Computer Hardware Maintenance

IT, Networking and Cloud

Course Description

This course is designed to help job roles that are involved in a computer hardware and network maintenance. The module discusses the basic hand tools used for hardware maintenance, installing programs, components of the computer, troubleshooting techniques and upgradation other important aspects. At the end of this course, the learners will be able to use the tools and techniques in their work life with the minimum supervision and they will be able to carry out jobs according to the industry standards.

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Instructional Objectives

This Module is intended to explain:

- Methods of disassembling and assembling of Computers and its I/O devices

- Basic troubleshooting methods of computers

- Procedures connecting external devices to computers

- Steps for the installation of software and operating system

- Management of files in Linux/Windows environment

- Considerations for the customization of computers

- Service and Maintenance of Computer Hardware

Learning Outcomes

At the end the module you should be able to:

- Disassemble and assemble PC using basic hand tools

- Perform basic troubleshoot of PC

- Work with different cables, connectors and its crimping techniques for PC

- Install and maintain software programs for a PC

- Manage files effectively in Windows and Linux environment

- Customize PC in Windows and Linux environment

- Conduct service and Maintenance of Computer Hardware

1. Basic Hand Tools

A hand tool is any tool that is operated by hand rather than a motor. Following are some of the most commonly used basic hand tools in the industry.

Screwdrivers	Hammers	Tape Measures	Pliers	Utility Knives
Adjustable spanner	Bubble Levels	Putty knife	Spanners	Drills
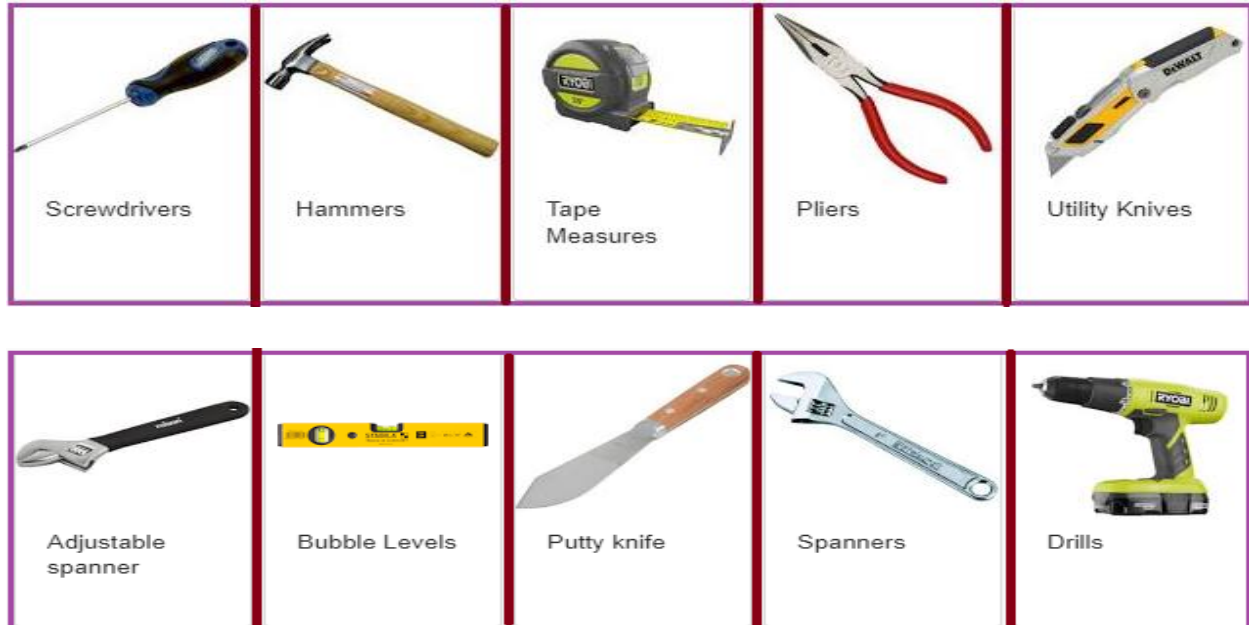
Tweezers

A tweezer is a small tool which is made of metal and joined at two ends. Tweezers are used for picking up objects too small to be handled from fingers and it is used to grab the object or to hold the hot object. The common use of tweezers is to manipulate the small objects, and particularly like surface mount, electronic parts and small mechanical parts for models.

The tweezers are useful when we drop a minor part into the inside of a system; typically, we can take out the part without entirely disassembling the PC.

1.1 Types of Tweezers
- Slanted tip
- Pointed tip
- Pointed slant
- Square tip
- Round tip
- Curved

Screwdriver

Screwdriver, also termed as turn screws is a handheld, a manually motorized tool designed for insertion, tightening and removal of screws. The screwdriver has a handle and a shaft ending in a tip. The shaft is made of steel to resist bending or twisting, and the handle is of metal, wood or plastic and it will be in hexagonal, square or oval in cross-section to improve the grip. A variety of screwdrivers used in the process of computer hardware maintenance. Below are some of the commonly used screwdrivers.

Further, there is a wide variety of power screwdriver starts with a simple stick type with batteries, a motor, and a powerful pistol is a cordless drill which functions as a screwdriver.

Cutting Pliers

Cutting pliers also called as 'diagonal pliers' used to cut the wire. The pliers are useful for bending and compressing a wide range of materials. The pliers are off in different shapes and in sizes and for many uses. Some of them used for gripping something round like a pipe or rod and some are used as twisting wires.

The varieties of pliers are:

- Slip-joint
- Water-pump
- Linesman
- Locking
- Needle-nose

Crimping tools

A crimping tool is a device used to combine two pieces of metal by twist one or both in a way that causes them to hold each other. An example of the crimping is the process of fixing a connector to the end of a cable. Crimping is mainly used in metalworking.

Soldering iron

A soldering iron is made up of a heated metal tip. It generates heat to melt spool solder so that it can stick between two workpieces or metal object.

De-soldering Pump

The de-soldering pump also termed as solder sucker used to remove the soldered items, heats the component on one side and uses the De-soldering Pump on the other side and it will be de-soldered. The pump looks like an injection tube used for removing the soldered component from a circuit.
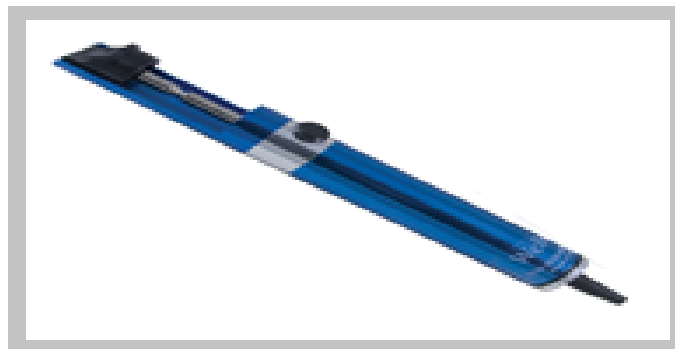
1.2 Safety hazards on basic hand tools

Often, we have heard that power tools are dangerous. The basic hand tools are even more dangerous. Though the basic hand tools appear to be harmless, they are dangerous in the hands of those who don't know how to use them. One of the surveys's conducted, it was estimated that around 8% of the common workplace injuries are due to mishandling of basic hand tools in the workshop. These injuries and accidents can be dangerous to the extent of loss of eyesight, fingers, hands, legs and often life.

Some basic hand tools safety hazards

- Hammer Safety
- Power Drill Safety
- Power Saw Safety
- Hand Files & Rasp Safety
- Chisel Safety
- Tool Boxes, Tool Chests & Cabinets

2. Disassembling and Assembling PC

2.1 Introduction to computers

The computer is an electronic device that obtains input, stores or processes the input as per the user's instructions provides output in the desired format. In the face pacing world, it is difficult to imagine life without computers. They have become an inevitable part of human's

life. Whether is an academic institution, hospital, government office, railway stations, airports or any other place, the computers are an inevitable part of human's life. The precise sense of computer is a device that can calculate. Nevertheless, contemporary computers can do many more things than just calculation.

2.2 Basic building blocks of a digital computer

The application is a computer program which is designed to help people perform an activity using the computer. Below are some of the most common building blocks of a digital computer.

- **The Arithmetic and Logic Unit (ALU)**

The Arithmetic and Logic unit performs computational and logical functions.

- **Random Access Memory (RAM)**

Random Access Memory is a data storage in that stores the information that the computer currently being used. It is a temporary storage. As soon as the computer is shut down, the data in the RAM will be lost.

- **Control Unit (CU)**

The Control Unit directs the operations of a processor. It helps computer's memory about how to respond to the instructions given by the user.

- **Man-machine interfaces**

It is also known as Human – Machine interface. The Human- Machine interface consists of hardware and software that allow user to provide inputs which later convert as signals to machines.

- **Switched Mode Power Supply (SMPS)**

Switched Mode Power Supply it is used to convert the Switching regulator to electrical power

- **Hard disk drive**

It is the data storage hardware device in a computer.

- **External storage**

It is used outside the computer; External storage sometimes needs an extra power source.

- **Internal storage**

It is inside installed inside the computer.

2.3 Different types of I/O

A. Input devices

The image below shows some of the most important input devices.

B. Output devices

3. Troubleshooting Techniques

3.1 Basic Troubleshooting Techniques

When a problem occurs, don't panic! Instead of that, work your way through some basic troubleshooting techniques and try to solve the problem.

1. Attempt to find out the problem with basic checks
2. Try to solve those problems with the basic method
   - Check the power connection
   - Check whether the monitor turned on
   - Reboot the system if the system takes an unusually long time
   - Ensure all the power connections, wires, cards are properly connected
   - Ensure the wires are connected in the correct port
   - If any new device is added, disconnect it until the system works fine and then plug in

If still the problem is not identified check for a user manual, access websites or helplines to fix the issue.

4. Cables and Connectors

Cables and connectors used to connect one device to another inside and outside the computer device. Generally, the connectors are either contain one or more visible pins or contain holes in which the pins are inserted. Below are some of the examples of cables and connectors.

a. Cables\Wires

- SATA Cable (Hard Drive to Motherboard).
- Portable HDD Dock and Wires to Motherboard.
- Accessory Wire (Connected Card Reader to Motherboard).
- Drive Ribbon (CD/DVD Drive to Motherboard).

b. Cable and Connectors

VGA Cable

Also known as D-sub cable, analog video cable. Connect the one end to computer monitor, television (PC input port). Connect another end to VGA port on the computer.

DVI Cable

Connect one end to a computer monitor. Connect another end to DVI port on the computer.

HDMI Cable

It connects one end to computer monitor, television. Connect another end to HDMI port on the computer

PS/2 Cable

It connects one end to the PS/2 keyboard, PS/2 mouse. Connect another end too: PS/2 ports on the computer.

Ethernet Cable

Ethernet cable also known as RJ-45 cable, connect one end to the router, network switch. Connect another end to the Ethernet port on the computer (see image above).

mm Audio Cable

Also known as phone connector, It connects one end to computer speakers, 3.5mm headphones, 3.5mm microphone Connect another end too: audio ports on the computer (see image above use Green socket).

USB Cable

There two formats of USB: USB 2.0 and the newer USB 3.0. in USB computer cable connections.

Computer Power Cord

Connect one end to AC power socket. Connect another end too: power supply unit (see image above).

ThunderBolt /USB-C

Mostly seen on laptops and Apple Macs these cables are high speed and can carry Data, video and other information.

Display Port

It is a digital display interface particularly computer monitors. It was developed by the Video Electronics Standards Association (VESA).

5. Software installation

The installation method for software depends on your operating system and the program you are installing. Many computer programs can be executed by copying that into a folder stored on a computer and executing them.

5.1 Types of software

System Software

It is programs and the file that comprises the operating system

Application Software

It is a subclass of a computer program which utilizes the capabilities of the computer.

5.2 Differences between Linux and Windows OS:

- Linux is an open source but windows os is not an open source.
- Linux supports file formats like Xfs, Btrfs, FAT, FAT32, Ext2 and windows os file formats supports FAT, FAT32, NTFS, exFAT.
- GUI and Kernel different in Linux but not in Windows.
- Linux is more secure compared to Windows OS.
- In windows, many users can log in to the operating system but in Linux single user can use it at a time. And Linux many users can be logged into the system.

Windows 32 bit, and 64-bit System

- 64-bit of Windows and processor will have the capability to install more than 4GB of RAM or more.
- 32-bit can only accommodate a 4GB of RAM, but it will only read 3.2GB of RAM when you look at your control panel.

- We can install 32-bit and 64-bit version of the application on a 64-bit version of Windows processor. But we are not able to install the 64-bit version of applications in the 32-bit version of Windows.

6. File Management

The document can be stored in anywhere, it is important to keep them organized and up-to-date. The goal of electronic file management is to ensure that you can find what you're looking for, even if you're looking for its years after its creation.
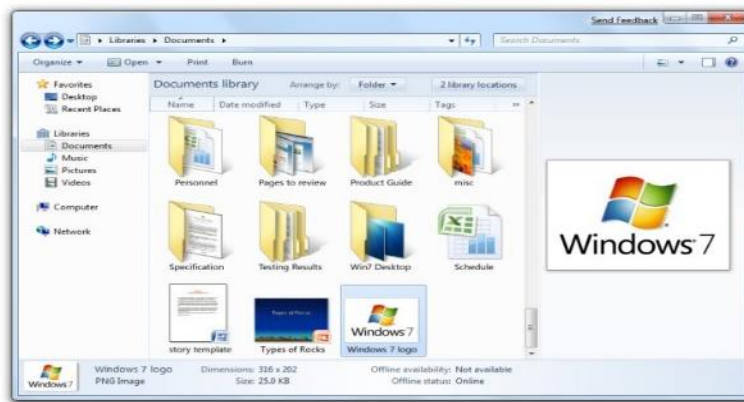

6.1 Functions of Keyboards

The keyboard is an input device used to enter characters and functions into the computer system by pressing buttons and keys. The keyboard is a primary device to enter text contains keys for individual letters, number, and specific keys.
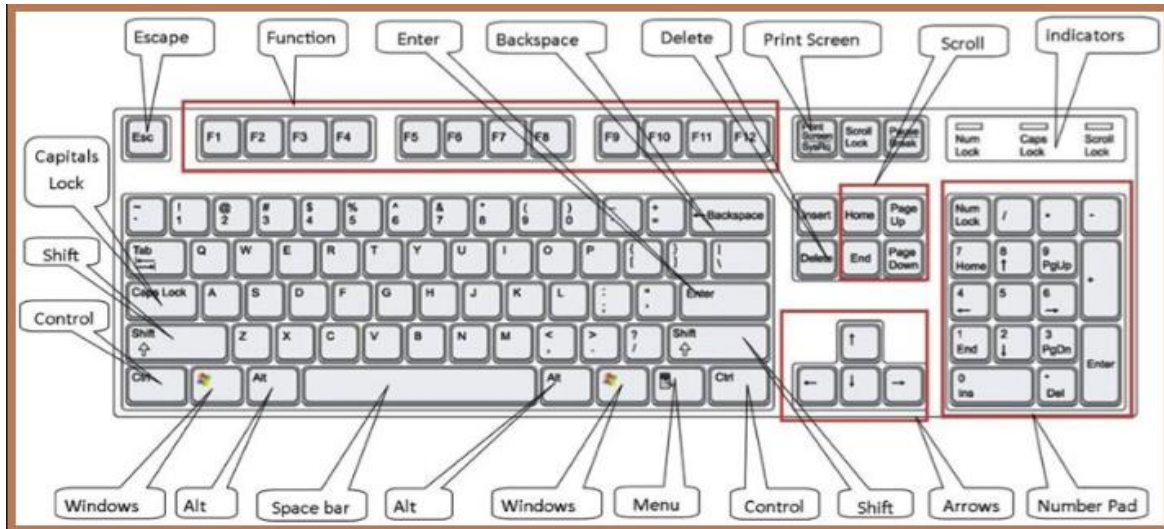
6.2 Functions of the Mouse

The mouse is a handheld pointing device which is used to points a cursor on the computer system. The device allows the user to select the item stored on a computer and similarly perform actions.
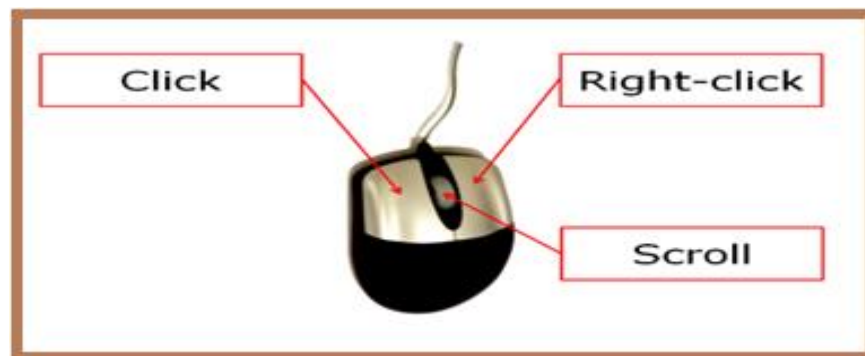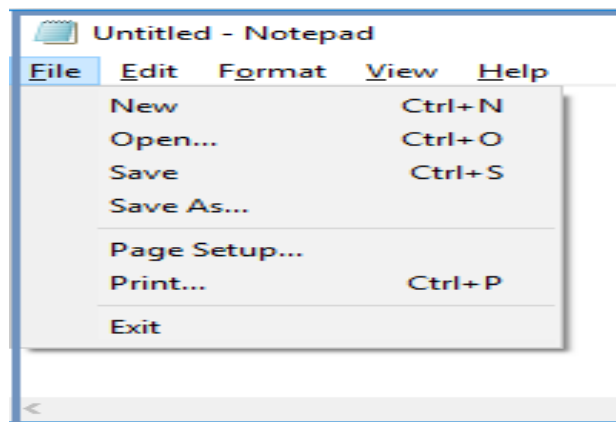

6.3 Application of MS Paint

MS paint is a simple program available in most of the versions of Microsoft programs. The work performed on MS Paint can be saved in any of the formats given below:

- JPEG
- Bitmap
- PNG
- GIF
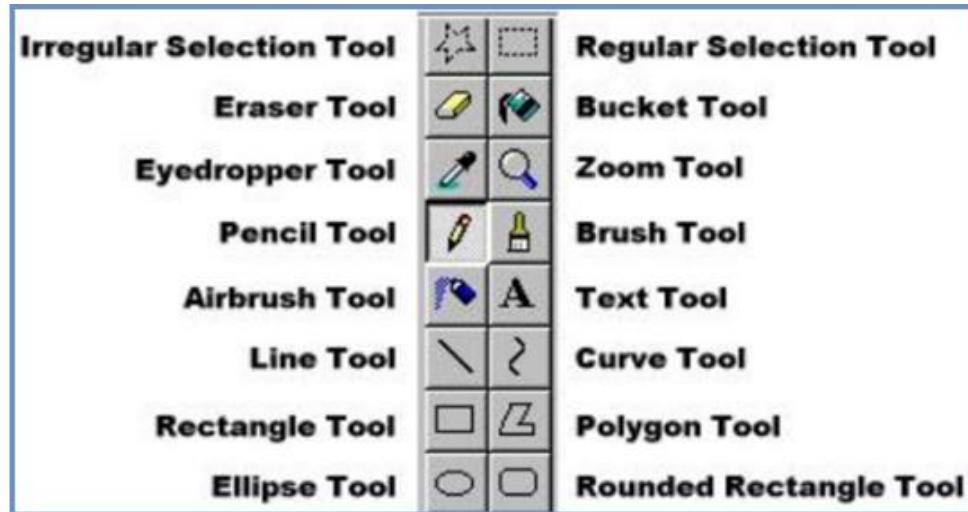
6.4 Application of Notepad

Notepad is a simple text editing program which helps users to create documents.

6.5 Different Text Formats

Following are some of the most important text file formats.

- .doc and .docx - Microsoft Word file.

- .odt - OpenOffice Writer document file.

- .pdf - PDF file.

- .rtf - Rich Text Format.

- .tex - A LaTeX document file.

- .txt - Plain text file.

- .wks and .wps- Microsoft Works file.

- .wpd - WordPerfect document.

6.6 Different file formats
The different types of image file formats are:

- TIFF (.tif, .tiff) Tagged Image File Format

- Bitmap (.bmp) Bitmap Image File

- JPEG (.jpg , .jpeg) Joint Photographic Experts

- GIF (.gif) Graphics Interchange Format

- PNG (.png) Portable Network Graphics

- Eps (.eps) Encapsulated PostScript file

- Raw image files (.raw, .cr2 , .nef , .orf , .sr2 and more)

6.7 Advantages of compressing files
Storage space provided by computer hard drives comes at a price. Compressing data files allow you to store more files in a storage space which is available. The compressed file is used in zip file technology and it can compress the file up to 50 % of its original file.

Preview.rar   Preview.zip

6.8 Distinguish between backup and cloning
Backup operation of Acronis software creates an image file for backup and for recovery purpose. When the Acronis backup is created, you will get a compressed file (. Tib) file which contains an exact copy of the hard disk, files or folders.

Cloning is a tool which copies all the data or content to one hard disk drive to another. Disk clone is a one-time operation to design a clone to one high hard disk content to another new

machine which results with the source and target disk have the same data. Once the content is copied to new machines no need to reinstall and reconfigure all the software.

7. Open office

An Apache Open office is an open source software suite, and it is designed alternative to MS office. It contains various components and has its own file formats and it is able to read and save other file formats.
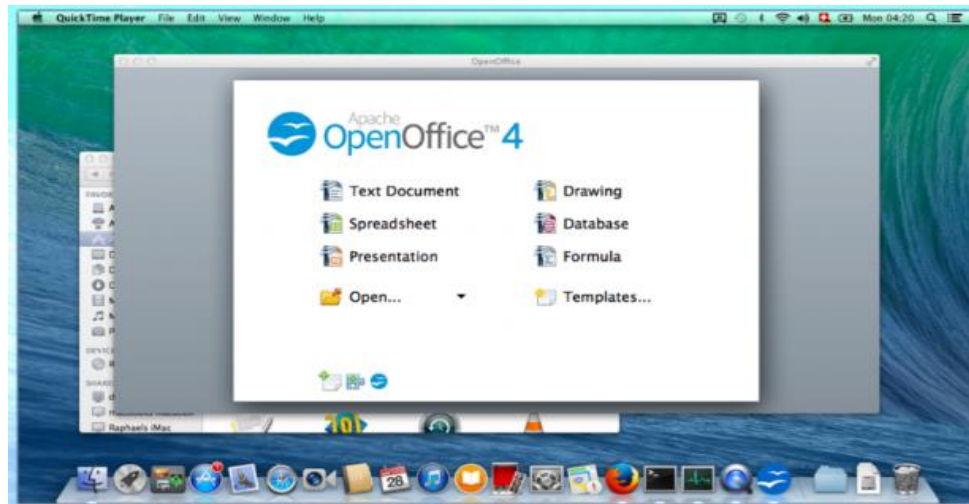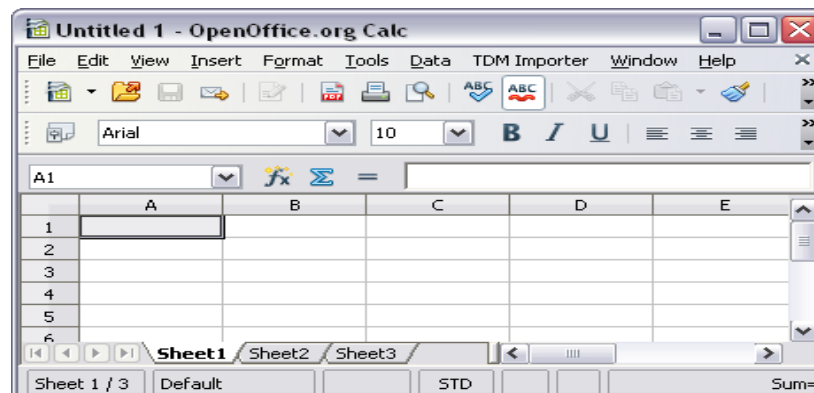

7.1 Components of Apache Open Office
The Apache Open Office components are:

7.1.1 Calc (Spreadsheet)
Calc spreadsheet has an advanced analytics, charting and decision-making features as a high-end spreadsheet. It includes 300 functions for financial, statistical, and mathematical operations. It can export spreadsheets to Adobe PDF and to HTML.

7.1.2 Impress (Presentation)

Impress has all common multimedia presentation tools like special effects, animation, and drawing tools. It is integrated with advanced graphics by open office draw and math components. Impress is compatible with MS PowerPoint file format and can save the work in graphics formats, including Macromedia Flash (SWF).
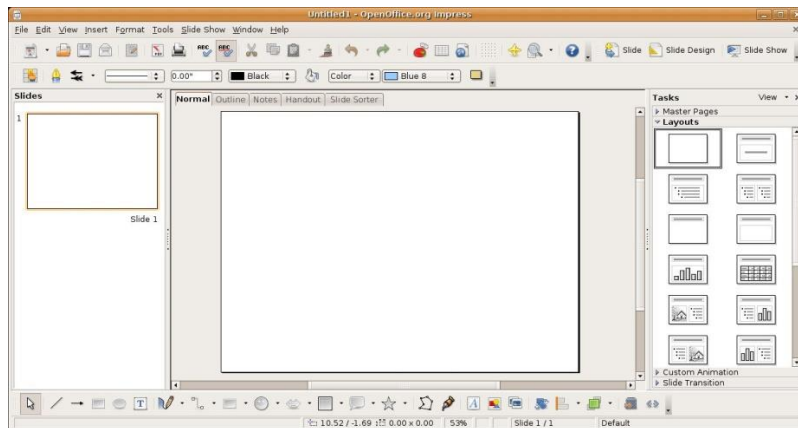
7.1.3 Writer (Word Processor)

It is a tool to create letters, books, reports, newsletters, brochures, and other documents. Graphics and objects can be inserted from other components into writer documents. The writer can export files to HTML, XHTML, XML, Adobe PDF and other versions of MS Word files and it will also connect to the email clients.
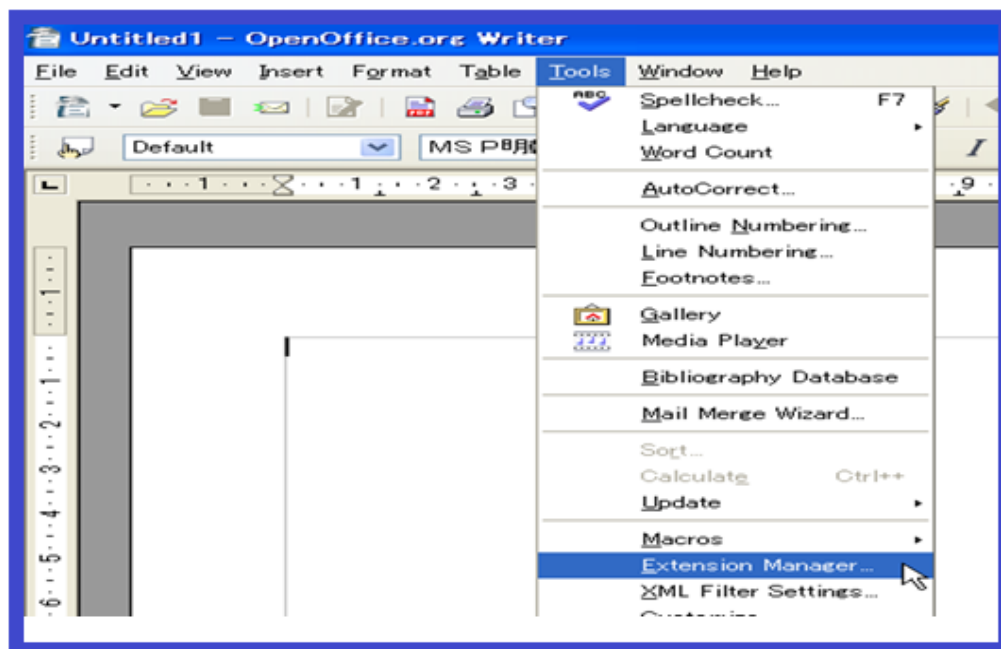
8. PC customization (Windows/Linux)

8.1 Linux operating system

Linux is an operating system or a kernel, it is open source and supports all kind of hardware components. This is like the Unix system.

8.2 Familiarization with GUI Environment

Linux is a GUI system. It depends on your level of expertise you can select a GUI system. In every windows or Mac system has a standard file manager, utilities and text editor and help system.

8.3 GUI based Linux commands

Below are some of the most important GUI based commands.

- xeyes Command
- xfd Command
- xload Command
- xman command
- xsm Command
- xvidtune Command

The Important Linux Commands and syntax

1. ls

   List all the Files or directories filled a given file system.

   Syntax: → ls /app

2. Cd

   It is used to change the directories, example if you are in the home directory you want to change to the application.

   Syntax: cd/application/app

3. mv

   This command is used to move files to folders and directories.

   Syntax: $ mv/app/application/app/apps

4. man

man, command or manual command, is used to display the manual of the inputted command

Syntax: $ man cd

5. mkdir

make directory command, it is used to allows the user to make a new directory

Syntax → Mkdir application

6. rmdir

Remove directory allows the user to remove the existing directory

Syntax: → rmdir application

7. clear

Clears the existing commands

Syntax: → $ clear

8. rm:

remove command allows the user to remove the files from Linux

Syntax: →$ rm

9. pwd

print working directory, it doesn't accept any option or argument and displays the detail of the current working directory

Syntax: $ pwd

10. Cal

calendar command displays the calendar of the current month.

Syntax $ cal

11. Echo

echo command will echo whatever you provide it.

Syntax: $ echo "hello"

12. Cat

cat command, this command is a concatenator, but it can be used to view the contents of a file.

Syntax: $ cat /user/passwd

8.4 Interface

The user interface allows the user to communicate with the OS (Operating System). The user interfaces are a keyboard, mouse, and menus of a computer system. The several types of interfaces are:

- Command Line Interface (CLI)
- Graphical User Interface (GUI)
- Menu-driven
- Form-based and
- Natural language

Command Line Interface (CLI)

It is a text-based interface that can be used to operate software and also operating systems allow users to respond to the visual prompts by typing a command.

Graphical User Interface (GUI)

It is an image-based interface rather than just words to represent inputs and output of a specific program. In simple terms, the GUI is a form of user interface that allows the user to communicate with the electronic devices through graphical icons and visual indicators. Graphical icon means icons represents the pictogram displayed on the computer screen where the user can navigate easily on the computer system.

Menu driven interface

Generally, menu-driven interface is also known as cash machines. This type of interfaces are used in Automatic Teller Machines (ATMs) and Ticket vending machines. They provide one-touch access to the users.

Form-based interface

Form-based interface uses text areas, drop down menus, radio boxes buttons to design electronic form which a user completes while entering data.

Natural language interface

It is a spoken interface used to communicate with the computer. That is the reason often this interface is popularly termed as a conversational interface. This type of interface commonly used in iPhones application(Siri)

8.5 Familiarization with GUI environment

Desktop

In the GUI, the desktop is a system of organization of icons on a screen.

Icon

It is a graphical representation of a program. By icon, the user can easily identify the application.

Selecting and choosing

The user can select any of the applications like My Computer on the computer screen and click the icon on it and choose the folders or drives to work on it. Examples Drive like local disk c: and d:.
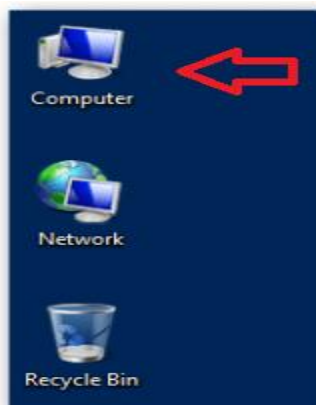
Drag and Drop

In the GUI, the drag and drop is a pointing device gesture in which user can select a virtual object by grabbing it and dragging it into the different location.
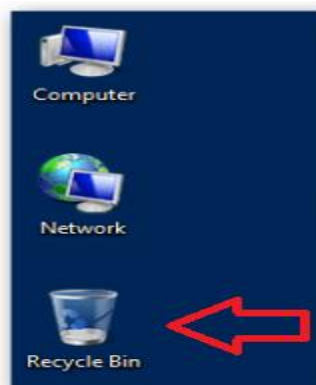

My Computer

My computer icon is full of stored resources in a computer which includes drives, control panel, and data.
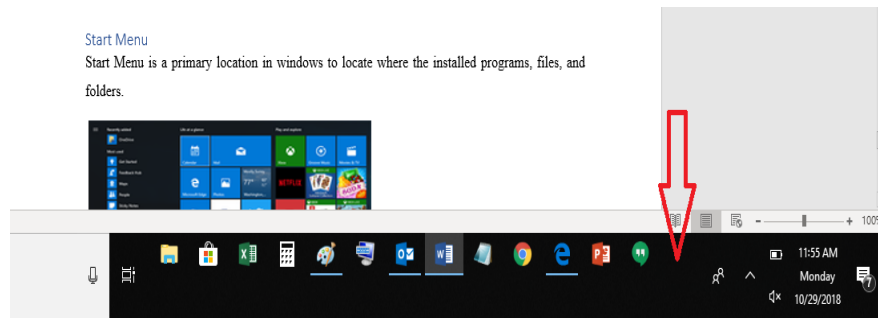

Recycle bin

The recycle bin is a location where the deleted files or folder temporarily stored in it. The deleted files are not permanently deleted from the hard drive.
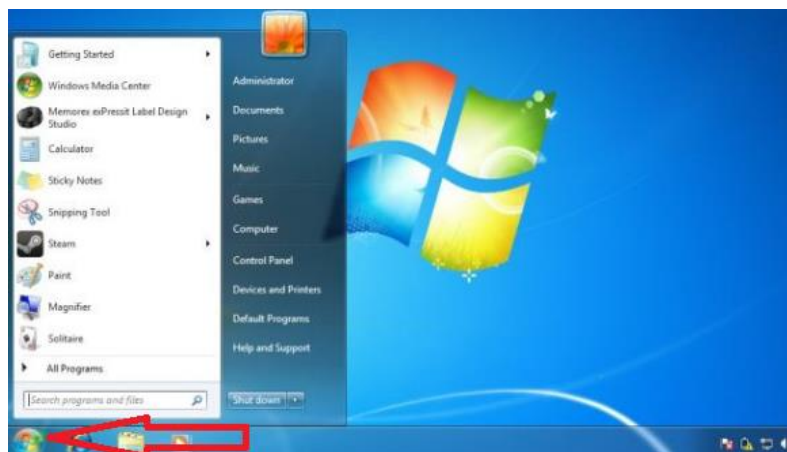
Taskbar

The taskbar is a GUI element which has a various purpose. It typically shows which programming is running currently in the system.
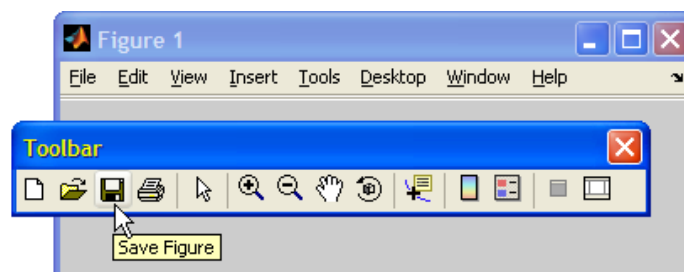

Start Menu

Start Menu is a primary location in windows to locate where the installed programs, files, and folders.

Tool Bar

A toolbar is a graphical control element on which on-screen buttons, menus, icons are placed.

Menu

The menu is a set of options presented to the user of a computer application to help the user find the information on it.
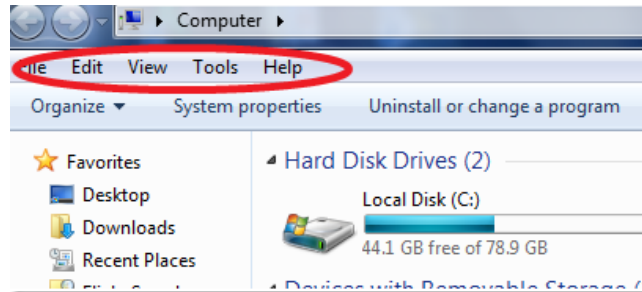
Window Explorer

Windows Explorer is also called as file explorer or file manager which allows the user to manage the files, folder, and network connection, as well as search files and the related components. Windows Explorer also has a new feature such as playing videos and audios and launching programs.
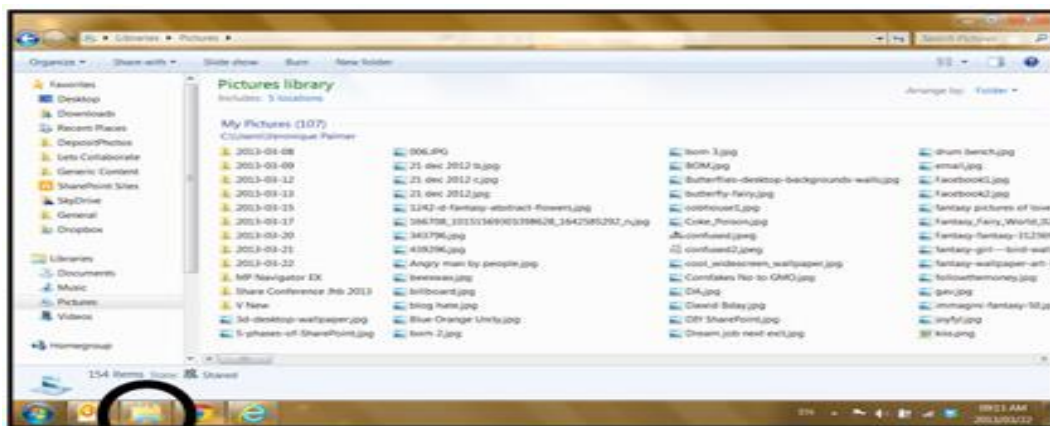
Windows Explorer

8.6 Properties of Files and Folders

Files and Folders

A file is an object which can store data, information, settings used by a computer program. Folders provide a method for organizing the file like a file folder which contains papers documents in a file cabinet.

New folder   Invoices
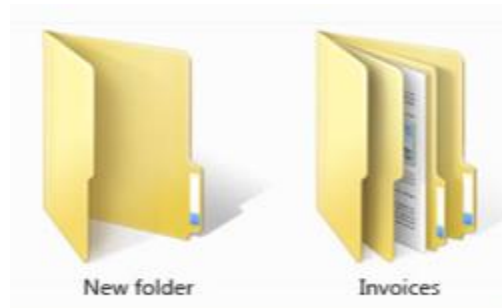
Properties

Primarily, select the file or folder and click ALT-enter then the user can access the properties dialogue box. The general tab of the properties dialogue box contains information such as the full path of the file or folder, size, the application configured to open it, and the date it was created, last modified and accessed.
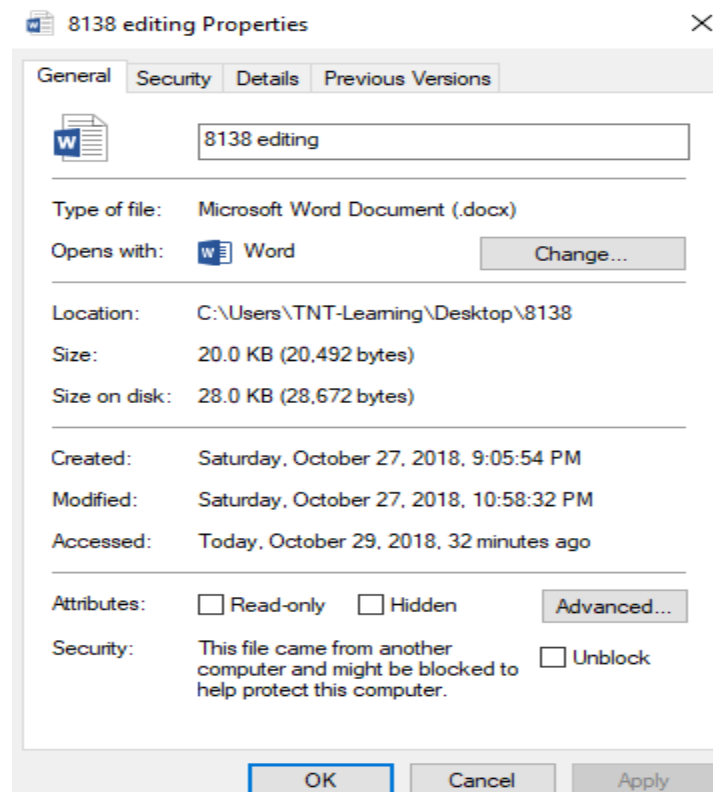
9. PC Management

9.1 Essential aspects of PC management

Disk management in Windows

It is a functionality of built into different operating systems, it is used for deleting, create, format partitions. We can access disk management through computer management.

Disk management in Linux

Type "df" "df –h" It will display list stored in your pc.

Task scheduler in Linux

It is a priority-based scheduler that schedules tasks based on static and dynamic priorities. the priorities are combined they form a task's *goodness*. Each time the Linux scheduler runs

Task Scheduler in Windows

Task Scheduler is a tool included with Windows It executes predefined programs or actions whenever a certain set of conditions is met.

Even viewer in windows

It is a database reporting program, this is a handful of simple flat text files. It is written in XML format.

Even viewer in Linux

It is used to execute the commands whenever you want to run.

Device manager in windows

It is used to view and control the hardware components of the computer, if the hardware component is not working, it will tell the user.

Device manager in Linux

It uses the Udev to manage the devices it manages device nodes

Shared folders in windows

Left-click on the file whichever you want to share, select share with an option from that you need to select specific people and give them a read/write/remove permission than click on shared.

Services and applications

By creating long-running executable applications that run in their own Windows sessions. This service can be automatically started whenever the computer boots, can be paused and restarted, and do not show any user interface.

9.2 Different types of virus, anti-virus, and firewalls

A. Virus

- Melissa

  It will impact to micro soft email outlook programming, it will make email services slow down, it spreads very quickly because of social engineering

- Chernobyl virus

  It will infect in the BIO (Basic input/output) systems and also, I will infect to your files and programs which u uses, it is also known as space filler virus

- Macro virus

  It is used to create shortcuts

- Worms

  It is a standalone piece of code which can infect your computer directly, It will act through email files.

- Trojan

- Memory resident virus

- Direct action virus

- Overwrite virus

- Boot sector virus

- Directory virus

- Polymorphic virus

- Companion virus

- Fat virus

- Web scripting virus

B. Anti-virus
- McAfee

- AVG

- Norton

- Kaspersky

- Adware

C. Different types of firewalls
  1. **Packet Filtering**

    It is a firewall technique, this mechanism work in the network layer of the OSI model. In packet filtering, used to control network access by observing outgoing and incoming packets and each packet passing through a firewall, it will allow them allowing based on source, destination and Internet Protocol addresses, protocols and ports.

  2. **Application level firewalls**

    This decides whether to drop a packet or send them through based on the application.

  3. **State-full inspection firewall**

    It provides the speed and flexibility of a packet filter firewall and gives the high security to the application-layer gateway.

  4. **Proxy firewalls**

    It works on the application layer to filter incoming traffic between your network and the traffic.

10. Hardware Maintenance

Computer hardware maintenance involves taking care of the physical components including desktop, CPU, Mouse, Pen drive, hard disk, and other important devices.

10.1 Common considerations
- **Keep the habit of taking backup of data frequently**

Backup data means copying the computer data into *an* archive file, so it may be used to restore the original after a *data* loss event. The main failure happens by constant reading and

writing of data will lead drive failure over time due to mechanical failure usually without warning. So, data backup to be stored in External hard drives, USB flash drives, Disc media).

- **Clean the dust from your computer**

If the dust stored in the computer, then it traps in heat, which can reduce its performance and lifespan. So, the easiest way to clean it with compressed air- open the case, take it outside and blow the dust-out.

- **Clean up cablings and all other components related to computer**

The two main things behind your computer: a mess of cables, and dust bunnies. So, clean up the cables and dust, then the area will improve the performance of the computer. Meanwhile, clean up the Keyboards key and desktop screen.

- **Organize your installation disks**

Keep the software, peripherals, and driver disks in a single location, mostly close to the computer.

- **Runs antivirus and spyware scans regularly**

The main thing to be needed when any computer is connected to the internet needs to have some sorts of antivirus software. There is tremendous variety antivirus software available i.e AVG free to enterprise level solutions. The antivirus software will monitor the system for threats in the real-time and it is necessary to scan the system every month.

- **Clean up your software**

On frequent intervals remove programs interface that is found in the control panel. If the software is there and it is not used anymore then remove it.

- **Clean up your Operating System (OS)**

Windows or any other OS also needs attention, though it saves a large amount of unnecessary information, in the form of temporary files (which never get deleted). There is an excellent program called CCleaner, which will clear out the most unneeded information automatically.

- **Update software.**

Check the updates, for your hardware and software. This consists of running Windows updates, checking for updated drivers, and checking for software patches.

- **Defragment**.

Once your hard drive has been cleaned up, it is a good time to defragment. This will organize your files, leading to faster disk access times and improve the system performance. The Windows defragment tool begins with (Start > All Programs > Accessories > System Tools > Disk Defragmenter) works well.

10.2 Considerations while purchasing and replacing the components

1. **While Purchasing the components the 3 things to be considered.**
   - Quality
   - Price
   - Service after the sale.

2. **To get the full picture on the computer while purchasing, Service after the sale is important**.
   - Return Policy
   - Warranty
   - Service agreements

3. **The concept of preventive and corrective maintenance**

Preventive Maintenance means it is done before anything goes wrong, to prevent it and the corrective maintenance means it is done after it goes wrong.

4. **Active and Passive maintenance**

The active maintenance programs include procedures that promote a longer, trouble-free life for your PC. The passive maintenance means treating your system with well and with care.

5. **Maintenance Scheduling**

The maintenance schedule means it is responsible to take maintenance plan and bring all the resources needed to complete it. The Scheduling role involves assembling and coordinating the information, people, materials, equipment along with all other necessary resources to get the work done.

6. **The need of diagnostics program**

The diagnostics program is an automatic computer program sequence that determines the operational status within the software, hardware or any combination in a component, a system, or a network of the system. It ideally, provide the user with guidance regarding any issues or problem found while during the operation.

Summary
Here is a quick recap of what we have learned so far

- Tweezers can be used to grip any minor screws that are problematic to hold in the bare hand.
- Basic hand tools are dangerous until and unless and unless an individual use them with due care
- The computer is an electronic device that obtains input, stores or processes the input as per the user's instructions provides output in the desired format.
- Cables and connectors used to connect one device to another inside and outside the computer device
- The mouse is a handheld pointing device which is used to points a cursor on the computer system.
- The keyboard is a primary device to enter text contains keys for individual letters, number, and specific keys

- Windows Explorer is also called as file explorer or file manager which allows the user to manage the files, folder, and network connection, as well as search files and the related components.
- The hardware components are - Hard Disk, Power Supply Unit, CPU, Motherboard and Input-Output devices

Terminal Questions

1. List the basic hand tools used in maintaining PC
2. Explain the basic troubleshooting procedures used in maintaining PC.
3. Explain the procedures involved in assembling PC
4. Mention any five input devices related to the computer
5. Explain the differences between system software and application software
6. What are the advantages of LCD monitor over CRT monitor?
7. Define antivirus with an example.

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