readers

    1.2.2   Key using touch typing techniques.

    1.2.3   Use keyboard short cuts.

- Operating systems
- Programs
- Manufacturers' variations

1.3   Describe the hardware components of a microcomputer.

    1.3.1   Define computer terms relating to the hardware components of a microcomputer.

- Power supply
- HDD
- FDD
- RAM
- CPU
- Motherboard
- CD-ROM
- CD-R/W
- DVD
- DVD-R/W
  - -R
  - +R
- Monitor
- Keyboard
- Mouse
- Printer/fax machine/all-in-ones
- Cable modem

- Peripheral device interfaces
  - NIC, video, modem, sound, SCSI, serial, parallel, Ethernet, firewire, wireless, PCMCIA
- BUS architecture
- Scanner/digital camera
- Modem
- Cache RAM
- Web cam
- Transfer rates
- PDAs
- Tablets

1.3.2   Identify the hardware components of a microcomputer.

- Power supply
- HDD
- FDD
- RAM
- CPU
- Motherboard
- CD-ROM
- CD-RW
- DVD
- DVD-RW
  - -R
  - +R
- Monitor
- Keyboard
- Mouse
- Printer/fax machine/all-in-ones
- Cable modem
- Peripheral device interfaces
  - NIC, video, modem, sound, SCSI, serial, parallel, Ethernet, firewire, wireless, PCMCIA
- Bus architecture
- Scanner/digital camera
- Modem
- Cache RAM
- Web cam
- Transfer rates
- PDAs

1.3.3   Describe how the various components interact.

- Processing
  - CPU vs. RAM
  - CPU vs. HDD
  - Different Busses
  - Cache
  - BIOS
  - IRQ and DMA controllers
  - Address and Databases
  - Chipset
  - System board clock
- Input/Output Devices
  - Scanner
  - Monitor
  - Keyboard
  - Printer
  - Mouse

1.4   Uninstall/reinstall specific hardware components.

- HDD
- FDD
- CD-ROM/CD-R/DVD/DVD-RW
- Video card
- Sound card
- RAM
- CPU
- Power supply
- Motherboard
- Adapters
  - USB-Serial
  - USB-Parallel
- Peripheral devices

1.5   Describe operating system software.

1.5.1   Describe the fundamental purpose of an operating system.

- Data storage
- Data types
- ASCII/EBCDIC coding systems
- File management
- Hardware management
- Software management
- Power management

1.5.2   Identify operating system software.

- DOS
- Windows 95/98/ME/2000/XP
- Windows NT/XP PRO/2000 server/2003 server
- UNIX/LINUX
- Mac

1.5.3   Explain the features of operating system software.

- DOS
- Windows 95/98/ME/2000/XP
- Windows NT/XP PRO/2000 server/2003 server
- UNIX/LINUX
- Mac

1.5.4   Compare performance characteristics of operating system software.

- DOS
- Windows 95/98/ME/2000/XP
- Windows NT/XP PRO/2000 server/2003 server
- UNIX/LINUX
- Mac

1.5.5   Compare the structure of the operating system and file system.

- DOS
- Windows 95/98/ME/2000/XP
- Windows NT/XP PRO/2000 server/2003 server
- UNIX/LINUX
- Mac

1.5.6   Navigate within a Graphic User Interface (GUI) environment.

- Start and exit a GUI.
- Open and close folders or groups.
- Launch applications.
- Switch tasks in a multitasking environment.
- Configure desktop.
- Manipulate windows.
- Locate accessories and utilities.
- Create folders and save files.
- Update files in folders.
- Rename and delete files and folders.
- Move and copy files and folders.
- Find files and folders.

1.6 Explain the characteristics of the storage media used by a microcomputer system.

    1.6.1 Examine storage media.

- Capacity
- Storage methods
  - HDD
  - Memory Sticks
  - CD-ROM/CD-RW
  - DVD-ROM/RW
  - FDD
  - External fixed disk
  - Networked device

1.7 Describe application software.

    1.7.1 Describe the purpose of application software.

    1.7.2 Identify application software.

- Word processors
- Spreadsheet software
- Database software
- Presentation software
- Browsers
- Electronic mail software
- HTML editor
- FTP programs
- Graphics editor
- Communication software/wizards
- Virus protection software

    1.7.3 Explain the features of application software.

- Word processors
- Spreadsheet software
- Database software
- Presentation software
- Browsers
- Electronic mail software
- HTML editor
- FTP programs
- Graphics editor
- Communication software/wizards
- Virus protection software

1.7.4   Compare performance characteristics of application software.

- Word processors
- Spreadsheet software
- Database software
- Presentation software
- Browsers
- Electronic mail software
- HTML editor
- FTP programs
- Graphics editor
- Communication software/wizards
- Virus protection software

1.8   Define the concept of how microcomputers communicate with other devices over a network.

1.8.1   Explain different methods of communication.

- Ethernet
- Wireless
- Cable
- Infrared

1.9   Identify the cost and performance characteristics of microcomputer components.

1.9.1   Compare the cost of components that can be upgraded to increase performance.

- HDD
- CPU
- RAM
- Video
- Peripheral devices

1.9.2   Justify the choice of hardware upgrades to increase the performance of a microcomputer.

1.9.3   Research the cost of a new microcomputer given specific user requirements.

- Performance
- Specifications
- Reliability
- Expandability
- Service/support
- Warranty
- Training

1.10   Navigate the Internet.

      1.10.1   Identify families of search engines.

      1.10.2   Identify security concerns.

      1.10.3   Search for information.

      1.10.4   Use Boolean logic for advanced searching.

      1.10.5   Access online help.

      1.10.6   Research documentation.

      1.10.7   Download drivers for particular hardware.

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Standards Study Guides
Internet

Minimum Equipment List:

1. Internet-ready PCs
2. PCs used for tear down and reassembly
3. PCs loaded with productivity tools suite (word processor, database, spreadsheet, etc.)
4. Assortment of computer parts for demonstration

Evaluation Structure				
Written Assignment	Theory Test	Observation/ Labs	Practical Assignment	Final Exam
15%	15%	10%	25%	35%

Number: 634A1.02

Title: **Health and Safety Practices**

Duration: Total Hours: 12   Theory: 10   Practical: 2

Prerequisites: None

Co-requisites: None

Cross-reference to Training Standard: 6270.01, 6270.02, 6270.03, 6270.04, 6270.05, 6270.06

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to identify the requirements for compliance with manufacturers' recommendations and specifications and for occupational health and safety procedures.

Learning Outcomes

Upon successful completion, the apprentice is able to:

2.1   Identify potential workplace environmental, health, and safety hazards.

2.1.1   List the measures taken to prevent illness or injury resulting from exposure to various hazardous materials and/or conditions.

- Adhesives
- Dust fumes
- Soldering fumes
- Sound levels
- Solvents
- Electrical and mechanical hazards
- Unidentified substances
- Compressed air

2.2   Identify safe handling, storage, and recycling procedures for workplace materials.

    2.2.1   List the measures taken to handle, store, and recycle various materials.

- New and used lubricants and fluids
- Gases
- Product consumables
  - Inks
  - Toners
  - Paper/Media
- Solvents
- Filters
- Adhesives

    2.2.2   Identify methods for disposing of IT waste.

- Equipment
- Packaging

2.3   Use personal protective equipment.

    2.3.1   Identify types of personal protective equipment.

- Glasses
- Face shield
- Respirators
- Ear plugs
- Ear muffs
- Gloves
- Boots
- Hazardous material clothing

    2.3.2   Select the appropriate personal protective equipment for the job.

- Glasses
- Face shield
- Respirators
- Ear plugs
- Ear muffs
- Gloves
- Boots
- Hazardous material clothing

2.4　Describe documents, acts, and regulations that relate to workplace environments.

    2.4.1　Explain the purpose of manufacturers' recommendations and specifications.

- Material Safety Data Sheets (MSDS)

    2.4.2　Explain the purpose of Occupational Health and Safety Act (OHSA).

    2.4.3　Explain the purpose of Environmental Protection Act (EPA).

    2.4.4　Explain the purpose of Workplace Hazardous Materials Information System (WHMIS).

- Joint Health and Safety Committee (JHSC)

2.5　Identify good housekeeping practices.

    2.5.1　Explain how to maintain a clean and orderly work area.

    2.5.2　Describe how to remove and dispose of potential fire hazards.

    2.5.3　List the steps necessary to clean up grease, oil, and/or fluids.

    2.5.4　Ensure work area is free of obstructions.

    2.5.5　Safely use, store, and maintain equipment, tools, and shop safety equipment.

    2.5.6　Identify ergonomically-appropriate furniture, equipment, and practices.

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Government Standards
Manufacturers' Specifications
Industry Specifications
Internet

Minimum Equipment List:
1. Glasses
2. Face shield
3. Respirators
4. Ear plugs
5. Ear muffs
6. Gloves
7. Boots
8. Hazardous material clothing

Evaluation Structure		
Theory Test	Practical Assignment	Final Exam
30%	20%	50%

Number: 634A1.03

Title: **Operating Systems**

Duration: Total Hours: 42   Theory: 24   Practical: 18

Prerequisites: Reportable Subject 1: Introduction to Microcomputers

Co-requisites: None

Cross-reference to Training Standard: 6274.01, 6274.02, 6274.03, 6274.04, 6274.05, 6277.0

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to install, configure, and maintain DOS, Windows, and Linux/Unix based operating systems.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3.1   Outline the foundation of simple disk operating systems.

    3.1.1   Define numerical systems.

- Binary
- Hexadecimal
- Decimal

    3.1.2   State reasons for the use of numerical systems in computers.

- Binary
- Hexadecimal
- Decimal

    3.1.3   Define the different families of Central Processing Units (CPUs).

- 8 bit
- 16 bit
- 32 bit
- 64 bit
- Internal Cache (level 1)
- External Cache (level 2)

3.2   Describe the common features of operating systems.

    3.2.1   Describe various user interfaces.

- Command line
- GUI
- Blended/Dialogue box

    3.2.2   Demonstrate different types of process management/multi-function activities.

- Foreground
- Background
- Scheduling
- Queued

    3.2.3   Identify device management activities.

- Interrupts
- Addressing
- Direct Memory Access (DMA)

    3.2.4   Describe file management structures.

- Directories
- File types
    - Attributes
- Disk /partitions
    - Boot sector
    - FAT tables

3.3   Outline the functions of an operating system.

    3.3.1   Identify the means by which the operating system controls hardware, software, and peripherals.

- Drivers
- Applets
- DLL files
- INF files
- INI files
- Registry
- Libraries

3.3.2   Define the ways by which the operating system manages memory.

- Temporary storage
- Virtual storage
- Expanded
- Base
- Cache
- Extended memory

3.3.3   Identify the methods by which an operating system processes input and formulates output.

- Keyboard
  - Listeners
  - Ports
- Data
  - EBCDIC
  - ASCII
- Sound
  - To interface
  - From interface
- Video
  - To interface
  - From interface
- Peripheral devices
  - To interface
  - From interface

3.4   Compare and contrast the installation and configuration of DOS, Windows-based, and Linux/Unix-based operating systems.

3.4.1   Outline the minimum system requirements to install each of DOS, Windows, and Linux/Unix.

- RAM
- CPU
- System Bus
- HDD
- BIOS
- Video
- Other peripherals

    3.4.2   Differentiate between the primary purposes of each of the three operating systems.

- Single user
- Small Office Home Office (SOHO)
- Enterprise

    3.4.3   Assess the impact of Graphical User Interfaces (GUI) for the three operating systems.

- User friendliness
- Functionality
- Necessity
- Productivity
- Interactivity

    3.4.4   Identify the issues pertaining to maintaining and upgrading each of the three operating systems.

- Availability of drivers for new hardware
- Availability of applications
- Availability of upgrades
- Availability of security upgrades
- Associated upgrade costs
  - Labour
  - Training
  - Maintenance

3.5   Install and configure a DOS, Windows-based, and Linux/Unix-based operating system.

    3.5.1   List the steps necessary to perform the installation of the three operating systems.

- Hardware Compatibility List (HCL)

    3.5.2   Describe the installation options available for the three operating systems.

- Over the network
- From media (HD, CD-ROM, FD, DVD)
- Auto install (unattended install)
- Imaging
- Diskettes
- CD

    3.5.3   Install each of the three operating systems.

3.6   Outline the differences among the user interfaces of the three operating systems.

  3.6.1   Define syntax.

- Change directories
- Create directories/files
- Rename directories/files
- Delete directories/files
- Edit directories/files
- Display directory structures

3.7   Demonstrate troubleshooting techniques for operating systems.

  3.7.1   Identify and repair system resource conflicts.

- Software vs. hardware
- Operating systems vs. applications

  3.7.2   Determine hardware incompatibility.

- Hard fault
- System error message

  3.7.3   Assign security.

- User permissions
- Use define

  3.7.4   Edit the registry using a registry editor.

  3.7.5   Find resources for fixing problems.

- Internet
- Manuals
- User forums
- Listservs

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Internet

Minimum Equipment List:
1. Meter
2. Basic Computer Tool Kit
3. Operating Systems software for loading and configuration
4. PC with HDD suitable for operating systems loading and configuration
5. DOS
6. Windows based operating system
7. Linux/Unix based operating system

Evaluation Structure			
Assignment	Labs	Theory Tests	Final Assessment (Theory and Practical)
20%	20%	30%	30%

Number:	634A1.04
Title:	**Microcomputer Applications**
Duration:	Total Hours: 36 Theory: 12 Practical: 24
Prerequisites:	Reportable Subject 1: Introduction to Microcomputers
Co-requisites:	None

Cross-reference to Training Standard: 6272.0, 6275.01, 6275.02, 6275.03, 6275.04, 6274.05

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to install and use basic microcomputer applications.

Learning Outcomes

Upon successful completion, the apprentice is able to:

4.1   Install application software.

    4.1.1   Identify system requirements prior to installing application software.

- O/S
- RAM
- HDD
- Video capabilities
- Processor speed
- Multimedia requirements

    4.1.2   Identify system components that are affected by installing application software.

- System registry
- HDD
  - Optimization
  - Capacity
- IRQs
- DLLs
- Communication ports
- Video drivers
- Peripheral devices

4.1.3   Describe the different methods of installation.

- Minimal
- Typical
- Custom

4.1.4   Use Wizards at all three levels.

- Minimal
- Typical
- Custom

4.1.5   Install upgrades and patches without Wizards using documentation and online support materials.

- Identify situations where patches and upgrades are appropriate.
- Install additional utilities that are not part of the operating system.
- Install virus protection.

4.2   Uninstall application software.

4.2.1   Use Wizards to uninstall.

4.2.2   Use operating systems settings to uninstall.

4.2.3   Use delete to uninstall.

- Implications

4.2.4   Use third party cleaning utilities.

4.3   Use Internet utilities.

4.3.1   Communicate via SMTP/POP3.

4.3.2   Download/upload files using FTP.

4.3.3   Search the World Wide Web using HTTP.

4.4   Demonstrate basic features of e-mail utilities.

4.4.1   Identify differences between corporate/workgroup and Internet based e-mail systems.

4.5   Demonstrate basic features of a word processor.

    4.5.1   Identify GUI features.

    4.5.2   Use format options.

- Font size
- Text colour
- Page breaks

    4.5.3   Use language tool features.

- Spelling
- Grammar
- Thesaurus
- Converters

    4.5.4   Use edit tool features.

- Cut
- Copy
- Paste
- Find
- Replace

    4.5.5   Use different view option.

- Toolbars
- Layouts

    4.5.6   Use hyperlinks.

    4.5.7   Use electronic help facilities.

- Search features
- Help index
- Internet help
- Wizards

4.6   Demonstrate the basic features of a spreadsheet.

    4.6.1   Identify GUI features.

    4.6.2   Use format options.

- Font size
- Text colour
- Page breaks

    4.6.3   Use language tool features.

- Spelling
- Grammar

    4.6.4   Use edit tool features.

- Cut
- Copy
- Paste
- Find
- Replace

    4.6.5   Use different view option.

- Toolbars
- Layouts

    4.6.6   Use hyperlinks.

    4.6.7   Create and use basic formulas.

- Order of operation
- Boolean logic

    4.6.8   Use functions.

- Built-in
- User-defined

    4.6.9   Use absolute and relative references.

- Define
- Create
- Apply
- Explain how to avoid circular references

4.7   Describe the basic concepts of a database management system.

    4.7.1   Explain the uses of a database management system.

- Tables
- Relationships
- Sort and filter
- Records
- Primary key
- Queries
- Reports
- Forms
- Maintenance

4.8   Demonstrate the basic features of presentation software.

    4.8.1   Identify GUI features.

    4.8.2   Use format options.

- Font size
- Text colour
- Page breaks

    4.8.3   Use language tool features.

- Spelling
- Grammar
- Thesaurus

    4.8.4   Use edit tool features.

- Cut
- Copy
- Paste
- Find
- Replace
- Insert and edit graphics

    4.8.5   Use different view options.

- Toolbars
- Layouts

4.8.6   Use slide layout.

- Types
- Templates
- Master slide

4.8.7   Use slide features.

- Hyperlinks
- Effects
- Slide transitions
- Animation
- Views
- Sound

4.8.8   Run a presentation.

- Navigate within a presentation.
- Project a presentation.

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Documentation
Industry Study Guides
Internet

Minimum Equipment List:
1. Internet-ready computer with productivity tools suite
2. Data projector

Evaluation Structure			
Assignment	Labs	Projects	Final Assessment (Theory and Practical)
20%	20%	30%	30%

Number: 634A1.05

Title: Basic Electrical/Electronics

Duration: Total Hours: 36   Theory: 18   Practical: 18

Prerequisites: None

Co-requisites: None

Cross-reference to Training Standard: 6270.0, 6273.0, 6276.0, 6277.0, 6278.0

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to use the basics of electrical and electronic theory to identify, inspect, and test electrical and electronic components of microcomputers.

Learning Outcomes

Upon successful completion, the apprentice is able to:

5.1   Describe electrical/electronic theory.

   5.1.1   Describe electron flow and magnetic fields.

   - Source of energy
   - Requirements for electron flow

   5.1.2   Perform unit conversions.

   - Engineer's table

   5.1.3   Define Ohm's Law.

   - Resistance
   - Voltage
   - Current
   - DC
   - AC
   - Power

   5.1.4   Define ground concepts.

   - Floating
   - Earth
   - Static

5.1.5   Identify the difference between conductors and insulators.

- No perfect insulator

5.2   Identify electrical/electronic components used in a microcomputer system.

5.2.1   Define DC power supply.

5.2.2   Define AC power supply.

5.3   Identify safe handling procedures of electronic components.

5.3.1   Describe the effects of Electromagnetic Field (EMF).

5.3.2   Explain the concepts of Electrostatic Discharge (ESD) protection.

5.3.3   List the safety measures taken to handle electronic components.

- Capacitors
- Transformers
- Power supply
- Transistors
- Integrated circuits
- Batteries

5.4   Demonstrate multimeter troubleshooting techniques.

5.4.1   Identify multimeter troubleshooting techniques.

- AC testing
- DC testing
- Continuity
- Ground

5.4.2   Test AC components.

- Receptacle voltage

5.4.3   Test DC components.

- Computer power supply output
- Batteries

5.4.4   Test continuity.

- Ground
- Power wires
- Data cables
- Fuses

5.5   Inspect for basic electrical problems.

    5.5.1   Visually inspect electrical components.

- Power supply
- Connector
- Cables
- Resistors
- Capacitors

    5.5.2   Use sense of smell to inspect electrical components.

- Capacitors
- Transistors
- Power supply
- Integrated circuits

5.6   Demonstrate soldering techniques.

    5.6.1   Describe basic soldering techniques.

- Ventilation
- Solder types
- Heat sinks

    5.6.2   Solder power cords.

    5.6.3   Solder mouse cords.

    5.6.4   Solder custom cables.

- Parallel cables
- Serial cables

    5.6.5   Make minor solder repairs.

- Cold solder joints
- Discolouration

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet

Minimum Equipment List:
1. Soldering iron with solder, sponge, station, helping hands, timing block
2. Basic electronic kit
3. Multimeter
4. Assortment of resistors
5. Computer power supplies
6. Capacitors
7. Integrated circuit
8. Breadboards/digital trainers
9. Parallel and serial connectors
10. Cable with different conductors inside them (9,25,4 conductor cable)

Evaluation Structure		
Assignment	Labs	Final Assessment (Theory and Practical)
30%	30%	40%

Number:	634A1.06
Title:	**Desktop Platforms**
Duration:	Total Hours: 42 Theory: 18 Practical: 24
Prerequisites:	Reportable Subject 1: Introduction to Microcomputers Reportable Subject 5: Basic Electrical/Electronics
Co-requisites:	None

Cross-reference to Training Standard: 6272.0, 6271.0, 6272.0, 6273.01, 6273.02, 6273.03, 6273.04, 6273.05, 6278.01, 6278.02, 6278.03, 6278.04

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to install, configure, and upgrade desktop platforms.

Learning Outcomes

Upon successful completion, the apprentice is able to:

6.1   Identify the configuration of microcomputer systems.

   6.1.1   Describe common system board architectures.

- Generations
- Chipset
- System bus/expansion slots
- AT/ATX

   6.1.2   Identify microcomputer components.

- CPU
  - Sockets
  - Slotted
  - Cooling methods
  - Speeds (MHz)
    - Generations
    - Cache
- RAM
  - DDRAM
  - SDRAM
  - NVRAM
  - RAMBUS
  - SODIMM
  - AIMM
  - VRAM

- CMOS
- BIOS
- Expansion slots
  - AGP
  - PCI
  - ISA

6.1.3   Explain the function of microcomputer components.

- CPU
  - Sockets
  - Slotted
  - Cooling methods
  - Speeds (MHz)
  - Generations
  - Cache
- RAM
  - DDRAM
  - SDRAM
  - NVRAM
  - RAMBUS
  - SODIMM
  - AIMM
  - VRAM
- CMOS
- BIOS
- Expansion slots
  - AGP
  - PCI
  - ISA

6.1.4   Describe the function of communication ports.

- Serial
  - COM ports
- Parallel
  - LPT ports
- USB
  - USB ports – version 1 and 2
- Fire wire
  - IEEE 1394
  - I link
- SCSI
- Ethernet
- Infrared
- PS/2

6.1.5   Explain Interrupt Requests (IRQs).

- Settings (0-15)

6.1.6   Explain I/O addresses.

6.1.7   Define Direct Memory Access (DMAs).

- Settings

6.1.8   Explain the function of storage devices.

- Fixed
  - HDD
    - Internal structure
      - Tracks and sectors
      - Read/write head
      - Platters
      - Cylinders
      - Transfer rate
  - Drive interface
    - IDE
    - EIDE
    - SCSI
    - Serial ATA
    - USB
    - Fire wire
  - Disk optimization/defragmentation
    - When
    - Why
    - How
- Removable
  - HDD/Hot swappable
  - Zip
  - FDD
  - Tape drive
  - Optical
    - CD-ROM/RW
    - DVD/RW
  - USB hard card
  - Combo drive
- External
  - USB
  - Network attached storage
    - Network attached storage
    - Storage area networks
  - RAID sets
    - Striping
    - Types

6.1.9　　Identify the different types of memory.

- RAM
  - Volatile
  - Banks
  - Standard vs. E.D.O.
- ROM
  - Non-volatile
  - EPROM/EEPROM
  - Flash ROM

6.1.10　　Describe power supplies.

- Voltage
- Form factors

6.2　　Install and configure peripherals.

6.2.1　　Install and configure printers.

- Laser
- Inkjet
- Dot matrix

6.2.2　　Install monitors.

- Flat panel
- CRT
- Touch monitor

6.2.3　　Install keyboards.

- One touch
- 104 keyboards
- Enhanced keyboards
- Ergonomic
- Cordless

6.2.4　　Install and configure pointing devices.

- Mouse
  - PS 2
  - Serial
  - Optical
  - Wheel
  - Wireless

6.2.5   Install and configure other peripherals.

- Multi-function devices
- Scanners
- Wands
- Barcode readers
- Docking stations
- Digital cameras

6.3   Install, upgrade and configure basic components in an existing system.

6.3.1   Replace system components.

- System boards
- Power supplies
- CPU
- BIOS
- RAM
  - Pins
  - Capacity
- HDD
- Peripherals
  - Printers
  - Monitors
  - Keyboards
  - Pointing devices
  - CD-ROM/RW
  - DVD/RW
- Expansion cards
  - Video adapters
  - S-Video
  - Sound cards
  - Modems
  - Interface Cards
    - Serial
    - Parallel
    - USB
    - Fire wire
    - Network

6.4   Describe alternate modem types.

     6.4.1   Explain modem types.

- Dial-up
  - Internal
  - External
- DSL
  - NIC
  - USB
- Cable
  - NIC
  - USB
- Satellite
  - NIC
  - USB

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Internet

Minimum Equipment List:
1. Used computers
2. Various computer parts
3. Multimeter
4. Peripherals devices as identified in learning outcomes
5. Cabling for peripherals

Evaluation Structure			
Assignment	Labs	Project	Final Assessment
15%	30%	25%	30%

Number:	634A1.07
Title:	**Mobile Platforms**
Duration:	Total Hours: 24 Theory: 12 Practical: 12
Prerequisites:	Reportable Subject 1: Introduction to Microcomputers Reportable Subject 5: Basic Electrical/Electronics Reportable Subject 6: Desktop Platforms
Co-requisites:	None

Cross-reference to Training Standard: 6272.0, 6271.0, 6272.0, 6273.01, 6273.02, 6273.03, 6273.04, 6273.05, 6278.01, 6278.02, 6278.03, 6278.04

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to identify mobile platforms and install, configure, and upgrade notebooks.

Learning Outcomes

Upon successful completion, the apprentice is able to:

7.1   Identify different mobile platforms.

      7.1.1   Describe the various types of mobile platforms.

- Notebook
- Tablet PC

      7.1.2   Explain the use of Personal Digital Assistants (PDAs).

      7.1.3   Identify future trends in mobile platforms.

- Cell phones
- Cameras
- GPS
- Watches
- E-books
- Visors
- Scanners
- Printers

7.2   Identify the configuration of notebook systems.

    7.2.1   Identify microcomputer components in a mobile unit.

- CPU
  - Form factors
    - Sockets
  - Specifications
    - Cooling methods
    - Speeds (MHz)
- System board
  - CMOS
  - BIOS
  - RAM
- Modular expansion
  - PCMCIA
  - Floppy
  - CD-ROM
  - Battery
  - Network card
  - Modem card
  - Docking station
- Communication ports
  - Serial
    - COM ports
  - Parallel
    - LPT ports
  - USB
    - USB ports
  - Fire wire
    - IEEE 1394
    - I link
  - Infrared
  - S-Video
  - Video
  - Audio
  - PS/2
  - Ethernet
- Integrated display formats
  - Active scan
  - Dual scan
- Integrated input devices
  - Keyboard
  - Pointing devices
    - Trackball
    - Touch pad
    - Integrated pointing device

7.2.2   Explain Interrupt Requests (IRQs).

- Settings (0-15)

7.2.3   Define Direct Memory Access (DMAs).

- Settings

7.2.4   Describe the differences between desktop and mobile storage devices.

- Fixed
  - HDD
    - Physical characteristics
    - Transfer rate
      - Serial ATA
      - PCMCIA
- Removable/Swappable
  - Floppy
  - Optical
    - CD-ROM/RW
    - DVD/RW
  - Combo drive
  - USB
  - PCMCIA

7.2.5   Compare the different types of memory.

- RAM
  - Volatile
  - Expansion capabilities
- ROM
  - Non-volatile
  - EPROM/EEPROM
  - Flash ROM
- Flash card

7.2.6   Describe power management.

- Voltage
  - AC/CD conversion
- Charging
- Battery
  - Core
  - Memory
  - Life

7.3   Install and configure external peripherals.

    7.3.1   Install and configure printers.

- Portable
- Standard

    7.3.2   Connect and configure external displays.

- LCD
- CRT
- Projection device

    7.3.3   Connect and configure external keyboards.

    7.3.4   Connect and configure external pointing devices.

- External mouse
  - Optical
  - Wheel
  - Wireless
  - Trackball
- Numeric keypad

    7.3.5   Install and configure other peripherals.

- Multi-function devices
- Scanners
- Wands
- Barcode readers
- Docking stations
  - Expansion cards
  - PDA
- Digital cameras
- Wireless

7.4 Install, upgrade, and configure basic components in an existing notebook environment.

    7.4.1   Replace system components.

- System boards
- Flash the BIOS
- RAM
  - Sticks
- HDD
- Monitors
- Keyboards
- Pointing devices
- Expansion ports
  - PCMCIA

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Internet

Minimum Equipment List:
1. Used notebooks
2. Laptop parts
3. Multimeter
4. Peripheral devices as identified in learning outcomes
5. Cabling for peripherals

Evaluation Structure			
Assignment	Labs	Project	Final Assessment (Practical and Theory)
15%	30%	25%	30%

Number:	634A1.08		
Title:	**Customer Service and Professionalism in the Workplace**		
Duration:	Total Hours: 24	Theory: 4	Practical: 20
Prerequisites:	None		
Co-requisites:	None		
Cross-reference to Training Standard: 6271.0			

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to act professionally with, and provide quality assistance to customers, colleagues, supervisors, and industry, according to established policies, procedures, and standards.

Learning Outcomes

Upon successful completion, the apprentice is able to:

8.1   Communicate effectively.

   8.1.1   Utilize business language in the workplace.

   8.1.2   Develop good listening skills.

- Basic listening modes (competitive, attentive, active)
- Elements of communication

   8.1.3   Apply effective writing and speaking skills.

   8.1.4   Write an incident report.

   8.1.5   Interpret instructions and procedures.

8.2   Develop positive values and attitudes.

   8.2.1   Dress appropriately in the workplace.

   8.2.2   Adhere to personal hygiene practices.

   8.2.3   Demonstrate a positive attitude.

   8.2.4   Exhibit enthusiasm and motivation.

   8.2.5   Indicate ways to incorporate skills identified in the Conference Board of Canada Employability Skills 2000+ Profile in the workplace.

8.3   Work effectively with others.

    8.3.1   Co-operate with peers.

    8.3.2   Demonstrate willingness to speak and ask questions.

    8.3.3   Identify methods for developing personal networks.

- Phone numbers
  - Personal
  - Work
- Email addresses
- Business cards

    8.3.4   Display team-leadership skills.

- Encourage workers

    8.3.5   Identify methods to manage projects.

8.4   Deal effectively with workplace stress.

    8.4.1   Identify the root causes and dangers of stress in the workplace.

    8.4.2   Describe techniques for dealing with workplace stress.

    8.4.3   Demonstrate techniques for dealing with workplace stress.

    8.4.4   Explain methods to handle suggestions and constructive criticism effectively.

8.5   Describe ethical issues in Information Technology.

    8.5.1   Identify specific ethical issues.

- Licence violations
- Using information technology for criminal activities
- Rights to privacy

    8.5.2   Recognize personal and professional ramifications of unethical practices.

8.6   Demonstrate time management skills.

    8.6.1   Explain the importance of time management systems.

    8.6.2   Identify components of time management systems.

    8.6.3   Describe strategies for multitasking.

    8.6.4   Prioritize and schedule tasks.

8.7   Resolve conflicts effectively.

      8.7.1   Identify causes of conflict.

      8.7.2   Describe strategies for dealing with conflict.

      8.7.3   Demonstrate effective workplace conflict management skills.

      8.7.4   Use negotiation skills for everyday life.

8.8   Provide quality customer service.

      8.8.1   Define customer service.

      8.8.2   Identify resources available to assist in problem resolution.

      8.8.3   Use available resources to assist in problem resolution.

      8.8.4   Follow an escalation procedure for problem resolution.

      8.8.5   Describe various methods for measuring customer service.

      8.8.6   Communicate with the customer through all phases of problem resolution.

      8.8.7   Suggest improvements to the process.

8.9   Appreciate the importance of staying current.

      8.9.1   Identify publications and web sites relevant to the trade.

Instructional/Delivery Strategies:
Role-plays
Lectures
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Reebok.com (Office Linebacker)
Industry Documentation
Internet

Minimum Equipment List:
N/A

Evaluation Structure			
Theory Test	Practical Assignment 1	Practical Assignment 2	Final Assessment
20%	30%	30%	20%

Number:	634A1.09
Title:	**Basic Network Systems**
Duration:	Total Hours: 51 Theory: 24 Practical: 27
Prerequisites:	Reportable Subject 1: Introduction to Microcomputers Reportable Subject 3: Operating Systems Reportable Subject 5: Basic Electrical/Electronics Reportable Subject 6: Desktop Platforms Reportable Subject 7: Mobile Platforms
Co-requisites:	None
Cross-reference to Training Standard: 6276.01, 6276.02, 6276.03, 6276.04	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to implement a peer-to-peer network, operate equipment that is connected in local area networks, and define basic concepts related to local and wide area networks using appropriate hardware.

Learning Outcomes

Upon successful completion, the apprentice is able to:

9.1   Explain basic LAN concepts, terminology, and types of LAN architectures.

    9.1.1   Identify reasons for networking.

    9.1.2   Describe a network operating system.

    9.1.3   Identify different network topologies.

- Star
- Extended star
- Bus
- Ring
- Dual ring

    9.1.4   Explain network access methods.

- CSMA/CA
- CSMA/CD
- Token passing

9.1.5   Identify types of logical media (framework) and appropriate IEEE standards.

- Ethernet (802.3)
- Token Ring (802.5)
- FDDI (802.8)
- Wireless
  - 802.11a
  - 802.11b
  - Bluetooth
- Packets

9.1.6   Describe basic security concepts in a network environment.

- Firewall
  - Internet
  - Wireless
  - Intranet
- Encryption methods
- File sharing
- Authentication

9.1.7   Determine which protocols are most appropriate in a variety of environments.

- TCP/IP
- IPX/SPX (Netware)
- NETBEUI (Microsoft)
- Apple (Mac OS)
- Voice over

9.2   Explain the Open Systems Interconnect (OSI) model.

9.2.1   Explain the impact of the International Standards Organization's OSI model on networking standards.

9.2.2   Explain the functionality of the seven layers.

9.2.3   Identify the purpose of each of the layers.

9.2.4   Describe the interrelationship of the various layers.

9.2.5   Describe the implications of the OSI model on peer-to-peer networking.

9.3   Identify the components required for a LAN.

    9.3.1   Explain the function of a network interface card (NIC).

    9.3.2   Describe types of physical media and appropriate AWG standards.

- Coaxial cable
- Twin-ax
- Twisted pair
- Fibre optics
    - Single mode
    - Multi mode
- Wireless
    - Laser
    - Microwave

    9.3.3   Identify the connector types used in a LAN environment.

- RJ-45
- RJ-11
- BNC
- VF-45
- SC
- ST
- FC
- RTMJ

    9.3.4   Repair common media types to EIA/TIA (568A/B) standards.

- CAT5 to CAT6
- Co-ax
- Cable tools
    - Cable crimpers
    - Side cutters
    - Cable testers

    9.3.5   Distinguish between various types of network connectivity devices.

- Routers
- Switches
- Bridges
- Modems
- Hubs
- Firewalls
- Repeaters
- Wireless access points
- Appliances

9.4 Configure and test the performance of a peer-to-peer LAN.

    9.4.1 Configure operating system network settings.

    9.4.2 Verify correct network configuration.

    9.4.3 Test the connection by using the appropriate equipment/software.

- Ping
- Traceroute

9.5 Describe the limitations of peer-to-peer networks.

    9.5.1 Describe the limitations of a peer-to-peer network in terms of number of users.

    9.5.2 Distinguish between peer-to-peer networks and client-server networks.

    9.5.3 Describe situations where a peer-to-peer network would be most appropriate.

    9.5.4 Describe situations where a client server would be most appropriate.

    9.5.5 Explain the differences between share level and user level resource access.

9.6 Connect to a file server and describe the resources available on the server.

    9.6.1 Connect to a file server through a network connection.

    9.6.2 Determine the authentication methods that are in use by the server.

    9.6.3 Describe the directory structure and display of the resources that are available.

9.7 Describe signaling methods.

    9.7.1 List data communication services provided by the common carriers.

    9.7.2 Define analog and digital signals.

    9.7.3 Compare baseband and broadband transmissions.

    9.7.4 Explain multiplexing and demultiplexing.

    9.7.5 Define asynchronous and synchronous transmissions.

9.8   Examine the specifications of WAN technologies.

    9.8.1   Describe the function of routing protocols.

- RIP Version 1
- RIP Version 2
- RIP IPX

    9.8.2   Explain the function of WAN communication protocols.

- Switching technologies
  - Circuit switched
    - ISDN
  - Packet switched
    - Asynchronous Transfer Mode (ATM)
    - Frame relay
    - Point-to-point (PPP)
    - SONET

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Reference Guides
Internet

Minimum Equipment List:
1. Cables
2. Cable tools as identified in learning outcomes
3. Peripherals as identified in learning outcomes
4. At least two networkable PCs

Evaluation Structure			
Assignments	Labs	Theory Test	Final Assessment (Practical and Theory)
20%	20%	20%	40%

Number: 634A1.10

Title: **Documentation**

Duration: Total Hours: 24   Theory: 10   Practical: 14

Prerequisites: None

Co-requisites: None

Cross-reference to Training Standard: 6272.01, 6272.02, 6272.03, 6272.04

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to create and maintain documentation.

Learning Outcomes

Upon successful completion, the apprentice is able to:

10.1   Create and maintain a technical reference library.

      10.1.1   Identify the steps required to create a technical reference library.

- Systematically organize manuals, reference texts, and software.
- Use help file software to create a custom resource.
- Utilize Internet resources to obtain information.
- Utilize hardware and software standards to identify compatibility issues.
- Describe problems caused by product incompatibility.
- Describe methods used to make hardware and software choices.
- Record common user issues and solutions.

10.2   Create and maintain records of inventory, warranties, and copyrights.

      10.2.1   Identify the steps required to create and maintain records of warranties, licences, copyrights, and inventory.

- List information necessary for complete records.
- Utilize tracking software.
- Review and modify applicable warranty and copyright information.
- Update inventory of field replacement units (FRUs).

10.3   Create and maintain user problem documentation.

    10.3.1   Identify the steps required to create user problem documentation.

- Generate trouble tickets.
- Confirm problem details with the user.
- Identify potential solutions.
  - Field service
  - Shop service
- Document a proposed solution.
- Document issue resolution.

10.4   Write a technical issue resolution process.

    10.4.1   Identify the main steps of the issue resolution process.

    10.4.2   Write a typical technical process.

    10.5   Write a technical report.

    10.5.1   Tailor tone of report to reading audience.

    10.5.2   Organize the report using the problem-solution approach.

    10.5.3   Map report with appropriate headings.

    10.5.4   Create report summary.

10.6   Develop visual representations.

    10.6.1   Explain the guidelines for illustration usage.

    10.6.2   Identify the best use of primary chart types.

    10.6.3   Determine the best type of visual for the purpose.

    10.6.4   Create basic charts using document, presentation, or graphics software.

    10.6.5   Provide appropriate legends and captions for charts and illustrations.

Instructional/Delivery Strategies:
Lectures
Labs
Review
Demonstration
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Internet
Task-specific freeware/shareware

Minimum Equipment List:
Microsoft Word
Internet Explorer or Netscape
Email account
Microsoft PowerPoint
Microsoft Access
Basic graphics editor

Evaluation Structure			
Assignments	Labs	Project	Final Assessment
30%	15%	30%	25%

Number: 634A1.11

Title: Troubleshooting

Duration: Total Hours: 45   Theory: 9   Practical: 36

Prerequisites: Reportable Subject 1: Introduction to Microcomputers

Reportable Subject 2: Health and Safety Practices

Reportable Subject 3: Operating Systems

Reportable Subject 4: Microcomputer Applications

Reportable Subject 5: Basic Electrical/Electronics

Reportable Subject 6: Desktop Platforms

Reportable Subject 7: Mobile Platforms

Reportable Subject 8: Customer Service and Professionalism
                      in the Workplace

Reportable Subject 9: Basic Network Systems

Reportable Subject 10: Documentation

Co-requisites: None

Cross-reference to Training Standard: 6272.0, 6273.03, 6274.03, 6275.03, 6276.02, 6277.01, 6277.02, 6277.03, 6277.04, 6277.05

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to troubleshoot microcomputer systems using problem-solving techniques.

Learning Outcomes

Upon successful completion, the apprentice is able to:

11.1   Document all relevant facts describing the incident.

11.1.1   Interact with the user to collect all relevant facts.

11.1.2   Utilize proper reporting procedures and protocols.

11.1.3   Prioritize urgency of the situation.

11.2   Identify the problem.

    11.2.1   Check for error codes.

- Isolate POST errors.
- Interpret "beep" codes.
- Identify BIOS error messages.

    11.2.2   Check for sensory indicators.

- Sight
- Smell
- Sound
- Feel
- Environmental conditions

    11.2.3   Check for connectivity.

- Peripheral and network devices
  - Loose cables
  - Broken or crimped cables
  - Integrity of connectors
  - Power

    11.2.4   Check for performance inhibitors.

- Software and hardware conditions
- Environmental conditions
- System processes
  - Determine memory usage.
  - Verify locked application.
  - Locate page faults.
  - Ascertain CPU usage.
  - Check virtual memory.
  - Verify system is within specifications.

11.3   Isolate the problem.

    11.3.1   Decode and interpret error messages.

    11.3.2   Consult technical reference manuals.

    11.3.3   Search internal resources for similar problems.

    11.3.4   Search the Internet for similar problems or for error codes.

11.4   Implement a solution based on the diagnostic information.

      11.4.1   Replace suspected malfunctioning hardware components for known good parts.

      11.4.2   Uninstall/reinstall, configure, and/or upgrade suspected malfunctioning software applications.

11.5   Verify the implemented solution.

      11.5.1   Confirm that system performs as expected.

      11.6   Document and report solutions.

      11.6.1   Record work flow.

      11.6.2   Report solution.

      11.6.3   Update knowledgebase.

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Internal Reference Manuals
Co-workers
Internal databases
Colleagues
Manufacturers' Manuals
Industry documentation
Internet
Government regulations

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified
3. Multimeter

Evaluation Structure		
Assignments	Labs	Final Assessment (Practical and Theory)
40%	40%	20%

Level 2

Network Technician

Summary Of Total In-School Training Hours Level 2 Network Technician

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1	Introduction to Advanced Networking	72	63	9
2	Disaster Recovery	18	12	6
3	Network Infrastructure Design	114	78	36
4	Installation and Configuration	84	36	48
5	Network Repair	36	15	21
6	Network Maintenance and Optimization	36	18	18
	Totals	**360**	**222**	**138**

Number:	634C2.01
Title:	**Introduction to Advanced Networking**
Duration:	Total Hours: 72 Theory: 63 Practical: 9
Prerequisites:	None
Co-requisites:	None
Cross-reference to Training Standard: 6291.01	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to install a network operating system and utilize the OSI model to support advanced networking concepts.

Learning Outcomes

Upon successful completion, the apprentice is able to:

1.1 Analyze the implications of Layer 1 of the OSI model.

    1.1.1 Differentiate between the physical characteristics of copper, fibre, and wireless technologies.

- Digital Subscriber Line (DSL)
  - Asynchronous Digital Subscriber Line (ADSL) Standard
  - Global Single Pair High Bit-Rate Digital Subscriber Line (G-SHDSL) Standard
- Ethernet
  - Long Reach Ethernet (LRE)
  - Gigabit Ethernet
  - Ethernet 10/100
- Frame Relay
  - Point-to-Point
  - Point-to-Multipoint
- Asynchronous Transfer Mode (ATM)
- Fibre
  - Single-mode
  - Multi-mode
  - Synchronous Optical Network (SONET)
  - Ethernet over fibre
  - 10/100/gigabit
  - Fibre Transceivers
- Wireless
  - IEEE 802.11 standards

1.2   Analyze the implications of Layer 2 of the OSI model on network traffic flow.

    1.2.1   Explain the linkages between the functions of the Media Access Control (MAC) layer and resolution protocols.

- MAC address
  - 48 bit hexadecimal
  - Hard coded
- Frame Types
  - IEEE Standards
- Broadcast
  - Address Resolution Protocol (ARP)
  - Reverse Address Resolution Protocol (RARP)
  - Proxy ARP
  - Inverse ARP

    1.2.2   Analyze the hardware Layer 2 functionality of switches.

- Bridging
  - Learning
  - Transparent
- Segmentation
  - Virtual Local Area Networks (VLANs)
  - Planning
  - Creating
    - IEEE802.1q
    - Deleting
- Spanning Tree
  - Operation of IEEE 802.1d Spanning Tree Protocol
- Trunking
  - Virtual Trunking Protocol (VTP)
  - LAN Emulation (LANE)
  - Multicast
  - Broadcast
  - Unicast

1.3   Analyze the implications of Layer 3 of the OSI model routing and routed protocols.

    1.3.1   Describe the TCP/IP Addressing Scheme.

- Classful
- Classless
  - Variable Length Subnet Mask (VLSM)
  - Classless Interdomain Routing (CIDR)

1.3.2   Explain the advantages and disadvantages of static and dynamic routing.

- Static
  - Default
  - Simple
  - Summarization
- Dynamic
  - RIP Version 1
  - RIP Version 2
  - Open Shortest Path First (OSPF)
  - Enhanced Interior Gateway Routing Protocol (EIGRP)
  - Exterior Gateway Routing Protocol (EGRP)

1.3.3   Analyze the hardware Layer 3 functionalities of routers.

- Switching processes
  - Cisco Express Forwarding (CEF)
  - Fast Switching
  - Process Switching

1.3.4   Describe the various types of router interface modules.

- Interface types
  - Ethernet
  - Fast
  - Gigabit
  - Serial
  - ATM OC3/OC12/T1
- Integrated Services Digital Network (ISDN)
  - Basic Rate Interface (BRI)
  - Primary Rate Interface (PRI)

1.3.5   Explain the advantages and disadvantages of connectionless and connection- oriented protocols.

- Connectionless
  - User Datagram Protocol (UDP)
  - Internet Control Management Protocol (ICMP)
  - Simple Network Management Protocol (SNMP)
  - Simple Mail Transfer Protocol (SMTP)
- Connection-Oriented
  - Transmission Control Protocol (TCP)

1.3.6   Analyze network services.

- Dynamic Host Configuration Protocol (DHCP)
- Domain Name Service (DNS)
- Remote Authentication Dial In User Services (RADIUS) authentication

1.4   Analyze the application of security and control mechanisms within the OSI model.

1.4.1   Explain the use of hardware and software firewalls.

- Network Address Translation (NAT)
- Filtering
- Static Translations
- Port Address Translations

1.4.2   Describe the purpose of Quality of Service (QoS) control mechanisms and their application.

- IP Packet Queuing
  - Resource Reservation Protocol (RSVP)
  - Differentiated Services
- Control Mechanisms
  - Port Numbers
  - Sequence Numbers
  - Windowing
  - Retransmission

1.4.3   Describe commonly used tunneling and encryption methods.

- IPSec
- Layer 2 Tunneling Protocol (L2TP)
- Data Encryption Standard (3DES)
- Virtual Private Networks (VPNs)
- Generic Routing Encapsulation (GRE)
- Point to Point Tunneling Protocol (PPTP)
- Point to Point Over Ethernet (PPOE)
- Wireless Encryption Protocol (WEP)
- Extensible Authentication Protocol (EAP)
- Light Extensible Authentication Protocol (LEAP)
- Current standards

1.4.4   Explain industry-standard authentication methods.

- Application protocols
    - Remote Authentication Dial In User Services (RADIUS)
    - Terminal Access Control Access Control Software (TACACS) Plus
    - Local
    - Dual authentication concepts
    - e.g., CERT

1.4.5   Name commonly used network monitoring mechanisms.

- Network Intrusion Detection System
- Probes
- Protocol Analyzer

Instructional/Delivery Strategies:
Lectures
Labs
Multimedia/Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet
www.cisco.com
American Registry of Internet Numbers: www.arin.net
Request for Comments (RFC)

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory)
15%	30%	25%	30%

Number:	634C2.02
Title:	**Disaster Recovery**
Duration:	Total Hours: 18 Theory: 12 Practical: 6
Prerequisites:	Reportable Subject 1: Introduction to Advanced Networking
Co-requisites:	None
Cross-reference to Training Standard: 6293.01, 6293.02, 6293.03, 6293.04	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to explain the need for and assess a network recovery procedure for inclusion in the organizational disaster recovery and business continuity plans.

Learning Outcomes

Upon successful completion, the apprentice is able to:

2.1   Identify possible disaster scenarios.

    2.1.1   Define the sources of potential disasters.

- Fires
- Storms
- Water
- Temperature
- Power
- Hardware failure
- Terrorism
- Loss of key staff
- Theft
- Security breach
- Viruses
- Damage/loss of access to site

2.2   Identify the steps required to formulate a disaster recovery plan for the network.

    2.2.1   Assess business impact.

- Costs
  - Lost resources
  - Recovery time
  - Customer impact
  - Loss of production
  - Revenue
- Health and safety issues
  - Loss of visibility to environmental controls

    2.2.2   Evaluate and prioritize the risk associated with the loss of network components and data to the organization.

- Mission critical
- Important
- Minor

    2.2.3   Assess a network and system recovery strategy.

- Network documentation
- Backup strategies
  - Offsite storage
  - Physical media
    - Media resiliency
- Telco diversity
- Disaster recovery site
- Hardware
  - Spares
  - Power
    - Generator/UPS
  - Maintenance contracts
- Recovery time
  - Shut down
  - Restore
  - Start up
- Network and system resiliency
  - WAN design
  - LAN design
  - IP addressing scheme
  - Redundancy

- Network and system services resiliency
  - DNS
  - DHCP
  - RADIUS
  - Other

Instructional/Delivery Strategies:
Lectures
Labs
Case Studies
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry/Government Standards Reference Documentation
Internet
www.cisco.com

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory)
25%	20%	25%	30%

Number:	634C2.03
Title:	**Network Infrastructure Design**
Duration:	Total Hours: 114　　　Theory: 78　　　Practical: 36
Prerequisites:	Reportable Subject 1: Introduction to Advanced Networking
	Reportable Subject 2: Disaster Recovery
Co-requisites:	None
Cross-reference to Training Standard: 6290.01, 6290.02, 6290.03, 6290.04, 6290.05, 6295.01	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to design a network infrastructure and system environment based on the customer's requirements, resource limitations, and industry best practices.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3.1　Identify customer requirements.

　　　3.1.1　Define and document the customer's logical requirements.

- Services and application requirements
- Security
- Bandwidth
- System requirements
  - Number of PCs
  - Number of PDAs
  - Number of servers
  - Remote access
  - Future growth
- Geographical locations
- Environmental concerns
  - Safety requirements
- Network traffic
- Financial resources
- Fault tolerance/Business continuity
- Disaster recovery

3.2   Confirm the physical site.

    3.2.1   Document and inventory the customer's physical requirements and resources.

- Bandwidth
- Power systems
  - Backup power sources
  - AC/DC
- Site conditions
  - Building plans
  - Square footage
  - Cable access
  - Accessibility
  - Telco room
  - Government regulations
  - Industry standards and codes
  - Available rack space
- Environmental concerns
  - Temperature
  - Humidity
  - Safety requirements
- Connectivity
  - Megabits to the desktop
  - Megabits to the servers
  - Wireless access
  - Internet access
  - PC and server physical distribution

3.3   Design the preliminary logical network infrastructure and system environment for present and future growth projections based on business continuity and disaster recovery requirements.

    3.3.1   Choose a WAN topology.

- Mesh
- Point to Point
- Access method
  - DSL
  - ISDN
  - T1
  - ATM
  - Frame relay
  - Fibre

3.3.2   Choose a LAN topology.

- Star
- Bus
- Path redundancy
  o Core
  o Distribution
  o Access
- Routing protocol
- IP hierarchical addressing and summarization
  o Layer 2 broadcast control

3.3.3   Develop system security, business continuity, and disaster recovery strategies.

- Server/workstation/PDA backup strategy (application and data)
- Network resiliency
- Fault tolerance
  o RAID
  o Clustering
- Antivirus
- Intrusion Detection System (IDS)

3.3.4   Select workstation, PDA, and server platforms.

- Operating System (e.g., Linux, Windows, Unix, Novell, MAC)
- Application Software
  o Directory services
  o Mail
  o DNS
  o DHCP
- Hardware
  o RAM
  o CPU(s)
  o Storage capacity
  o Redundancy
  o Backup device and media
  o Network interface equipment
  o Peripherals (e.g., CD-ROM, audio, printing devices, NICs)
- Licensing

3.3.5   Identify network media.

- Copper
  - Category 5
  - Category 5e
  - Category 6
- Fibre
  - Multimode
  - Single mode
- Wireless

3.3.6   Determine the network hierarchical scheme, redundancy, and backup strategy.

- Core
  - Bandwidth requirements
  - Core switch locations
- Distribution
  - Network flow patterns
  - Bandwidth requirements
  - Router location
  - Server location
  - Wiring closet locations
    - Main Distribution Facility (MDFs)
- Access
  - Data flow patterns
  - Bandwidth requirements
  - Workgroup switch location
  - Intermediate Distribution Facility (IDFs)
  - Security
    - Demilitarized Zone
    - Firewall/Concentrator
  - Workgroups
  - Printers
- Future growth
  - Plan for 1-year, 3-year, and 5-year growth
  - Plan for near term technology advancements

3.3.7   Design the preliminary physical network infrastructure environment.

- Routing and switching hardware selection
  - Media type
  - Throughput
  - Processor requirements
  - RAM
  - Software version and features
  - Licensing

- Physical media infrastructure
  - Copper
  - Fibre
  - Wireless
- Electrical Infrastructure
- Building Codes/Fire Codes
- Environmental concerns
  - Temperature
  - Humidity
- Network Documentation
  - MDFs
  - IDFs
  - Jack locations
  - Implementation cost estimates

3.3.8   Gain customer design approval.

- Submit documentation.
- Revise based on customer feedback.
- Obtain final approval.

3.3.9   Formulate hardware procurement recommendations.

- Consider existing hardware.
  - Manufacturer compatibility
  - Maintenance and support
- Select vendor.
  - Tender process (large project)
  - Research and recommend (small project)
- Evaluate tenders and recommendations.
  - Use vendor resources
- Work with purchasing department and vendor.

Instructional/Delivery Strategies:
Lectures
Labs
Case Studies
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry/Government Standards Reference Documentation
Internet
www.cisco.com

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes
4. Design utilities

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory and Practical)
20%	30%	20%	30%

Number:	634C2.04
Title:	**Installation and Configuration**
Duration:	Total Hours: 84 Theory: 36 Practical: 48
Prerequisites:	Reportable Subject 1: Introduction to Advanced Networking
	Reportable Subject 2: Disaster Recovery
	Reportable Subject 3: Network Infrastructure Design
Co-requisites:	None
Cross-reference to Training Standard: 6291.01, 6291.02, 6291.03, 6291.04, 6295.02, 6295.03, 6295.04	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to install, configure, and test the network environment to industry standards and customer requirements.

Learning Outcomes

Upon successful completion, the apprentice is able to:

4.1   Verify that the hardware and software inventory and physical site readiness meet the network design requirements.

    4.1.1   Confirm the accuracy of the hardware and software received.

- Workstation, PDA, and server
- Operating system
- Software upgrades
- Physical modules
  - Connection types
  - Transceivers
  - Serial connectors
  - Carrier Service Unit/Data Service Unit (CSU/DSU)
  - Connectors
  - Tools
  - Wall jacks
  - Patch panels
  - Racks
  - Cable type
  - Cable length

4.1.2   Inspect the site environment for installation readiness.

- Power
- Grounding
- Temperature/humidity control
- Physical access security
- Cable access raceways

4.2   Install and configure the network components to industry standards.

4.2.1   Prepare servers (for each server)

- Configuration and burn in testing
  - Install hardware (e.g., drives, controllers, NICs)
  - Perform Power On Self Test (POST)
  - Configure drivers and controllers
  - Update firmware (if required)

4.2.2   Install network operating system.

- Install operating system, service packs, patches, and updates
- Implement required security measures
- Configure operating system services as per requirements (e.g., DHCP, DNS, WINS)
- Install vendor server management tools
- Install applications
- Test environments
- Document installation and disaster recovery procedure
- Rebuild server as per "as-built" documentation

4.2.3   Prepare workstations and PDAs

- Load images and configure each workstation/device

4.2.4   Install required cable run lengths.

- Label and document as per network drawings

4.2.5   Install patch panels and equipment racks.

- Rack mounts
- Wall mounts
- Cabinets
- Interconnect patch panel using manufactured and tested jumper cables
- Label and document as per network drawings

4.2.6   Terminate cable connectors at jack and patch panel.

- Label and document as per network drawings.

4.2.7   Test and certify the cable installation.

4.2.8   Install system and network components.

- Configure as per network documentation.
  - IP addressing
  - Routing
  - Switching
  - Security
    - Demilitarized Zone
    - Firewall/Concentrator
- Configure as per system documentation.
  - Workstation, PDA, and server platforms
  - Server/workstation/PDA backup
  - Antivirus
  - Intrusion Detection System (IDS)
  - DHCP
  - DNS
  - RADIUS
  - Directory services

4.2.9   Test network environment.

- Connectivity
- Backups
- Applications
- Services
- Redundancy
- Performance (benchmark)

4.2.10   Confirm network environment meets design requirements.

- Meets industry standards
- Meets customer requirements
- Licensing compliance

4.3   Diagnose and troubleshoot network environment problems as required to verify network design.

4.4   Finalize "as-built" documentation.

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory)
10%	40%	20%	30%

Number: 634C2.05
Title: **Network Repair**
Duration: Total Hours: 36   Theory: 15   Practical: 21
Prerequisites: Reportable Subject 1: Introduction to Advanced Networking
     Reportable Subject 2: Disaster Recovery
     Reportable Subject 3: Network Infrastructure Design
     Reportable Subject 4: Installation and Configuration
Co-requisites: None
Cross-reference to Training Standard: 6292.01, 6292.02, 6294.01, 6295.01

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to isolate, diagnose, and repair common network environment problems.

Learning Outcomes

Upon successful completion, the apprentice is able to:

5.1   Use standard troubleshooting techniques to investigate network environment problems.

   5.1.1   Gather relevant information regarding the network environment.

   - Document all relevant facts describing the problem
       o   Confirm the fault
       o   Trouble reports
       o   User complaints

   5.1.2   Identify the probable cause.

   - Confirm scope and magnitude of problem
       o   Isolated/global
   - Determine changes to the environment
       o   Change reports/logs
       o   Peer confirmation
   - Check for obvious errors and alarm indicators
       o   Monitoring systems
       o   Logs
       o   External cues
       o   Sensory indicators

- Check for known errors
- Check power
- Check logical connections
- Check physical connections
- Consider security threats
  - Viruses
  - Worms
  - Denial of service

5.2   Isolate network environment problem.

    5.2.1   Isolate network point of failure.

- Connectivity testing based on network schematic
  - PING
    - Extended
  - Traceroute
    - Extended
  - ARP
    - Show ARP
  - Layer 2 Discovery Protocol (CDP)
  - Monitoring software
- Power failure
- Media based
  - Connector
  - Transceiver
  - Broken media
- Server based
  - Login errors
  - DNS
  - DHCP
  - Client software
- Network switch and routing
  - Configurations
  - IP addressing error
  - Routing failure
  - CPU overload
  - Buffer over run
  - Spanning Tree error
- Failed hardware module
- Application-related failure

5.3   Implement a repair strategy.

    5.3.1   Review all information.

- Collected data
- Knowledge bases
- Technical manuals

    5.3.2   Formulate the strategies.

    5.3.3   Apply solution(s).

5.4   Verify the repair.

    5.4.1   Test the network.

5.5   Document solution(s).

Instructional/Delivery Strategies:
Lectures
Labs
Demonstration
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory)
10%	40%	20%	30%

Number:	634C2.06
Title:	**Network Maintenance and Optimization**
Duration:	Total Hours: 36 Theory: 18 Practical: 18
Prerequisites:	Reportable Subject 1: Introduction to Advanced Networking
	Reportable Subject 2: Disaster Recovery
	Reportable Subject 3: Network Infrastructure Design
	Reportable Subject 4: Installation and Configuration
	Reportable Subject 5: Network Repair
Co-requisites:	None
Cross-reference to Training Standard: 6294.01, 6294.02, 6294.03, 6294.04	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to maintain and optimize a network environment.

Learning Outcomes

Upon successful completion, the apprentice is able to:

6.1.   Maintain the network environment.

      6.1.1   Perform physical maintenance.

- Check for network traffic congestion.
  - Performance indicators (LEDs)
    - Excessive collisions
    - Dropped or discarded packets
    - Link light
- Check for integrity of physical media
  - Loose connectors
  - Improperly terminated connectors
  - Db loss on fibre
  - Wireless signal strengths

6.1.2　　Perform software/firmware maintenance.

- Updates
- Service packs
- Patches
- Anti-virus and security updates
- License management
  - Concurrent users
- Accounts and permissions administration

6.1.3　　Monitor network/server performance.

- Network monitoring (e.g., SNMP)
  - Network traffic patterns
  - Bandwidth usage
  - Interface errors
  - CPU usage
  - Environmental concerns
    - Temperature
    - Humidity
  - Logs
    - Syslog server
    - Event logs
    - Backup logs

6.2.　Optimize network performance.

6.2.1　　Ensure optimal switch functionality.

- Broadcast propagation
- Port configuration
- Spanning Tree convergence optimization
  - Port Fast
  - Uplink Fast
  - Backbone Fast
  - Bridge Protocol Data Unit (BPDU) filter
  - Loop guard
  - Per VLAN Spanning Tree (PVST)
  - Optimal root bridge selection

6.2.2   Ensure optimal router functionality.

- Routing process
  - Broadcasts
  - Multicast
  - Unicast
- CPU processes
- Buffer overflow
- Packet drops
- Cyclical Redundancy Check (CRC) errors
- Input/Output errors
- Memory usage
- Software bugs

6.2.3   Ensure optimal server functionality.

- CPU processes
- Packet drops
- Cyclical Redundancy Check (CRC) errors
- Input/Output errors
- Memory usage
- Storage
- Port configuration

6.3.   Verify network performance.

6.3.1   Perform baseline testing.

6.3.2   Compare results to "as built" baseline test results.

6.4.   Document network and system changes.

Instructional/Delivery Strategies:
Lectures
Labs
Case Studies
Review
Class Participation/Recall
Online

Reference Materials:
Manufacturers' Manuals
Industry/Government Standards Reference Documentation
Internet

Minimum Equipment List:
1. Computer systems
2. Peripherals as identified in learning outcomes
3. Software as identified in learning outcomes

Evaluation Structure			
Assignment	Lab/Practical	Theory Test	Final Assessment (Theory and Practical)
20%	30%	20%	30%

skilledtradesontario.ca