Apprenticeship
Curriculum Standard
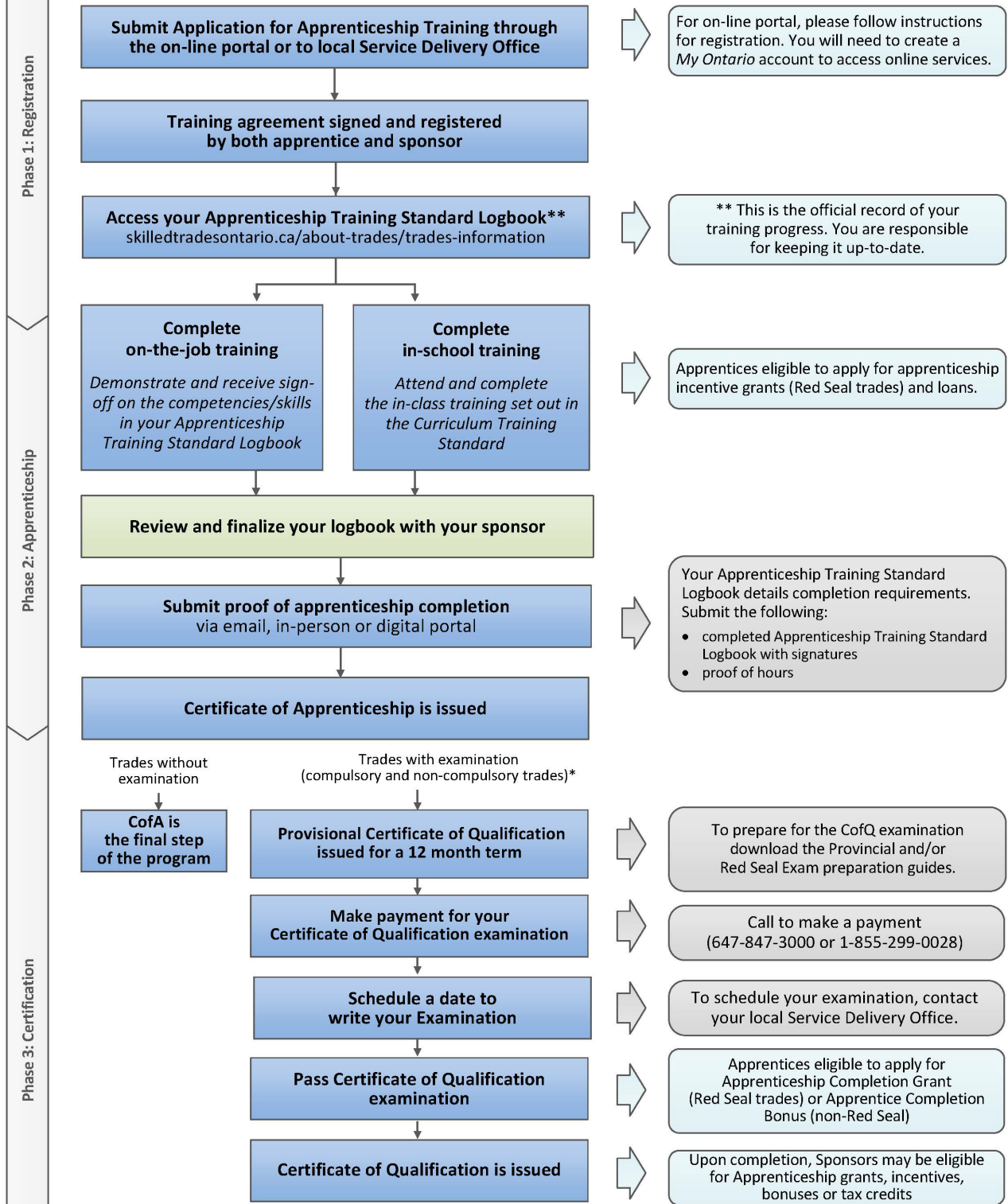
Information Technology —
Hardware Technician

Levels 1 & 2

634B

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

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Table of Contents

Please Note: 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 — Hardware 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 Hardware 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 Hardware 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 includes specific references to the Ministry of Labour, Immigration, Training and Skills Development Apprenticeship Training Standards. While these references to various performance objectives in the Training Standards have been linked to the respective in-school outcomes, employers should not assume complete coverage to a journeyperson level. The in-school delivery focuses primarily on the knowledge required to master the respective objectives outlined in the Training Standards. Employers, therefore, are expected to complete the training of these respective objectives by applying the prescribed in-school knowledge to the required practical learning experienced in the work setting.

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

Program Summary of Reportable Subjects

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 Hardware Technician				
1	Intermediate Electrical/Electronics	60	36	24
2	Integrated Circuit Concepts	24	9	15
3	Peripheral Devices	78	51	27
4	Maintaining Microcomputer Systems and Peripherals	48	21	27
5	Advanced Troubleshooting	60	9	51
Level 2 Totals		**270**	**126**	**144**
Totals		**630**	**282**	**348**

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.

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- 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

Hardware Technician

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

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1	Intermediate Electrical/Electronics	60	36	24
2	Integrated Circuit Concepts	24	9	15
3	Peripheral Devices	78	51	27
4	Maintaining Microcomputer Systems and Peripherals	48	21	27
5	Advanced Troubleshooting	60	9	51
	Totals	**270**	**126**	**144**

Number:	634B2.01		
Title:	**Intermediate Electrical/Electronics**		
Duration:	Total Hours: 60	Theory: 36	Practical: 24
Prerequisites:	Level 1		
Co-requisites:	None		
Cross-reference to Training Standard: 6279.01, 6279.02, 6279.03, 6279.04			

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to apply electrical/electronic theory to identify and explain electrical and electronic components and associated tools for repair of microcomputer systems and peripherals.

Learning Outcomes

Upon successful completion, the apprentice is able to:

1.1   Explain electrical/electronic concepts.

    1.1.1   Describe semiconductors.

- N and P junctions
- Transistor
- Diode/diagnostic lights

    1.1.2   Define circuit protection concepts.

- Fuses
- Metal oxide varistor (MOV)
- Circuit breaker

    1.1.3   Identify types of switches.

- Mechanical
- Solid state
- Solenoids/relays
- Sensors
- Proximity and auditory alarms

1.1.4   Explain the concept of switching.

- Mechanical
- Solid state
- Solenoids/relays
- Sensors
- Proximity and auditory alarms

1.1.5   Identify types of motors and fans.

- Steppers
  - 4-wire
  - 5-wire
  - 6-wire
- DC motors
  - 2-wire
  - 4-wire
- DC servos
  - 2-wire

1.1.6   Explain the operation of motors and fans.

- Steppers
  - 4-wire
  - 5-wire
  - 6-wire
- DC motors
  - 2-wire
  - 4-wire
- DC servos
  - 2-wire

1.1.7   Explain the application of motors and fans.

- Steppers
- DC motors
- DC servos

1.1.8   Identify display/control modules.

- LCD
- LED
- Control panels

1.1.9   Explain load concepts.

- Device connected vs. not connected

1.1.10   Explain power consumption concepts.

- Power source vs. load

1.1.11   Describe different cooling methods.

- Cooling failsafes
- Thermistors
- PC concepts
- Printer concepts

1.2   Identify electronic symbols.

- Resistor
- Capacitor
- Transformer
- Diode
- Switch
- Transistor
- Motor
- LED/light bulb
- IC
- Regulator

1.3   Identify approved safety labels.

- Canadian Standards Association (CSA)
- Federal Communications Commission (FCC)
- Underwriters Laboratories Canada (ULC)
- Underwriters Laboratories (UL)

1.4   Explain analog concepts.

1.4.1   Define AC wave.

1.4.2   Define Root Mean Square (RMS).

1.4.3   Define the process of analog to digital conversions.

1.5   Explain power supply components.

    1.5.1   Identify specifications.

- Input/Output

    1.5.2   Describe the operation of transformers.

    1.5.3   Describe the operation of voltage regulators.

    1.5.4   Identify types of filters.

- Inductors
- Capacitors
- Ferrite cores/rings

1.6   Demonstrate the use of service tools.

    1.6.1   Identify types of service tools and fasteners.

- Hand tools
- Power tools
- Fasteners
  - Standard and metric
- Screw types
  - Standard and metric
  - Machine vs. self-tapping
- Electrical/electronics service tools
  - Gauges
  - Dial
  - Tension
  - Feeler
  - Extraction tools
  - Magnification devices
- Electrical/electronics equipment
  - Logic probe
  - Huntron tracker
  - Oscilloscope

1.6.2   Utilize service tools.

- Hand tools
- Power tools
- Electrical/electronics service tools
  - Gauges
  - Dial
  - Tension
  - Feeler
  - Extraction tools
  - Magnification devices
- Electrical/electronics equipment
  - Logic probe
  - Huntron tracker
  - Oscilloscope

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

Reference Materials:
Manuals
Industry Standards Reference Documentation
Internet
Multimedia

Minimum Equipment List:
1. Various hand tools
2. Electrical/Electronic components as identified in learning outcomes
3. Electrical/Electronic tools and equipment as identified in learning outcomes
4. Computer system and peripherals as identified in learning outcomes

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

Number:	634B2.02
Title:	**Integrated Circuit Concepts**
Duration:	Total Hours: 24 Theory: 9 Practical: 15
Prerequisites:	Reportable Subject 1: Intermediate Electrical/Electronics
Co-requisites:	None
Cross-reference to Training Standard: 6279.01, 6279.02, 6279.03, 6279.04, 6280.01, 6280.02, 6280.03, 6280.04, 6280.05	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to apply repair techniques to integrated circuits and circuit boards.

Learning Outcomes

Upon successful completion, the apprentice is able to:

2.1   Identify types of integrated circuits.

- Packaging
  - Surface Mount Technology (SMT)
  - Solder-through
  - Socket
- Casing
- Product identification
- Installation techniques

2.2   Visually inspect circuit boards.

- Cracks
  - Cold solder
  - Trace
  - Board
- Discolouration
  - Solder
  - Components
  - Trace
- Bad or missing components
- Burnt components
- Foreign objects

2.3   Interpret bloc/schematic diagrams.

2.4   Determine repair strategy.

     2.4.1   Identify warranty policy and procedures.

- In warranty
- Out of warranty

     2.4.2   Apply replacement techniques.

- Board
- Component
- Assembly

     2.4.3   Apply repair techniques.

- Board
- Component
- Assembly

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

Reference Materials:
Manuals
Industry Standards Reference Documentation
Internet
Multimedia

Minimum Equipment List:
1.   Various hand tools
2.   Electrical/Electronic components as identified in learning outcomes
3.   Electrical/Electronic tools and equipment as identified in learning outcomes
4.   Computer system and peripherals as identified in learning outcomes

Evaluation Structure		
Labs	Practical Assignment	Final Assessment
40%	30%	30%

Number:	634B2.03
Title:	**Peripheral Devices**
Duration:	Total Hours: 78 Theory:51 Practical: 27
Prerequisites:	Reportable 1: Intermediate Electrical/Electronics
	Reportable 2: Integrated Circuit Concepts
Co-requisites:	None
Cross-reference to Training Standard: 6280.01, 6280.02, 6280.03, 6280.04, 6280.05	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to explain peripheral device technologies and their associated safe handling procedures.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3.1   Explain how printers function in an application environment.

    3.1.1   Identify different types of printing technologies.

- Page printer
- Ink jet
- Thermal
- Impact

    3.1.2   Explain the printing technologies.

- Page printer
    - Laser/LED
        - Mono vs. colour
- Ink jet
    - Dye sublimation
    - Phase change
    - Piezo-electric
    - Thermal
- Thermal
    - Direct
    - Wax transfer

- Impact
  - Serial dot matrix
  - Line dot matrix/print shuttle/band
  - Daisy wheel

3.1.3   Define printing terminology.

- Page protection
- Characters per second (CPS)
- Page per minute (PPM)
- Bi-directional (Bi-D) vs. Uni-directional (Uni-D)
- Dots per inch (DPI)
- Resolution improvement technologies
  - Edge smoothing
- Printer language/emulations
- Fonts
  - Fixed
  - Scaleable
  - Raster
  - Vector
  - True type
  - Internal/External

3.1.4   Explain memory concepts.

- Physical memory
- Spooling
- Queuing
  - Local
  - Network

3.1.5   Recognize diagnostic indicators.

- LED
- Buzzer
- Software

3.2   Describe digital imaging.

3.2.1   Describe digital imaging processes.

- Scanners
  - Mono vs. colour Charge Coupled Device (CCD)
- Fax machines
- Digital cameras
- Digital camcorders
- Lighting/illumination
- All-In-One/multi-function device

3.3   Explain the operation of display technologies.

    3.3.1   Describe different types of display technologies.

- Cathode Ray Tube (CRT)
- Liquid Crystal Display (LCD)
- Plasma
- Light Emitting Diode (LED)
    - Point of Sale (POS) environments
- Data/Video Projector
    - Digital Light Processing (DLP)
    - LCD

3.4   Identify potential hazards.

    3.4.1   Identify potential printer hazards.

- Laser optical hazards
- High voltage
- Static
- Environmental
    - Waste management
    - Ozone
    - Chemical
- Heat
- Mechanical

    3.4.2   Identify potential display hazards.

- High voltage
- Static
- Electromagnetic field (EMF)
- Environmental
    - Waste management
    - Chemical
- Heat

    3.4.3   Identify potential digital imaging hazards.

- Bright light
- High voltage
- Static
- Environmental
    - Waste management
    - Chemical
- Heat
- Mechanical

3.4.4   Describe safe handling procedures.

- Printers
- Displays
- Digital imaging

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

Reference Materials:
Manuals
Industry Standards Reference Documentation
Internet
Multimedia

Minimum Equipment List:
1. Various hand tools
2. Electrical/Electronic components as identified in learning outcomes
3. Electrical/Electronic tools and equipment as identified in learning outcomes
4. Computer system and peripherals as identified in learning outcomes

Evaluation Structure		
Assignments	Theory Test	Final Assessment
40%	30%	30%

Number:	634B2.04
Title:	**Maintaining Microcomputer Systems and Peripherals**
Duration:	Total Hours: 48 Theory:21 Practical: 27
Prerequisites:	Reportable 1: Intermediate Electrical/Electronics
	Reportable 2: Integrated Circuit Concepts
	Reportable 3: Peripheral Devices
Co-requisites:	None
Cross-reference to Training Standard: 6280.01, 6280.04, 6280.05	

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to service and maintain microcomputer systems and peripherals.

Learning Outcomes

Upon successful completion, the apprentice is able to:

4.1   Use cleaners/solvents and lubricants according to manufacturers' specifications.

- Compressed air
- Vacuum
- Oil/grease
- Rubber rejuvenator
- Lens/glass cleaner
- Denatured alcohol
- Degreaser
- Detergent
- Anti-static cloths and sprays
- Lint-free cloths

4.2   Demonstrate servicing techniques for chassis maintenance.

4.2.1   Identify the elements for chassis maintenance

- Cleaning
  o Air flow
  o Foreign substances
  o Lubrication
  o Internal/external
- Checking fasteners
- Checking mounting devices

4.2.2   Apply service techniques for chassis.

4.3   Demonstrate servicing techniques for printer mechanism.

    4.3.1   Identify the elements for paper feed assemblies service.

- Input mechanism
    - Trays
    - Tractor/friction
    - Pick up rollers
    - Sensors
    - Motors
    - Clutches
    - Belts
- Paper feed mechanism
    - Paper path
    - Levers
    - Sensors
    - Gears
    - Rollers
    - Motors
    - Clutches
    - Belts
- Output mechanism
    - Rollers
    - Gears
    - Duplexer
    - Collator
    - Tray
    - Sensors
    - Heating unit
    - Fusing unit
    - Motors
    - Clutches
    - Belts

    4.3.2   Apply service techniques for paper feed assemblies.

    4.3.3   Identify the elements for fuser maintenance.

- Fuser assembly
- Sub assembly
    - Heat lamp
    - Heat/Teflon roller
    - Pressure roller
    - Cleaning roller
    - Gears

    4.3.4   Apply service techniques for fusers.

4.3.5   Identify the elements of image creation assemblies.

- Page printer
  - Imaging cartridges
  - Optical
  - Charge/transfer
    - Corona wire
    - Brushes
    - Rollers
  - Fan
    - Filter
- Ink jet
  - Printhead
  - Ink supply system
    - Ink cartridges
    - Cap/pump/wiper
    - Waste ink
  - Carriage assembly
    - Motors
    - Belts
    - Gears
    - Sensors
  - Fan
- Impact
  - Ribbons
  - Printhead
  - Carriage assembly
    - Motors
    - Belts
    - Gears
    - Sensors
  - Fan
- Thermal
  - Printhead
  - Paper
  - Carriage assembly
    - Motors
    - Belts
    - Gears
    - Sensors
- Scanners
  - Scanhead
    - Lamps

      o Carriage assembly
- Motors
- Belts
- Gears
- Sensors
- Glass

4.3.6   Apply service techniques for image creation assemblies.

4.4   Demonstrate servicing techniques for power supplies and fans.

- Repair/replace

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

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet
Multimedia

Minimum Equipment List:
1. Various hand tools
2. Electrical/Electronic components as identified in learning outcomes
3. Electrical/Electronic tools and equipment as identified in learning outcomes
4. Computer systems and peripherals as identified in learning outcomes
5. Cleaners/solvents and lubricants
6. Personal protective equipment as required

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

<table>
<tr><td>Number:</td><td colspan="3">634B2.05</td></tr>
<tr><td>Title:</td><td colspan="3">Advanced Troubleshooting</td></tr>
<tr><td>Duration:</td><td>Total Hours: 60</td><td>Theory:9</td><td>Practical: 51</td></tr>
<tr><td>Prerequisites:</td><td colspan="3">Reportable 1: Intermediate Electrical/Electronics</td></tr>
<tr><td></td><td colspan="3">Reportable 2: Integrated Circuit Concepts</td></tr>
<tr><td></td><td colspan="3">Reportable 3: Peripheral Devices</td></tr>
<tr><td></td><td colspan="3">Reportable 4: Maintaining Microcomputer Systems and Peripherals</td></tr>
<tr><td>Co-requisites:</td><td colspan="3">None</td></tr>
<tr><td colspan="4">Cross-reference to Training Standard: 6280.01, 6280.02, 6280.03, 6280.04, 6280.05</td></tr>
</table>

General Learning Outcome

Upon successful completion of the reportable subject, the apprentice is able to diagnose and repair microcomputer systems and common peripherals.

Learning Outcomes

Upon successful completion, the apprentice is able to:

5.1   Test cables and conduits.

      5.1.1.   Identify advanced testing equipment.

- Digital volt meter
- Timed domain reflectometer
- Tone generator
- Wiremap tester
- Noise tester
- Breakout box

      5.1.2.   Identify various types of cables.

- Serial
- Parallel
- USB/USB2
- Fire wire
- Optical fibre
- Internal cables

      5.1.3.   Apply advanced techniques to test cables.

5.2   Diagnose printers, faxes, and scanners.

- Image quality
- Connectivity
- Memory
- Diagnostic indicators
- Mechanical assemblies
  - Paper feed assemblies
  - Imaging assemblies
- Consumables
  - Paper
  - Ink
  - Ribbon
  - Imaging cartridge
    - Toner
    - Organic Photo Conductor (OPC)
    - Developer

5.3   Repair printers, faxes, and scanners.

- Image quality
- Connectivity
- Memory
- Diagnostic indicators
- Mechanical assemblies
  - Paper feed assemblies
  - Imaging assemblies
- Consumables
  - Paper
  - Ink
  - Ribbon
  - Imaging cartridge
    - Toner
    - Organic Photo Conductor (OPC)
    - Developer

5.4   Diagnose and repair monitor.

5.4.1.   Diagnose image quality.

5.4.2.   Adjust image quality.

- Focus
- Brightness
- Contrast
- Vertical/horizontal positioning

- Colours
- Degaussing
- Calibration
- Pin cushion

5.4.3. Repair/replace monitor.

5.5 Diagnose power supplies and fans.

5.6 Repair power supplies and fans.

5.7 Replace circuit boards.

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

Reference Materials:
Manufacturers' Manuals
Industry Standards Reference Documentation
Internet
Multimedia

Minimum Equipment List:
1. Various hand tools
2. Electrical/Electronic components as identified in learning outcomes
3. Electrical/Electronic tools and equipment as identified in learning outcomes
4. Computer systems and peripherals as identified in learning outcomes
5. Cleaners/solvents and lubricants
6. Personal protective equipment as required

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

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