ESSCI
Skilling India in Electronics

Participant Handbook

Sector
Electronics

Sub-Sector
IT Hardware

Occupa on
A er Sales Support

Reference ID - ELE/Q4601, Version 1.0
NSQF Level 4

Field Technician - Compu ng & Peripherals

> " Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission. "

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO

QUALIFICATION PACK - NATIONAL OCCUPATIONAL

STANDARDS

is hereby issued by the

ELECTRONICS SECTOR SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: 'Field Technician Computing and Peripherals' QP No. 'ELE/Q4601, NSQF Level 4'

Date of Issuance : 31st March 2017
Valid up to*   : 31st March 2019
*Valid up to the next review date of the Qualification Pack or the
 'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory
(Electronics Sector Skill Council)

Acknowledgements

About this Book

This Par cipant Handbook is designed to enable training for the specific Qualifica on Pack (QP). Each Na onal Occupa onal (NOS) is covered across Unit/s.
Key Learning Objec ves for the specific NOS mark the beginning of the Unit/s for that NOS.

Field Technician: Also called 'Service Technician', the Field Technician provides a er sale support services to customers, typically, at their premises.

Brief Job Descrip on: The individual at work is responsible for a ending to customer complaints, installing newly purchased products, troubleshoo ng system problems and, configuring peripherals such as printers, scanners and network devices.

Personal A ributes: The job requires the individual to have: ability to build interpersonal rela onships and cri cal thinking. The individual must be willing to travel to client premises in order to a end to calls at di erent loca ons.

Role Descrip on: Installing the system and configuring the peripherals, and a ending to field calls from customer and complaints for system trouble shoo ng and repairs.

The symbols used in this book are described below.

Symbols Used

Key Learning Outcomes	Steps	Role Play	Tips	Notes	Unit Objec ves

Ac vity

Table of Contents

ESSCI

1. Introduc on to Computers and its Peripherals

Unit 1.1 – Basics of Computers

Unit 1.2 – Computer Peripherals

Unit 1.3 – Opera ng Hardware System and Peripherals

ELE/N4602
ELE/N4603

Key Learning Outcomes

At the end of this module, you will be able to:

1. Outline the history of computers
2. Explain the basics of computers
3. Identify computer peripherals and their applications
4. Explain the operation of hardware system and peripherals

UNIT 1.1: Basics of Computers

Unit Objectives ⊚

At the end of this unit, you will be able to:

1. Outline the history of computers
2. Define computer and its types
3. Identify computer hardware and software and its applications
4. List the different types of computer equipment assembled in a pack

1.1.1 History of Computers

Computer has become an indispensable and multi purpose device. It has become a basic necessity of life and it is difficult to imagine life without it.   Computer is, basically, an electronic device for performing arithmetic and logical operations, or it can be said that "Computer is a device, or a flexible machine used to process data and convert it into information." For many people, computer is just a device used for calculation or computation, but actually it is much more than that.

Development of Computers

Computation has been done since earlier times with the aid of devices, when generally there was interaction at one-to-one level utilizing fingers. A form of tally stick was possibly the first counting device. Later, people in the Fertile Crescent region began record keeping by using calculi with aids such as clay spheres and cones. These aids were, possibly, representations of items such as livestock or containers of grains. Counting rods and stones were used with passing of time. People, gradually, began to follow certain steps to calculate with stones, giving birth to digital counting devices. These proved to be the predecessor of the first device invented for calculation, called as the ABACUS.

The ABACUS

Abacus was used to do quick additions and subtractions mechanically. Although it was initially developed in the 10th century by the Egyptians, it was the Chinese who gave it its proper shape in the 12th century. It comprised of a wooden frame with rods fixed from one end to the other. The rods had round beads slid onto them, which represented different numbers according to their position. The abacus had an upper section called Heaven and a lower section called Earth.

NAPIER'S BONES

Napier Bones was invented by John Napier of Scotland in the year 1617. This device had bone rods with numbers printed on them and enabled easy calcula ons.

PASCAL'S CALCULATOR

Pascal's calculator was invented by Blaise Pascal of France in the year 1642. It was an adding machine which had gears on it to represent the posi on of the digits.

LEIBNZ CALCULATOR

Leibnz calculator was a modifica on of the Pascal's calculator and could do mul plica on and division opera ons. It was devised by Go ried Leibniz of Germany in the year 1671.

ANALYTICAL ENGINE

Sir Charles Babbage of England,also called father of the computer, invented the Analy cal engine in the year 1833. It is considered as the first mechanical computer, which could safeguard data. Charles Babbage added such features in it which are similar to the present day computer language.

The Von Neumann model

The architecture of computer has been modified many mes over the last 20 years according to new developments. The way the algorithms are mapped to the hardware of a computer has been modernized and the quan ty of circuits which can be added to the silicon wafers too has changed. However, the basic concept of computer design has remained unchanged. Von Neumann devised the computer architecture in such a way so as to enable it to store th e program instruc ons and data in its memory.

Earlier, every compu ng device was made for a single, specific purpose. The programming entailed the circuits to be rewired manually and snags were di cult to detect or rec fy.

Von Neumann's architecture had the computer with three main components:

- A central processing unit (CPU)
- Memory
- Input/output (I/O) interfaces.

Genera on is a term used in connec on with the changes or developments in the computer's hardware and so ware technology over a period of me. There are mainly five computer genera ons commonly accepted ll date.

First Genera on

The computers used in the period 1946-1959 are considered as first-genera on computers.

The main features of this genera on are:

Vacuum tube technology

Unreliable as prone to fusing of installations

Supported machine language only

Expensive

Generated lot of heat

Slow input and output devices such as punched cards, paper tape, and magnetic tape

Huge size

Non-portable

Consumed lot of electricity

Mainly used batch processing operating system
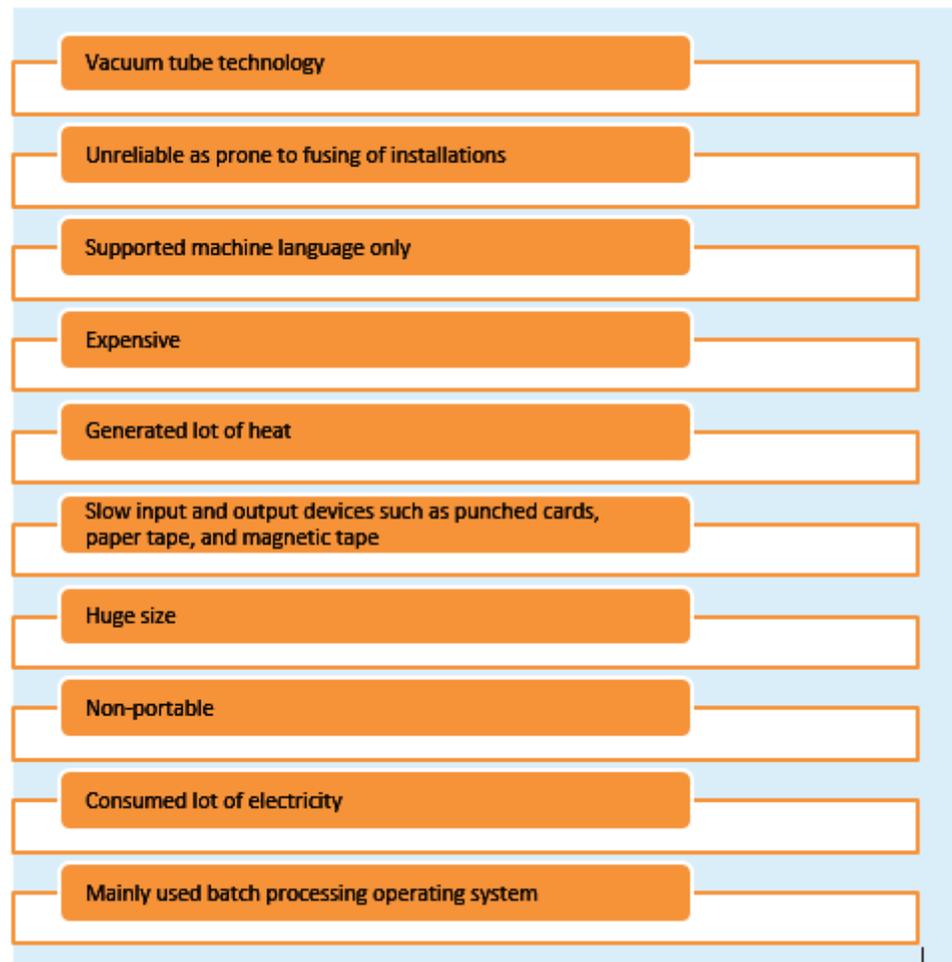
Fig. 1.1.1: Features of first genera on

Some examples of computers of this genera on are:

ENIAC

EDVAC

UNIVAC

IBM-701

IBM-650

Fig. 1.1.2: Examples of first genera on of computer

Second Generation:

The computers used in the period 1959-1965 are considered as second-generation computers. In these computers, magnetic cores served as primary memory and magnetic tapes and disks as devices for secondary memory.

The main features of this generation are:

Use of transistors

Reliable as compared to the first generation computers

Smaller in size as compared to the first generation computers

Generated less heat as compared to the first generation computers

Consumed less electricity in comparision to the first generation computers

Faster than the first generation computers

Still expensive

A.C. was needed

Supported machine and assembly languages such as FORTRAN and COBOL

Utilized batch processing and multi programming operating system

Fig. 1.1.3: Features of second generation

Some examples of computers of this genera on are as shown in figure:

| IBM 1620 | CDC 3600 | UNIVAC 1108 | IBM7094 | CDC 1604 |
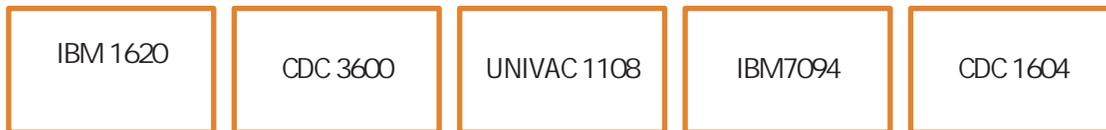
Fig. 1.1.4: Examples of second genera on of computer

Third Genera on:

The computers used in the period 1965-1971 are considered as third genera on computers. Jack Kilby had invented integrated circuits (IC's) which replaced transistors. An IC comprised of mul ple transistors and capacitors connected to the associated circuitry. The computers were faster, smaller in size, more dependable and e cient. They generated less heat, r equired lesser maintenance, consumed less electricity but were s ll expensive and needed alterna ng current (AC). High-level languages such as FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC and ALGOL-68 were used. The opera ng system had features such as, me sharing, mul - programming and remote processing.

Some examples of computers of this genera on are as shown in figure:

| IBM-360 series | Honeywell-6000 series | Personal Data Processor(PDP) | IBM-370/168 |

| TDC-316 |

Fig. 1.1.5: Examples of third genera on of computer

Fourth Genera on:

The computers used in the period 1971-1980 are considered as fourth genera on computers. They used Very Large Scale Integrated (VLSI) technology which involved around 5000 transistors and all other circuit elements along with their linked circuits placed on a single chip. The computers were portable, reliable, powerful, easily available and economical. They did not require AC to func on. Their distributed opera ng system had features such as pipeline processing, real me, networks and me sharing. The high-level languages such as C, C++, DBASE and so on were used in these computers. The concept of personal computers (PCs) was brought to the fore and internet was introduced. There was major progress in the field of networks.

Some examples of computers of this generation are as shown in figure:

| DEC 10 | STAR 1000 | PDP 11 | CRAY-1 (Super Computer) |

| CRAY-X-MP (Super Computer) |
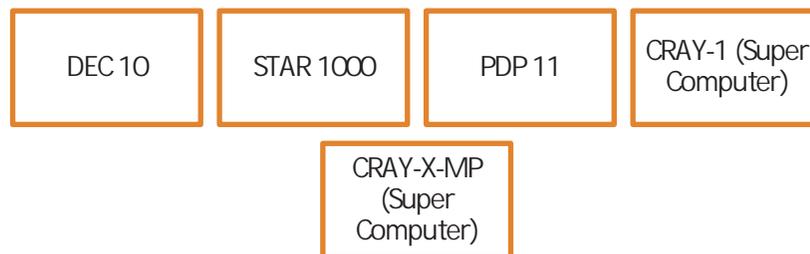
Fig. 1.1.6: Examples of fourth generation of computer

Fifth Generation:

The computers used in the period 1971-1980 are considered as fourth generation computers. They used Very Large Scale Integrated (VLSI) technology involving microprocessor chips which comprised of ten million electronic components. High-level languages such as C and C++, Java and .Net were utilized in this generation. The multimedia features of the computers had user friendly interfaces. The computers were powerful, compact and economical. The main features of these computers also included progress in parallel processing hardware, progress in superconductor technology and development of true artificial intelligence (AI) as well as of natural language processing. AI is an upcoming branch of computer science which interprets procedures of enabling computers to think like humans.

The following figure shows the features of fifth generation of computer:

| Neural networks | Robotics | Game Playing | Natural language understanding and generation | Expert systems to make decisions in real life situations |
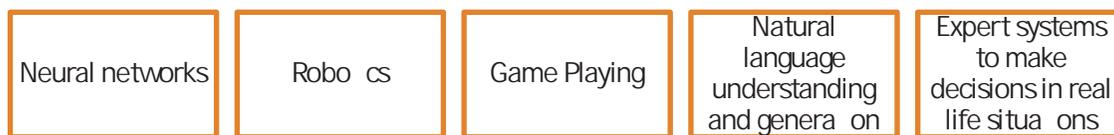
Fig. 1.1.7: Features of fifth generation of computer

Some examples of computer of this generation are:

| Desktop | Ultra Book | Laptop | Chrome Book |

| Notebook |
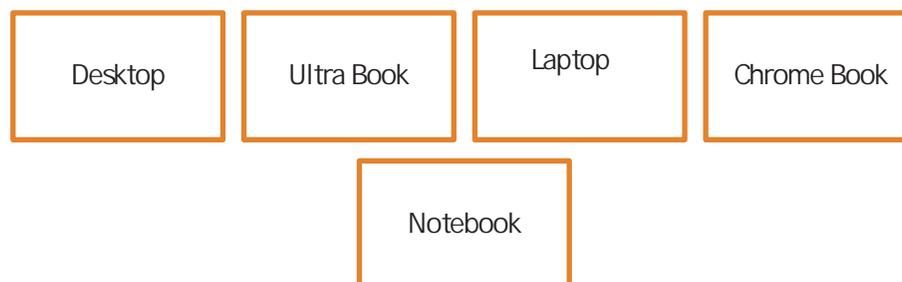
Fig. 1.1.8: Examples of fifth generation of computer

1.1.2 Computer and its Types

A computer is an electronic device which transforms data into meaningful informa on. The following image shows a computer:

Fig. 1.1. 9: A Computer

The basic func onality of computers, irrespec ve of its size or make, is shown in the following figure:

| Accepts data | Stores data | Processes data as required | Retrieves the stored data as and when required | Prints (outputs and not only prints) the result in the required format |
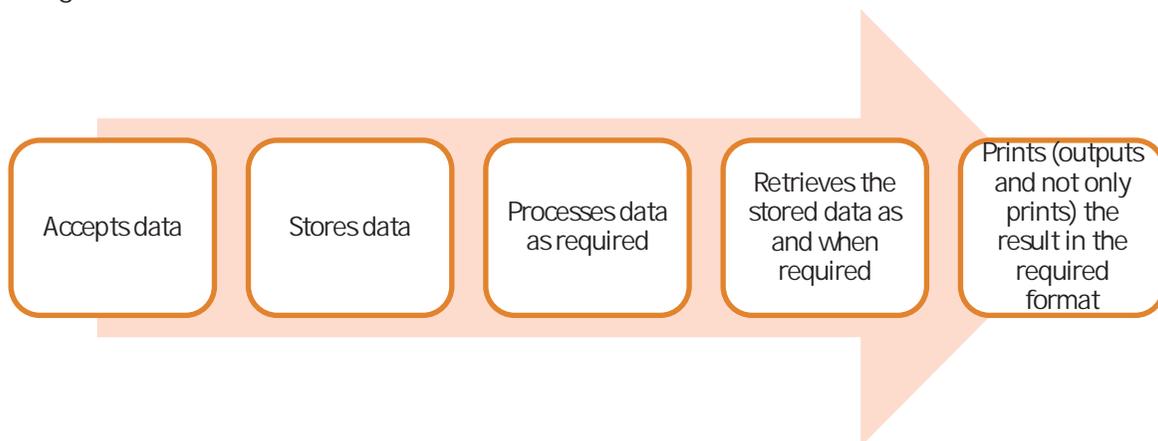
Fig. 1.1.10: Func ons of a computer

Some characteris cs that have made usage of computers almost a necessity in life are they are fast, accurate, diligent, and adaptable and have good storage capacity.

A computer consists of various units or parts that enables it to perform its func ons. The following figure shows a block diagram of the func onal units of a computer:
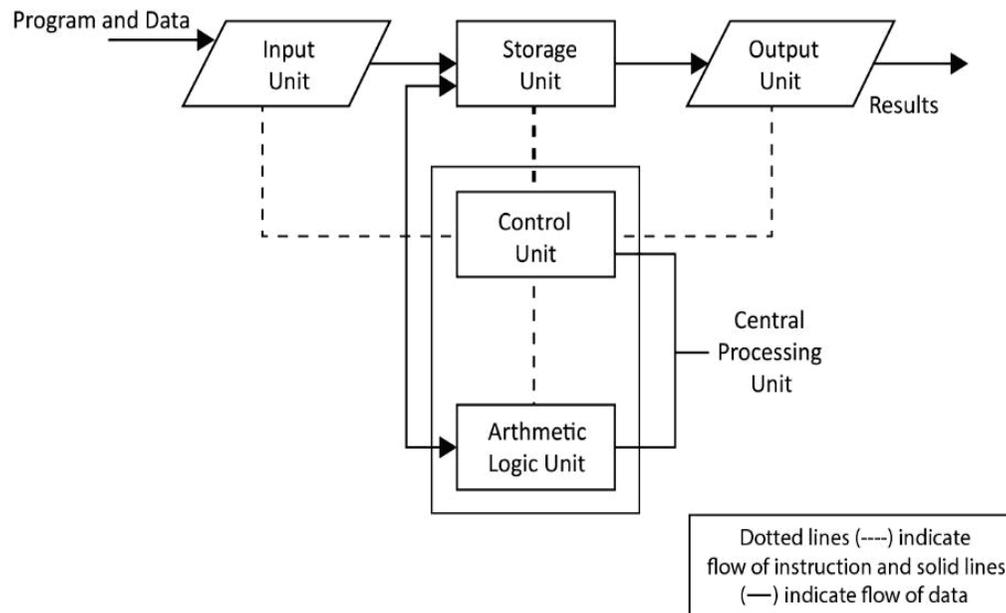
Fig. 1.1.11: Func onal units of a computer

The four main func onal units in a computer are described in the following figure:

Input unit
- This unit accepts data or instruc ons from the user for processing by using an input peripheral device.

Storage unit
- This unit stores data and instruc ons before and a er processing. It is mainly divided into two parts, primary and secondary storage.

Central processing unit (CPU)
- This unit takes data and instruc ons from the storage unit and processes the data as required, based on the instruc ons given and the type of data provided.
- Data is then sent back to the storage unit a er processing, if required.
- This unit includes the arithme c logic unit (ALU) which helps in performing calcula ons using arithme c operators such as addi on (+), subtrac on (-) and so on.
- This unit also uses comparison operators such as greater than (>), less than (<) and equal to (=). This control unit controls all these opera ons, enables retrieving data from storage and helps store informa on back to a storage device.

Output unit
- This unit is used for displaying the result to the user in the required format by using an output peripheral device.

Fig. 1.1.12: Func onal units of a computer

Types of Computers

Computers can be classified based on their size, speed and compu ng power. The following table lists the di erent types of computers:

Type	Descrip on	Image
Microcomputer	It is a single user computer system with a single chip and moderately powerful microprocessor. The di erent types of microcomputers are: Desktop Computer Laptop Computer Notebook Tablet	

Mini Computer	It is a computer which can support hundreds of users simultaneously and has more powerful processors than a microcomputer. It is also called mid-range computer.	
Main Frame	It is a mul -user system, like a minicomputer but the technology is di erent than that of a minicomputer. It is used to handle and process large amount of data such as in banks and government o ces.	
Super Computer	It is the fastest and most expensive computer system. It is used for complex scien fic computa ons and numerical calcula ons such as weather forecas ng, nuclear simula ons and astrophysics.	
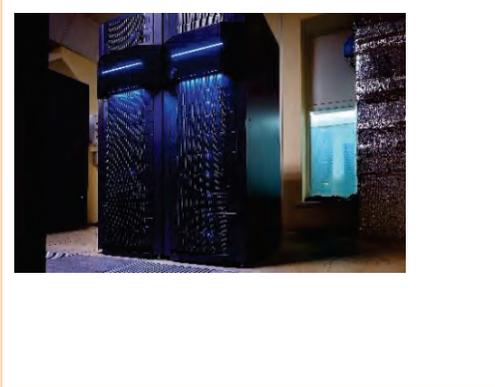
Fig. 1.1.13: Type of computers

Computers are commonly classified as:

- Laptop
- Desktop
- Server

Laptop

Laptop is a ba ery or alternate current (AC) -powered, portable, wireless personal computer (PC), generally smaller than the size of a briefcase. It is a small personal computer with a "clamshell" form factor, a thin Liquid Crystal Display (LCD) or Light E mi ng Diode (LED) computer screen on the upper por on and a keyboard on the lower part of the "clamshell".

Laptops have a similar display as desktops. The main di erence in both are the displays; the laptop's display is a ached to it, whereas the desktop's display is a separate piece of hardware, the monitor. The following figure shows the basic types of laptop displays:

LCD
- The LCD displays of the laptops work like a regular LCD display. However, the laptop LCD display need an inverter to supply the power to the CCFL backlight, while stand-alone monitors do not require an inverter.

LED
- These are LCD monitors which use LEDs as their backlights. Because the LEDs do not require AC voltages, the LED monitors do not require an inverter.
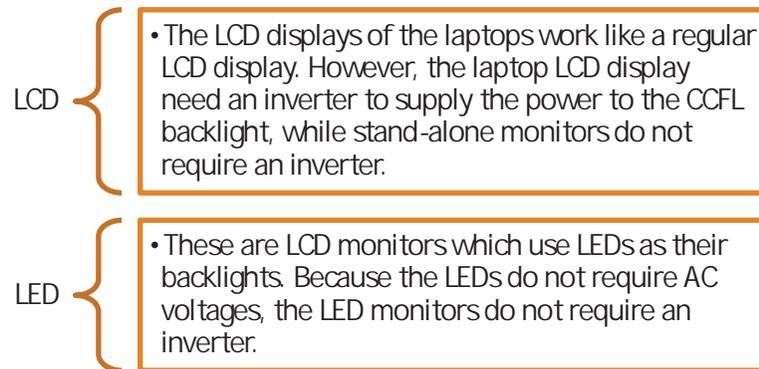
Fig. 1.1.14: Types of laptop displays

The following image shows a laptop and the internal view of the laptop:

Fig. 1.1.15: Exterior and interior of a laptop computer

Few common laptop features are as follows:

- Unique Func on Keys: Keyboards generally have func on keys, marked from F1 to F12 that can be used when working. For instance, if the F1 key is pressed then it will open help. Similarly, the F5 key can be used to refresh a document or a website.

  On laptops, the func on keys have more than one purpose, which can be accessed by pressing the Fn key, and a er that pressing the desired func on key. The 'a' key can be pressed to get a lowercase a, or the Shi key can be pressed with the 'a' key to get a capitalized A. Some features of func on keys are:

  o Dual Displays: The dual-display key is useful when there is a second monitor connected to the laptop or when the laptop is connected to a projector during a presenta on. If this key is pressed, four choices will be seen, with one selected. If it is pressed again the next choice will be selected. The four choices are as follows:

    1. Computer Only
    2. Duplicate
    3. Extend
    4. Projector Only

o   Screen Brightness: Keyboards have some keys to increase or decrease the screen brightness. For example, F4 is used to decrease the brightness and F5 is used to increase it. The screen brightness controls commonly use a circular icon which resembles the sun, with a plus "+" and "-" sign to increase and decrease the brightness respec vely.

o   Bluetooth: Laptops have a special key to turn the Bluetooth on and o . It is usually indicated by an icon resembling an uppercase B.

Desktop

A desktop is a PC that is made to be used on or near a desk or a table, and is not portable. A desktop PC has a mouse, a keyboard and a base unit which includes the computer's components. Some newer models have the base unit within the monitor to save space.

The following image shows a desktop computer along with its system unit or CPU and peripherals:

Fig. 1.1.16: A desktop computer along with its CPU and peripherals

Server
A server computer is a central computer, which comprises of collec on of data and programs. It is also known as a network server as it allows all the connected systems to share and store data and applica ons. File servers and applica on servers are the two main types of servers. The following image shows a server computer connected to various other computers:
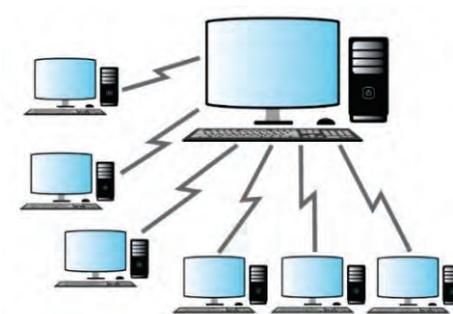
Fig. 1.1.17: A server computer linked to other computers

1.1.2 Computer Hardware and So ware

Computer hardware refers to the physical parts of a computer, outside and inside the system unit. The internal parts of a system are known as components, while external parts are typically called peripherals such as the keyboard, mouse, speakers and printers.

The following image shows the basic components of computer hardware:
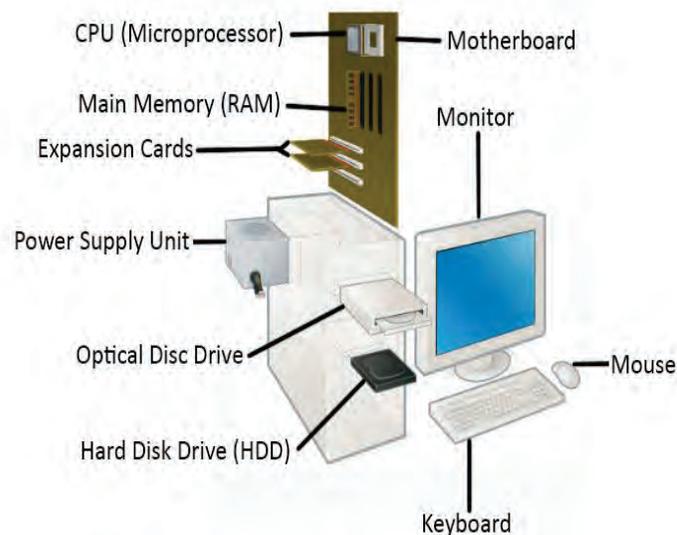
Fig. 1.1.18: Basic components of computer hardware

When a new desktop is bought, some hardware components and devices, shown in the following figure, come along with it:

Fig. 1.1.19: Components and devices of a computer hardware

Computer Case

A computer case is a steel, aluminium or plas c enclosure which contains most of the components of a computer. It is also known as a tower, cabinet, system unit or base unit. It is available in di erent sizes and shapes. It has points, slots and screws for various components to be fit into. A typical tower is shown in the following figure:

Fig. 1.1.20: A typical tower

Motherboard

The main printed circuit board, or PCB, in a computer that holds the microprocessor, provides sockets and slots to connect/hold the other peripherals/parts of the computer and connects the power supply to various other electronic parts. It is also called as a system board or main board, and allows the components to communicate with each other, making it a complete working unit. It also has a provision for ini al set up of computer a er power is turned on, which is the Basic Input/output System (BIOS) or boot firmware. The motherboard also contains slots and provision for expansion cards. Some mes, another board, called a daughter board, is connected to the main motherboard for providing further expandability.

The following image shows a labelled motherboard:
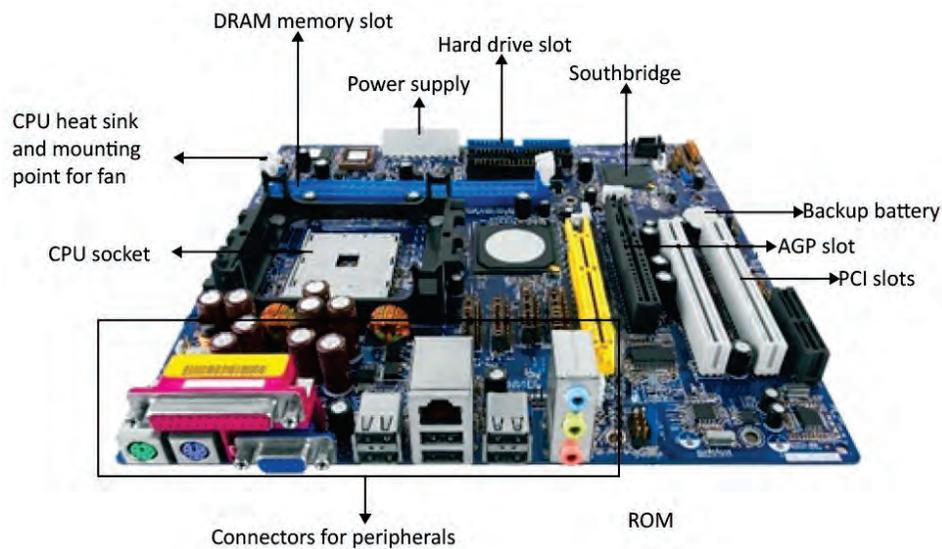
Fig. 1.1.21: Motherboard

Types of Motherboard

Following are the main types of motherboard:

- Integrated Motherboard: It has various components integrated into the board itself. These may include the CPU, video card, sound card, and various controller cards.
- Non-integrated Motherboard: It uses various instable components and expansion cards. For example, a non-integrated system board may enable upgrading the video card by evacua ng the old one and introducing another one.

Form Factor

The form factor of the motherboard determines the physical organiza on, general shape, the sorts of cases and the power supply usage of the PCB. It also specifies the physical layout, order of the board and the arrangement of moun ng holes in the PCB. For example, a company can manufacture two motherboards with the same func onality but having a di erent form factor. The real di erences lie in the physical layout and the posi on of the components on the board. On the basis of the form factor, following are a few types of motherboards:

Form Factor	Originated	Max. Size
XT	IBM 1983	8.5 × 11 in
AT (Advanced Technology)	IBM 1984	12 × 11–13 in
Baby-AT	IBM 1985	8.5 × 10–13 in

ATX	Intel 1996	12 × 9.6 in
SSI EEB	SSI	12 × 13 in
BTX (Balanced Technology Extended)	Intel 2004	12.8 × 10.5 in
DTX	AMD 2007	200 × 244 mm max.
ETX	Kontron	95 × 114 mm
LPX	Unknown	9 × 11–13 in
PC/104	PC/104 Consor um 1992	3.8 × 3.6 in
NLX	Intel 1999	8–9 × 10–13.6 in
UTX	TQ-Components 2001	88 × 108 mm
WTX	Intel 1998	14 × 16.75 in
SWTX	Unknown	16.48 × 13 in
HPTX	EVGA 2008	13.6 × 15 in
XTX	2005	95 × 114 mm

Fig. 1.1.22: Func onal units of a computer

Chipset

A chipset is a motherboard component that includes the CPU and other chips that support basic func ons of the computer.

The two main chips in the chipset are:

- Northbridge: Northbridge is the part of the computer chipset that provides a network between the CPU and the other interfaces of the computer. These interfaces may include memory, Accelerated Graphi cs Port (APG) port and Peripheral Component Interconnect (PCI) bus. It is also linked to the Southbridge.
- Southbridge: Southbridge is the por on of the computer chipset that provides a network between the north bridge and the slower speed interfaces and further connects the interfaces to the CPU. These interfaces may include parallel ports, serial ports, Universal Serial Bus (USB) ports and PS/2 ports.

    The south bridge controls the slower I/O components like the Serial ports, USB ports and the integrated development environment (IDE).

The following image shows the connec on of south bridge and northbridge in a PCB:
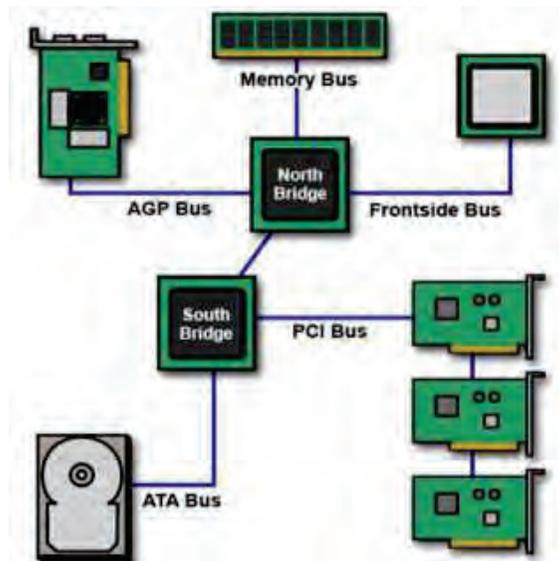
Fig 1.1.23: Connec on of south bridge and northbridge in a PCB

There are several types of chips found on a motherboard of a CPU as shown in the following table:

CPU chip	Input	Processing Unit	Output
8088 CPU	Inputs 8 bits of data	Processes 8 bits of data	Outputs 8 bits of data
80286 CPU	Inputs 16 bits of data	Processes 16 bits of data	Outputs 16 bits of data
80386SX CPU	Inputs 16 bits of data	Processes 32 bits of data	Outputs 16 bits of data
80386DX CPU	Inputs 32 bits of data	Processes 32 bits of data	Outputs 32 bits of data
80486SX CPU	Inputs 32 bits of data	Processes 32 bits of data	Outputs 32 bits of data
80486DX CPU	Inputs 32 bits of data	Processes 32 bits of data	Outputs 32 bits of data
586 CPU	Inputs 32 bits of data	Processes 32 bits of data	Outputs 32 bits of data

Pen um/P6/K5 CPU	Inputs 64 bits of data	Processes 64 bits of data	Outputs 64 bits of data
Pen um Pro CPU	Inputs 64 bits of data	Processes 64 bits of data	Outputs 64 bits of data

Fig 1.1.24: Type of CPU chips

Slots (or Expansion Slots)

An expansion slot is a slot in the motherboard used to add an expansion card (or addi onal circuit board). The extra expansion card provides extra features to a computer such as video, sound, advanced graphics, Ethernet or memory.

The number of expansion slots that a system can have depends on the physical arrangement of the case and motherboard. Some of such slots are:

CPU Slot	RAM Slot	Peripheral Component Interconnect (PCI) Slot	PCI Express Slot
• Also known as a CPU socket • Is where the processor or the CPU chips are inserted on a computer's motherboard.	• Provide slots or placement for inser ng RAM chips. • These can be easily removed and replaced.	Used for expansion devices such as modems, network cards, television tuners, radio tuners, video cards and sound cards.	• Used for expansion cards. • However, PCI express slot is used for higher transfer speeds and is typically used for graphics cards.
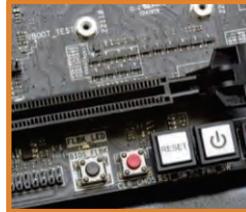
Fig. 1.1.25: Types of expansion slots

Expansion Cards

The circuit boards which are inserted in the slots are called expansion cards. These expansion cards allow a computer system to connect and communicate with its peripherals.

The following image lists few of the expansion cards:

| Graphic Card | Sound Card | Network Interface Card |

Fig. 1.1.26: Types of expansion cards

Ports

A port serves as an interface between the computer and other computers or peripheral devices. The ports vary depending on the kind of equipment that will be connected to the ports such as to connect a monitor, webcam, speakers the ports sizes are di erent, as shown in the following image:
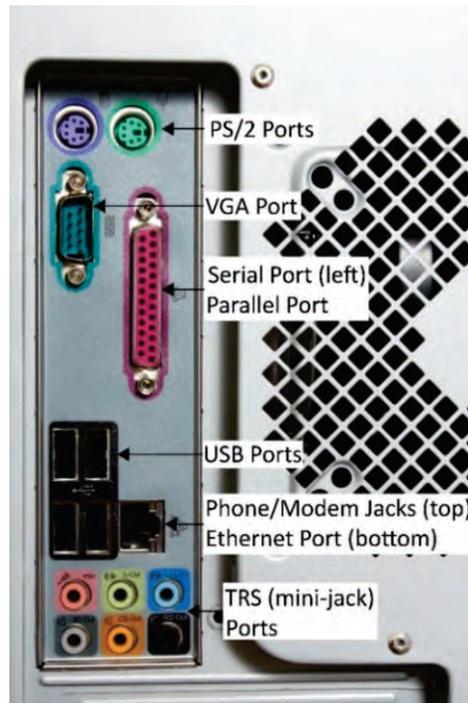
Fig. 1.1.27: Types of ports

The usage of the ports is as follows:

- Serial Port: This port is used with a 9-pin connector. It is no longer in use, because these are replaced by interfaces such as Ethernet, FireWire and USB.
- PS/2 Port: This port was earlier used to connect keyboards and mouse. These were round ports for six pin connectors. They have now been replaced with Universal Serial Bus (USB) ports.
- Parallel Port: A common parallel port is used for 25 pins connector. These ports are similar to serial ports and were used to connect printers and joys cks. They are no longer in use and have also been replaced by USB ports.
- Video Graphics Array (VGA) Port: A VGA port is used to connect video display devices such as monitors and projectors to a computer. It has three rows for a 15 pin connector.
- USB Port: The USB port is nowadays the most popular type of port on a computer which is used to connect mouse, keyboard, printer, and external storage devices such as DVD -RW drive and flash drive to a computer.
- TRS: Tip, ring and sleeve (TRS) ports, or mini-jacks or audio jacks, are commonly used to connect audio devices such as headphones and microphones to computers.

- Ethernet: This port is used for network connec ons. They use fast transmission and category 5 (CAT5) network cable for network connec ons.
- HDMI: A HDMI (High Defini on Mul media Interface) port is tha t port where a device can be connected such as a DVD or a Blue ray player, a stereo speaker or a flat -screen TV. HDMI enables excellent image and sound reproduc on over the connected hardware.
- RJ11 connector: Registered Jack-11 is a telephone interface that uses a cable of twisted pairs of wire and a modular jack with two, four or six contacts. RJ-11 is the common connector for plugging a telephone into a wall and a handset into a telephone.

In addi on, the motherboard contains a number of other contacts. These include:

- The big connector which supplies the motherboard with power from the power supply
- Other connectors for the diske e drive, hard disk, CD -ROM drive and so on.
- Jumpers, which are used on some motherboards to configure voltage, various opera ng speeds and so on.
- A number of pins used to connect the reset bu on, LED for hard disk ac vity, built -in speaker and so on.

Connectors

Motherboards commonly have connectors that are used to run wires to the front panel. There are several front panel connectors on the motherboard. Wires are plugged into these connectors with the other ends going to the appropriate connec on on the front panel. For example, power drive, power bu on, reset bu on and so on.

Jumpers

Motherboards have a variety of di erent pins that can be connected with jumpers for di erent purposes. The most common reason to access a jumper is to reset the BIOS password. It is possible for a user to set the password for the BIOS so that only that user can access the BIOS se ngs. If the user forgets the password, it can be cleared with a jumper to manage the BIOS.

RAM Chips

RAM is the short-term memory used to store informa on which is being processed. It is available as a RAM chip, which is an integrated circuit (IC) soldered on the motherboard. The two types of RAM are sta c RAM (SRAM) and dynamic RAM (DRAM). SRAM is expensive to produce, but faster and requires less dynamic power than DRAM. SRAM is typically used as a cache memory for the CPU.

The following images shows di erent types of RAM:

Fig. 1.1.28: Types of RAM chips

Memory modules come in several form factors, such as:

- Single inline memory module (SIMM) – SIMM has a single row of 30 or 72 edge connectors on the bo om of the module. Single refers to both sides of the module having the same pin out.
- Dual inline memory module (DIMM) – DIMM are available in 168-pin, 184-pin, and 240-pin versions. Dual refers to each side of the module having a di erent input.
- Small Outline DIMM (SODIMM) – SODIMM are a compact version of the standard DIMM module, available in various pin out for use in notebook computers and laser/LED print ers.
- Rambus inline memory module (RIMM)

ROM Chips

Read-only memory (ROM) is a non-vola le memory. It is available as a ROM chip, which is also an IC soldered on the motherboard. The five basic types of ROM are:

- ROM - Read Only Memory
- PROM - Programmable Read Only Memory
- EPROM - Erasable Programmable Read Only Memory
- EEPROM - Electrically Erasable Programmable Read Only Memory
- Flash EEPROM memory

The following image shows a ROM chip for a DVD (CD-ROM):

Fig. 1.1.29: A ROM chip

System Resources

System resources are not actual physical devices; they cannot be touched by reaching into the machine. But, they are very important for two reasons. First, they dictate how the PC organizes its access to various memory areas and devices. Second, they are one of the most common areas where people have problems with the setup of their PCs: also called resource

conflicts. The following are the four types of resources that the various parts of a computer can some mes decide to fight over:

- Interrupts (IRQs): As described in the example in the chapter on how the PC works, a device requests me from the processor using these interrupt requests. Under tradi onal designs, each device has a di erent IRQ number. If two try to use the same one, a conflict can result. Newer technologies can allow mul ple devices to share an IRQ channel.
- Direct Memory Access (DMA) Channels: Some devices have the ability to read and write directly from the system memory, instead of asking the processor to do it fo r them. Cu ng the "middle man" out in this manner improves the e ciency of the system. Each device that does this, needs its own DMA channel.
- Input/Output (I/O) Addresses: Devices exchange informa on with the system by pu ng data into certain specific memory addresses. For example, when the le er "M" was pressed in the example men oned above, the keypress was stored in a certain memory address un l it was me for the processor to deal with it. Any me some informa on goes into or out of the machine, to the modem or the hard drive or the printer, for example, it uses these I/O addresses. Again, each device needs its own memory area.
- Memory Addresses: Similar to I/O addresses, many devices use blocks of memory as part of their normal func oning. For example, they may map hardware programs (BIOS code) into memory, or use a memory area to hold temporary data they are using.
- Jumpers: Motherboards have a variety of di erent pins that can be connected with jumpers for di erent purposes. The most common reason to access a jumper is to reset the BIOS password. It is possible for a user to set the password for the BIOS so that only that user can access the BIOS se ngs. If the user forgets the password, it can be cleared with a jumper so that the BIOS can be managed.

Power Supply Unit (PSU)

PSU converts the AC power to low voltage direct current (DC) power, vital for the internal components of the PC. The following image shows a PSU:

Fig. 1.1.30: Power supply unit

Mouse (Input Device)

The mouse is an input device, used to make selec ons and move objects on a computer screen. A mouse can be with a laser or a ball, wired or wireless.

Some di erent types of mouse are shown in the following image:

Wireless Mouse   Ball Mouse   Wired Mouse   Op cal Mouse

Fig. 1.1.31: Types of mouse

Though the mouse is considered as a peripheral, it is a vital device and essen al for using computers.

BIOS

The Basic Input/output System (BIOS) includes a so ware code that provides a computer with basic instruc ons so that it can start. When a computer is turned on, it runs the program within BIOS to do some basic system checks, locate the opera ng system on a disk, and start.

The program within BIOS is stored in a chip on the computer that can be rewri en. Older computers used an electrically erasable programmable read-only memory chip (EEPROM) for the BIOS. Read-only memory (ROM) has gone through several itera ons over the years, from programmable read-only memory (PROM), to erasable read-only memory (EPROM), and then to EEPROM. New computers use a type of flash memory, similar to what is used with USB thumb drives.

The BIOS is o en referred to as firmware. It is a hardware chip that can be physically seen and touched, and it includes so ware that runs code on the computer. The combina on of hardware and so ware is firmware.

BIOS vs. CMOS

The term complementary metal oxide semiconductor (CMOS) is used in the study of computers. The di erence between BIOS and CMOS needs to be understood.

BIOS- This is the firmware. It stores the instruc ons for star ng the computer and includes a program that can be used to change some se ngs. The firmware can be updated in a procedure referred to as flashing the BIOS.

CMOS-This holds only the user-configurable BIOS se ngs, such as the current me. Users can change these se ngs by accessing the BIOS applica on. CMOS is vola le; meaning that the data is lost if the system is turned o . Motherboards include a CMOS ba ery to retain the CMOS data even if the system is turned o . BIOS is the applica on while CMOS is the data, and a CMOS ba ery keeps the CMOS powered to retain the se ngs. Unfortunately, it's misleading.

Technically, CMOS is a specific type of chip that is rarely found on any motherboard, but there is s ll a need to store the user-configurable se ngs. Instead of CMOS, the data can be stored on ba ery-powered sta c RAM. Some mes, it is stored in the same chip as the real- me clock that is keeping me. Just like CMOS, these chips are powered by a ba ery when the system is turned o to ensure the system keeps these se ngs. When the BIOS is using newer flash memory, the user-configurable data is often stored on the same chip as the BIOS applica on. Due to how flash memory stores data, it doesn't even need a ba ery. However, the real- me clock s ll needs a ba ery to keep me when the system is turned o . Even though systems no longer have CMOS, and this ba ery isn't powering the CMOS, it is s ll commonly called the CMOS ba ery. Even the CompTIA objec ves refer specifically to CMOS and the CMOS ba ery.

BIOS Vendors- Just as so ware developed by di erent vendors can be purchased, motherboard manufacturers can use BIOS developed by di erent vendors. Two of the most popular BIOS vendors are American Megatrends (AMI) and Phoenix Technologies. Each vendor develops di erent versions of BIOS to meet the needs of di erent motherboard manufacturers.

The motherboard vendor chooses the BIOS to include with the motherboard. There are di erences between versions, so it is important to realize that one system will look di erent from another.

Accessing the BIOS Applica on

When a computer is first turned on, one or more screens can be seen flashing onto the screen, providing bits of informa on. One of these screens gives a message to press a specific key to access the setup op ons or the setup u lity.

The only sure way of knowing what key to press is by reading the screen. For example, if the screen says to press the <F2> key to enter the setup u lity, the F2 func on key has to be pressed. Other common keys or key combina ons are: F1, F10, Del (delete key), Ctrl+Alt+Esc keys (pressed at the same me), and Ctrl+Alt+Enter keys. On some laptops, the FN+Esc or FN+F1 keys can be pressed. There are a lot of combina ons and one needs to read the messages on the screen as the system starts as shown in the figure:
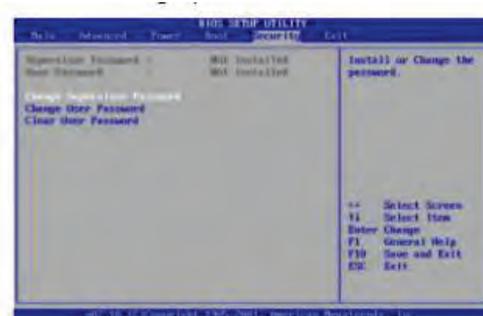
BIOS setup utility.

Fig. 1.1.32: BIOS message on screen

BIOS Component Informa on

The BIOS can be used to verify the di erent components that are installed on a system. This can be useful to ensure that the system is recognizing newly installed hardware. For example, if new RAM is installed but not recognized, the BIOS can some mes give insight into the problem.

Figure shows a screen from a di erent BIOS version with the system informa on page selected.
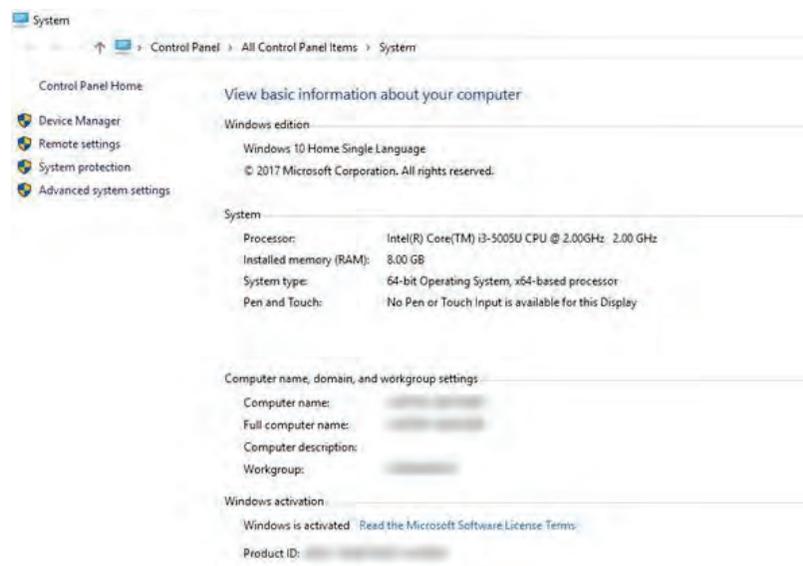
Fig. 1.1.33: System informa on page

This page shows informa on about the processor type, processor cache, and memory. It can be seen that the processor is an Intel Core i7, with a 133-MHz clock mul plied by 20, giving a CPU speed of 2.66 GHz. It can also be seen that the system has 12 GB (12,288 MB) of RAM installed. The RAM has a speed of 1,066 MHz (using a 133-MHz clock mul plied by 8) and is DDR3 SDRAM.

Addi onally, most BIOS systems will automa cally detect the presence of di erent drives and report their presence within BIOS. This includes hard disk drives and di erent types of op cal drives, such as DVD drives. Some mes, these se ngs are reported in the Standard CMOS Features page, if it exists, and other mes the se ngs are on a dedicated page for the drives.

Drives might be reported as SATA1, SATA2, and so on, if the system is using a SATA interface. If the system is using an EIDE interface, they might be reported as IDE, EIDE, or as hard disk drives. This can be useful if a new drive has been installed but is not recognized a er star ng. Then, one has to go into BIOS, find the drive se ngs, and ensure that the new drive is recognized by BIOS. If it's not recognized, the hardware such as the cables or the configura on has to be checked.

BIOS Configura on

There are a few configura on se ngs that are important to understand. Changes that are made in the configura on will remain in the system even a er the system has been powered o .

Time and Date: A very basic se ng for the BIOS is the me and date. These se ngs can be seen on the very first page of the BIOS, which is some mes called the Main page or the Standard CMOS Features page. The computer keeps me with a real - me clock, and the CMOS ba ery keeps the clock cking even when the system is turned o . This rarely needs to be changed except when the CMOS ba ery is failing. If the ba ery is failing, the real - me clock becomes slow and needs to be reset o en. When replacing the ba ery, make sure that it is replaced with the correct type. Motherboard manufacturers warn the users that a wrong ba ery could explode. Also, local regula ons should be followed when disposing the original ba ery.

Boot Sequence: One of the most important BIOS se ngs for a technician to understand is the boot sequence. The boot sequence se ng tells the computer about the device from which it should try to boot first. If the hard drive does not have a bootable opera ng system, it will look for a bootable opera ng system on the CDROM, then on a floppy drive, and then by using PXE. As configured, it will never boot using the CDROM drive, unless the hard drive fails. If the boo ng has to be done using a bootable CDROM drive, the configura on will have to be changed.

Clock Speeds: Motherboards typically include a serial presence detect (SPD) chip that detects and stores the speed of the CPU and the RAM. The BIOS either reads the data from the SPD chip or automa cally detects the clock speeds and reports them. Some BIOS u li es allow manipula ng these clock speeds by altering the frequency, the mul plier, or the volta ge. For example, if a system has a 133-MHz clock and a 20x mul plier, the speed is 2.66 GHz. If the clock is changed from 133 MHz to 148 MHz, the speed is 2.96 GHz. If the mul plier is changed from 20x to 24x, the speed is 3.55 Ghz.

Manufacturers commonly warn that modifying these se ngs can cause addi onal heat or other damage. It can also cause the CPU or other components to fail, and reduce the system performance. However, for the promise of a quicker PC, many hobbyists are willing to take the risk. The biggest danger of over-clocking is heat. The more quickly a system runs, the ho er it gets. If it gets too hot, it can destroy components.

Security: Many BIOS u li es include security se ngs, and the most common security se ng is related to BIOS passwords. Other possible se ngs are related to a Trusted Pla orm Module (TPM) and LoJack. Looking again at the given figure, the se ngs for a supervisor password and a user password can be seen. When set, the supervisor password provides full control over any BIOS se ngs and is some mes set by administrators to ensure that they can override any changes made by a user. Depending on the BIOS, the user password provides varied access. It might allow the user to do anything except change the supervisor password, or it might allow the user to change only limited se ngs such as the date and me. In some systems, it requires a user to enter the password every me the system is started.

POST and Other Diagnos cs: POST is an in-built diagnos c tool that starts as soon as the processor of a computer starts. POST verifies that the various hardware components of a computer such as the keyboard, random access memory and disk drives are func oning properly. If POST is successful then the computer begins to boot, else the BIOS issues an error message. The error message is in the form of a series of beeps. These beeps may have a pa ern of long beeps or short beeps or a combina on of the two depending on the nature of the problem. The pa ern of beep conveys informa on about the type of the fault detected. For example, if the POST is unable to detect the processor, it will stop the boot process and convey the message through a code of beeps.

Out of Service Tests (OST)

POST can only test internal func oning of the card and not the external interface logic of the card. There are two types of test that can test the external interfaces of the card with other boards in the system. These are shown in the following figure:

Interface Tests

The card is labelled as out of service. The neighboring cards are then configured to work in the interface test mode. The card under test is instructed to run the test. The neighboring cards are then restored by bringing them out of test mode.

Echo Back Test

The card is configured in echo back mode. The interface receives the data and echoes it back by transmi ng it to the card under test. The card under test receives back the data that it had transmi ed.

Fig. 1.1.34: Out of service tests (OST)

The following beep codes are for AMI BIOS:

Beeps and Error	Resolu on
1 Beep - Refresh Failure	Reseat/replace memory, troubleshoot motherboard
2 Beeps - Parity Error	Reseat/replace memory and troubleshoot motherboard
3 Beeps - Memory Error (first 64KB)	Reseat/replace memory
4 Beeps - Timer Failure	Troubleshoot motherboard
5 Beeps - Processor Failure	Troubleshoot CPU and motherboard
6 Beeps - Keyboard Controller Failure	Troubleshoot keyboard and motherboard

7 Beeps - Virtual Mode Excep on Error	Troubleshoot CPU and motherboard
8 Beeps - Display Memory Failure	Troubleshoot graphics card and motherboard

Fig. 1.1.35: Beep codes

Keyboard (Input Device)

A keyboard is one of the primary input devices and it looks similar to those found on electric typewriters. The following image shows a keyboard:

Fig. 1.1.36: A keyboard

Keyboards allow users to enter le ers, numbers and other symbols into a computer that can serve as commands or be used to type text.

The keys in keyboards can be categorised as shown in the following figure:
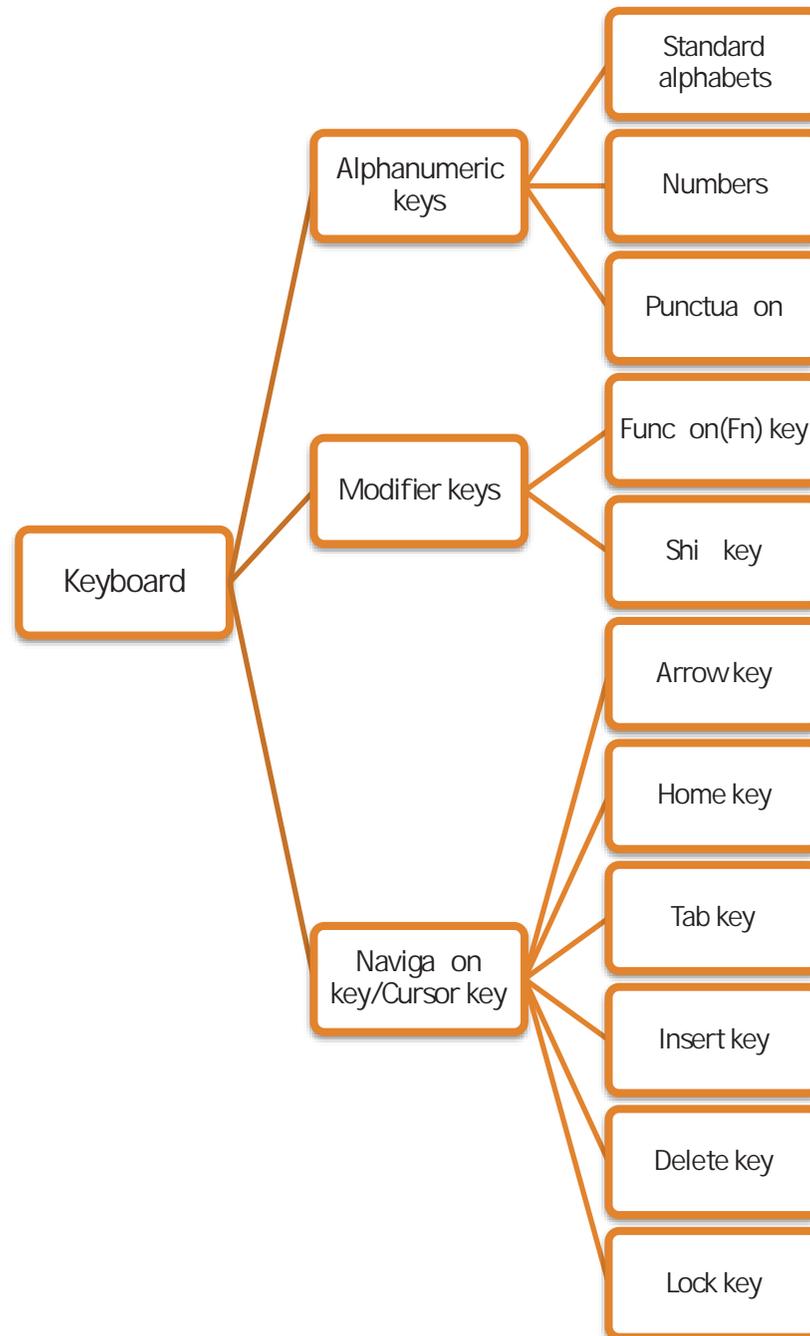
Fig. 1.1.37: Hierarchical structure of keyboard keys

The keys typically found on keyboards can be categorized as follows:

- Alphanumeric keys: Are the standard le ers and numbers, and also include punctua on keys such as comma, period, semicolon, and similar keys
- Modifier keys: Are special keys that modify the normal ac on of another key, when the two are pressed in combina on and are categorised into:

- o   Fn key
- o   Shi key
- o   Alt key
- o   Ctrl key

- Naviga on keys or cursor keys: Includes a variety of keys which move the cursor (a mouse cursor, also called a pointer, is a symbol which is shaped like an arrow or a small hand poin ng towards the top of the display device.) to various places on the screen:

Monitor (Output Device)

The monitor is an output device, also called a visual display unit (VDU) that shows the graphical and textual informa on of the computer. The following image shows a LCD monitor:

Fig. 1.1.38: Monitor

Storage Devices

Storage devices, also called storage media, are hardware devices which are used to store data or informa on. It can store informa on temporarily or permanently. These devices can be added to computers externally or internally. Storage devices are of two types:

- Magne c storage: Includes hard disk drive, magne c tapes, floppy drive and so on.
- Op cal storage: Includes CD-R, CD-RW, Blue ray disk, DVD, flash drive and so on. It uses laser ray or light to access data in it.

The following images shows the storage devices:

DVD Disk   Floppy Disk   External Hard Disk   Flash Drive

Fig. 1.1.39: Types of storage

Hard Disks (Hard Disk Drive HDD)

A hard disk is a device that stores data on a computer permanently (non-vola le). A hard drive is a collec on of one or more disks or pla ers shielded with ferro magne c material to which data is wri en with the help of a magne c head. Hard disks are connected to the motherboard using special cables such as PATA (Parallel ATA), SATA (Serial ATA), USB or SAS (Serial a ached SCSI) cables and they are powered by a power supply unit. The following images shows hard disk drives:

Fig. 1.1.40: Hard disk drives

In case of a laptop, the hardware components and devices that come along in the package are same as that of a desktop except a few changes; instead of mouse, laptops have touchpads or track pads and instead of external power source, laptops have an internal ba ery.

Physical components:

- Pla ers: Hard drives have mul ple spinning pla ers, and each pla er can be wri en on both the sides.
- Read/write head: A hard drive will have one read/write head for each pla er side. This drive has two pla ers and four read/write heads.
- Actuator: The actuator controls the movement of the arm.
- Actuator arm and axis: The actuator arm is moved back and forth by pivo ng around the actuator axis.

Logical components:

- Tracks: Each pla er is logically divided into mul p le tracks, which are circular areas on the disk. When the head is posi oned over a track, it can read or write data on the track as the pla er spins.
- Sectors: Tracks are logically separated into track sectors. A sector can be between 512 bytes and 2 KB in size.
- Clusters: A cluster is a group of mul ple sectors. Clusters are also known as alloca on units and are the smallest element of a drive to which an opera ng system can write.
- Files: Files are wri en to clusters. If the file is bigger than a single cluster, the file is wri en to mul ple clusters. Ideally, a file will be wri en to clusters that are next to each other, or

con guous clusters. However, if other data is already wri en on an adjoining cluster, the file is fragmented and wri en to another available cluster.

Hard Drive Characteris cs

It is rela vely common to replace or add a hard drive to a system. For example, many people store enough data on the original drive that came with their computer and fill up the drive. They can either buy a new computer or buy an addi onal hard drive; the addi onal hard drive is much cheaper.

While buying a new hard drive, the following important considera ons need to be kept in mind:

1. Capacity or Size: The size of the drive is listed as GB or TB; for example, 750 GB or 1 TB. Bigger drives hold more data but are more expensive.

2. Interface: A drive can be connected internally or externally.

3. Rota onal speed: This is stated as rpm, and higher speeds generally result in a faster drive.

Hard Drive Speeds

The rota onal speed of the drive helps determine how quick it will be overall. Common speeds are 5,400, 7,200, 10,000, and 15,000 rpm. Drives with 7,200 rpm are used in standard desktop computers.

Other factors also contribute to the speed. For example, seek me refers to the average amount of me it takes to move the read/write head from one track to another track; lower seek mes are be er. If two drives are of the same size with the same rpm speed but one is significantly cheaper, it might be due to a higher seek me, resul ng in overall slower performance.

The interface can also limit the speed. Imagine a drive spinning at 15,000 rpm with a low seek me. It can read and write data to and fro from the hard drive, but how much data ca n actually be transferred between the hard drive and the other computer components is limited. The following sec ons describe the common interfaces.

Processor

Processor is a logical circuitry unit which is embedded in a printed main board (or motherboard), which responds to instruc ons and also helps in running programs like OS, and others such as Windows O ce and so on. The processor is commonly known as a central processing unit or CPU; a small silicone chip aimed to perform complex computa ons. There are many types of processors like AMD (advanced Micro devices), Intel processors and DSP (Digital signal Processing) processors.

There are two primary manufacturers of computers used in computers: Intel and Advanced Micro Devices (AMD).

1. Intel: Intel is the largest seller of CPUs, selling about 80 percent to 85 percent of all CPUs. It manufactures other products as well, including chipsets, motherboards, memory, and SSDs.

2. AMD: AMD is the only significant compe on to Intel for CPUs, and it sells about 10 percent to 15 percent of all CPUs. It also manufactures other products, including graphics processors, chipsets, and motherboards.

Processor Technologies

Processor technologies in the following sec ons might be used by AMD only, by Intel only, o r by both vendors. These technologies are used to help dis nguish di erent processors from each other in terms of performance or features.

Processor technologies can be classified into following types:

Overclocking

VRM

Thro ling

Hyper threading (HT Technology)
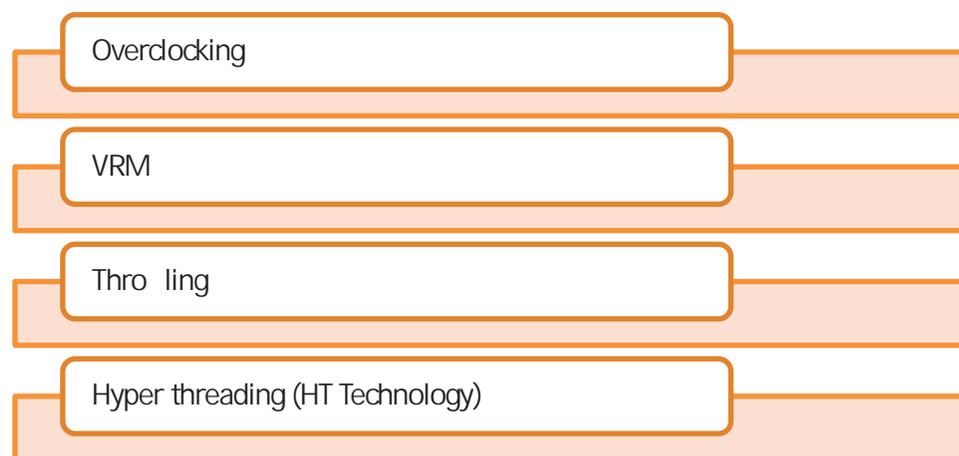
Fig. 1.1.41: Processor technologies

Mul processing, Mul ple processors, and mul -core processing

CPU designers have come up with several crea ve ways of doing more than one thing at a me to improve performance. Three methods are popular: mul processing, dual processors, and mul -core processing. Mul processing is accomplished when a processor contains more than one ALU. Older processors had only a single ALU. Pen ums, and those processors coming a er them, have at least two ALUs. With two ALUs, processors can process two instruc ons at once and, therefore, are true mul processing processors.

A second method of improving performance is installing more than one processor on a motherboard, crea ng a mul processor pla orm. A motherboard must be designed to support more than one processor by providing more than one processor socket.

The latest advancement in mul ple processing is mul -core processing. Using this Technology, the processor housing contains two or more cores that operate at the same frequency , but independent of each other. Each core is a logical processor which contains two ALUs; therefore, each core can process two instruc ons at once.

So ware

So ware is a set of instruc ons or programs used to instruct a computer to perform specific tasks. The following figure shows classifica on of so ware based on their applica on:

```
                        ┌──────────────────┐
                        │     So ware      │
                        └──────────────────┘
                 ┌───────────────┴───────────────┐
        ┌──────────────────┐          ┌──────────────────────┐
        │ System So ware   │          │ Applica on So ware   │
        └──────────────────┘          └──────────────────────┘
                 │                              │
        ┌──────────────────┐          ┌──────────────────────┐
     ───┤ Opera ng System  │       ───┤ Genaralized Packages │
        └──────────────────┘          └──────────────────────┘
                 │                              │
        ┌──────────────────┐          ┌──────────────────────┐
     ───┤     U li es       │       ───┤ Customized Packages  │
        └──────────────────┘          └──────────────────────┘
```
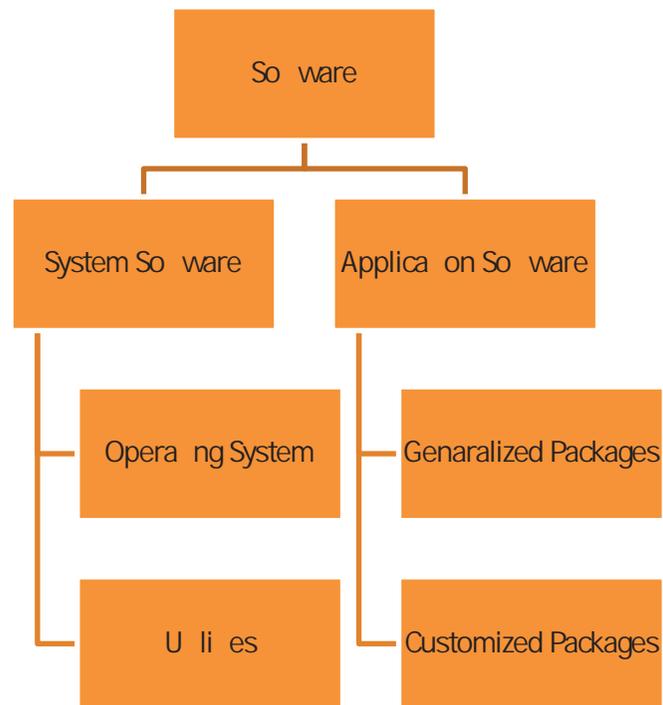
Fig. 1.1.42: Classifica on of so ware

System so ware are a combina on of programs, which help in func oning of a computer, including controlling managing the resources such as peripherals and other applica ons. The system so ware is classified as follows:

- Opera ng System: It is a system so ware which acts as an interface between a user and a computer. It helps in managing various hardware devices, maint aining the file systems and func oning of other applica on programs. Few popularly used opera ng systems are Windows, Linux and Mac OS.
- U li es: These are the system so ware which help in analysing, configuring, op mizing or maintaining computer and computer resources such as an -virus so ware, zip/unzip files, disk defragmenter and file manager.

Applica on so ware is a set of programs used to perform specific tasks, for example, a word processing or spreadsheet so ware, which is an applica on so ware to handle all the processes in a hospital. Applica on so ware are classified as follows:

- Generalized packages: Are user friendly so ware such as Word processing so ware for preparing documents (MS Word), spreadsheets for data analysis (MS Exce l).
- Customized packages: Are applica on so ware that are developed or customized as per a specific requirement such as inventory control or a payroll system.

Opera ng System and Other So ware

The following figure shows a block diagram of a computer with respect to the opera ng system:
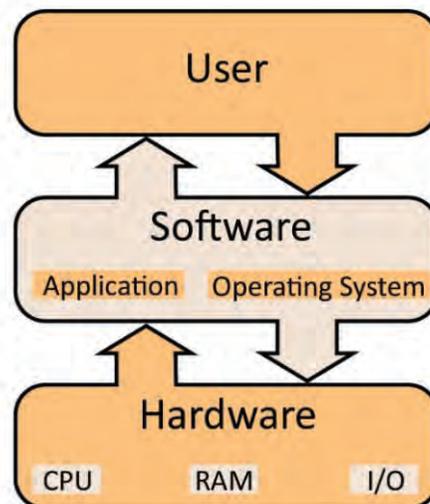
Fig. 1.1.43: Block diagram of a computer with respect to the opera ng system

The three most commonly used opera ng systems for personal computers are Microso Windows, Mac OS and Linux.

Microso Windows

Windows is an OS owned by Microso . It is di erent from any open source so ware in the sense that only Microso can make changes to the code. It can be installed on di erent kinds of computers, by various manufacturers, giving a wide range of choice for hardware to the user.

The latest version Windows is 10 which includes touchscreen support. This combines the usability of a touchscreen tablet and the power of a desktop/laptop computer. It also includes the "Play To" and "Remote Media Streaming," features that allow a user to play media from the computer on another device. These features also allow the user to access media when away from the computer.

A processor running Windows OS has two modes:

• User mode
• Kernel mode

The Windows hardware abstrac on layer is an interface between the hardware and the rest of the OS. It hides di erences in hardware components and provides a consistent pla orm for the kernel to run. This layer includes hardware -specific code which controls mul ple processors, I/O interfaces and interrupt controllers.

The following figure shows the architecture of Windows OS:
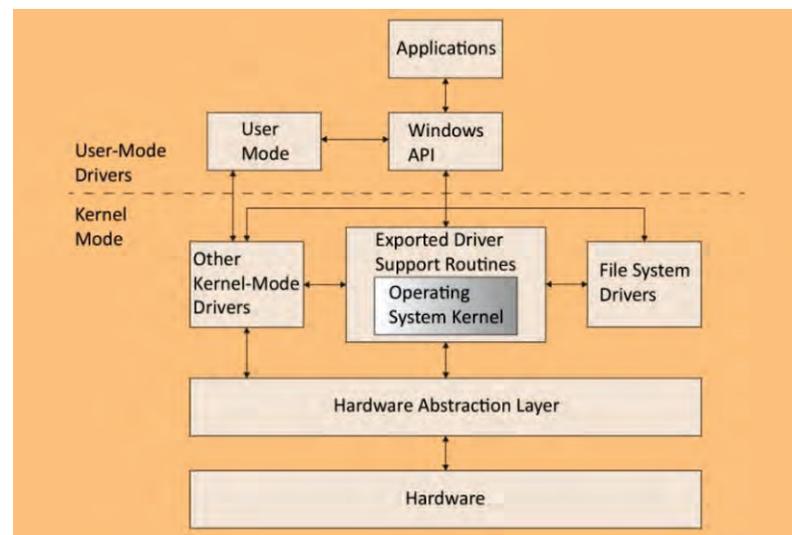
Fig. 1.1.44: Architecture of Windows OS

An opera ng system has four major func ons:.

Process Management

A process is a func oning program comprising of a code, data, some specific resources assigned to it, and certain levels of execu on through its code. The assignment of resources to the processes is controlled by the system OS. The OS also gives system calls to regulate these processes.

Memory Management

The OS has to share memory with an applica on program. It manages the memory management hardware of the computer and decides which memory loca ons a process may access. It controls the assignment of memories to the processes.

File System Management

A large magnitude of informa on has to be conveyed, processed or saved in a computer. The file system comprises of a systema c set of abstract file system objects. The OS renders the essen als to manage these objects.

Device Management

The transfer of informa on in a computer takes place through the various input and output devices. Processes use the system call interface to access these devices. The OS has to control the devices in such a way that they are properly shared by all the processes needing them. The programming interface made available to the services by the OS is termed as the system call. It is commonly wri en in C/C++ language.

Directory Structure

The root directory in Windows OS is represented as "drive:". For example, the root directory is generally "C:\". The directory separator is a "\" but the OS also recognizes a "/" internally. The following figure shows the folders which appear in the root directory of a Windows OS:
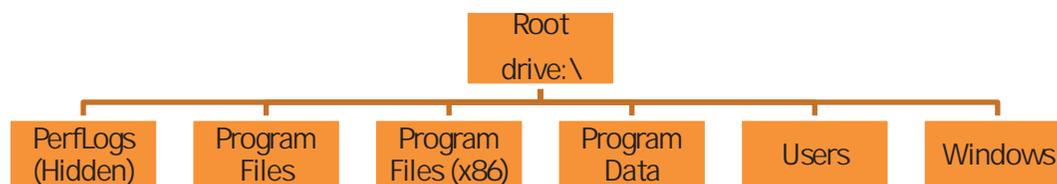
Fig. 1.1.45: Windows directory structure

U li es

U li es of Windows depends on the version a user is using. The following figure lists some common u li es for Windows as per the di erent versions of the opera ng system:

Windows Default U li es

Windows 10	Windows 8.1	Windows 7
Language Packs Microso O ce Device Drivers Developer Tools Windows Essen als	Bing Toolbar Microso Camera Codec Pack Language Packs Windows Phone for Desktop	Silverlight Skype for Windows Device Drivers Disk Cleanup
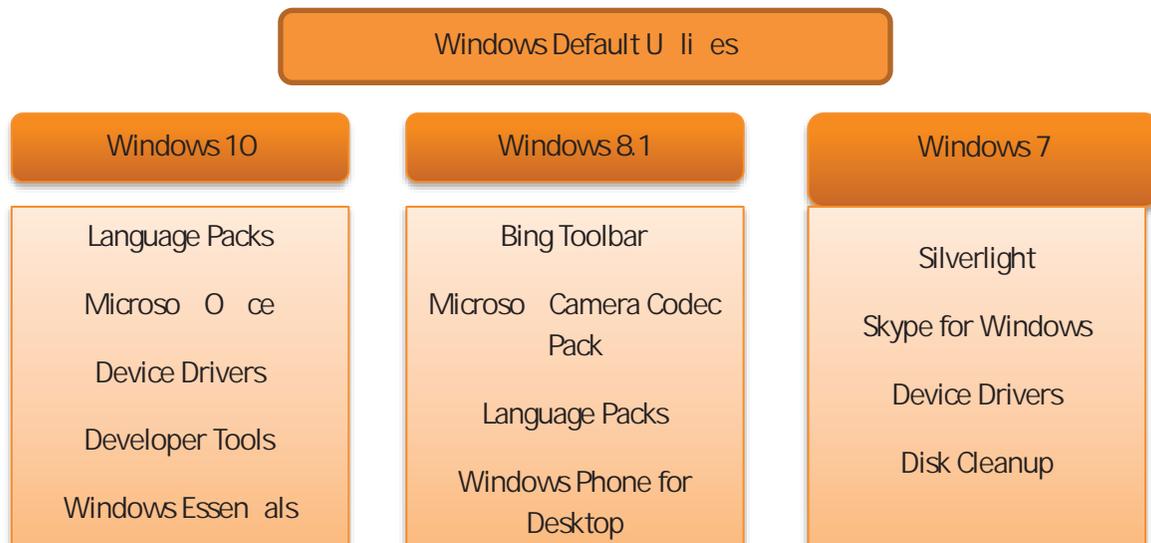
Fig. 1.1.46: Common Windows u li es

Configura on/Installa on

The steps that should be performed in order to install the Windows opera ng system on a computer are shown in the following figure:

Start the computer. → Enter the BIOS's boot op ons menu. → Select the CD-ROM drive as the first boot device of the computer.

Switch on the power of the PC and insert the Windows disc into the CD/DVD drive. ← Save the changes of the se ngs and shut down the system.
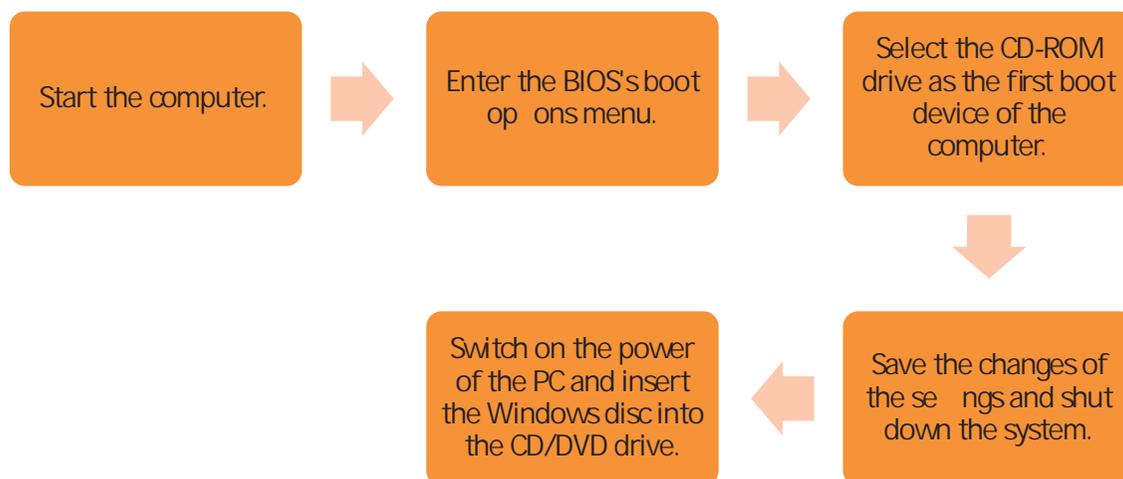
Fig. 1.1.47: Steps to install Windows opera ng system

Mac OS

Mac OS which was known as Mac OS X earlier, is a Unix-based graphical OS developed by Apple Inc. and is designed to be run only on Apple's Macintosh computers. A er Microso Windows, Mac OS is the second most widely used desktop OS. In the earlier years, Mac OS had a negligible number of types of spyware and malware which have a ected the Windows

users. The share of usage of Mac OS is smaller compared to Windows. Apple regularly releases security updates for Mac OS. The latest version of this is Mac OS 10.12 Sierra.

Func onally, the Mac OS architecture consists of several layers. The base level of the opera ng system is its Unix core. The next layer is the graphics and media layer, which consists of Core Audio, OpenGL, Core Video, Core Image and QuickTime. Then comes the applica on framework layer, whose components are, Carbon, Cocoa, and Java. Finally, the top layer is the user interface, which is called Aqua. It provides a working interface to the user.

The following figure shows the architecture of Mac OS:
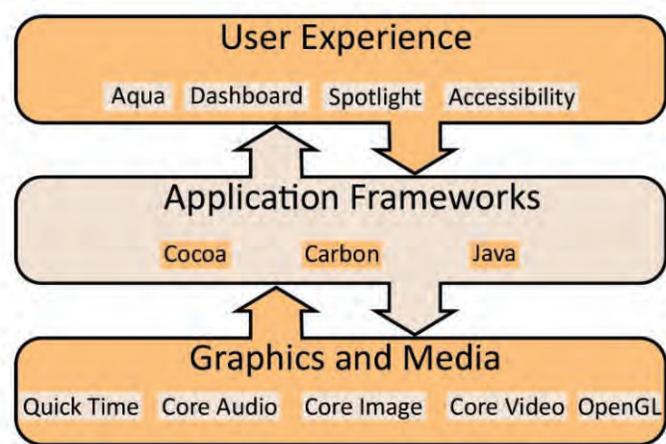
Fig. 1.1.48: Architecture of Mac OS

Directory Structure

The Mac OS file system also stores the files within folders or directories. The topmost folder is the root directory. Folders located within the root are called subdirectories.

The root directory is referred to as /. Within the root, by default, there are several addi onal folders. These include the Applica on folder that stores programs and the Users folder that stores the home folder informa on for each user account.

The following figure lists some directories of Mac OS:

```
                                                    /Applica on
                                                    /Developer
                                                    /Library
                                                    /Network
                                                    /System
                                                    /Users
                                                    /Volumes
        / (root directory)
                                                    /bin
                                                    /etc
                                                    /dev
                                                    /usr
                                                    /sbin
                                                    /tmp
                                                    /var
```
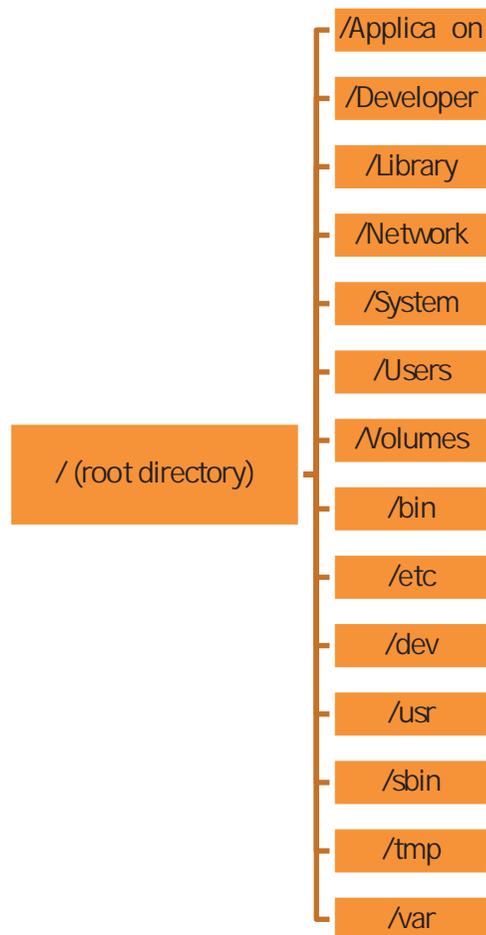
Fig. 1.1.49: Some directories of Mac OS

U li es

The following figure shows the list of some common u li es of Mac OS:

Mac OS Default U li es

Mac OS Sierra

Default Folder

Text Expander

Bartender

Launch Bar

Fig. 1.1.50: Some common u li es of Mac OS

Configura on/Installa on

One can install Mac OS over any earlier version, without removing the data. The following figure lists the steps to reinstall the Mac OS:
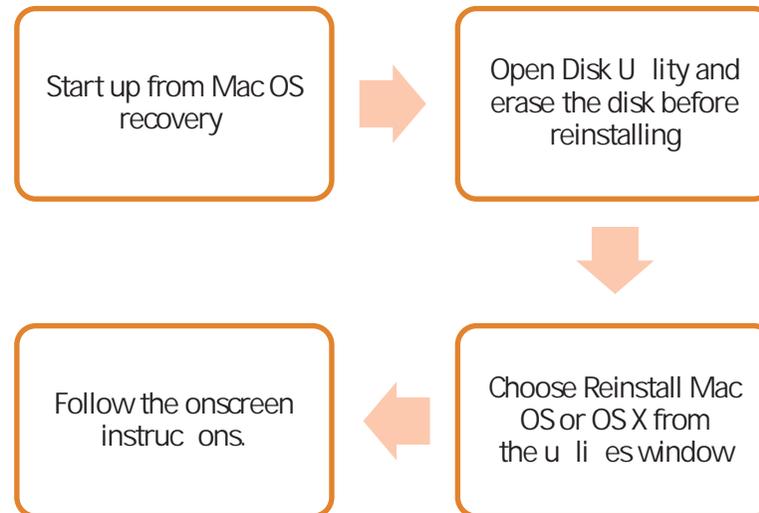
Fig. 1.1.51: Steps to reinstall Mac OS

Linux

Linux is a free and open-source so ware. The main component of the Linux OS is the Linux kernel.

The user interface, called shell, may be a command-line interface (CLI) or a GUI. For any desktop system, the default mode is usually GUI. The CLI is also available either through a terminal emulator Windows or an independent virtual console.

Linux OS has three components:

- Kernel is the core of Linux OS. It is responsible for the major ac vi es of the OS. It interacts with the underlying hardware components directly with the help of its various modules. It hides low level hardware details, thus providing required abstrac on to the system.
- System libraries are special programs which are used by the system u li es and applica on programs to access Kernel features.
- System u lity programs are mainly concerned with specialized and individual level tasks.

The following figure shows the architecture of the Linux OS:
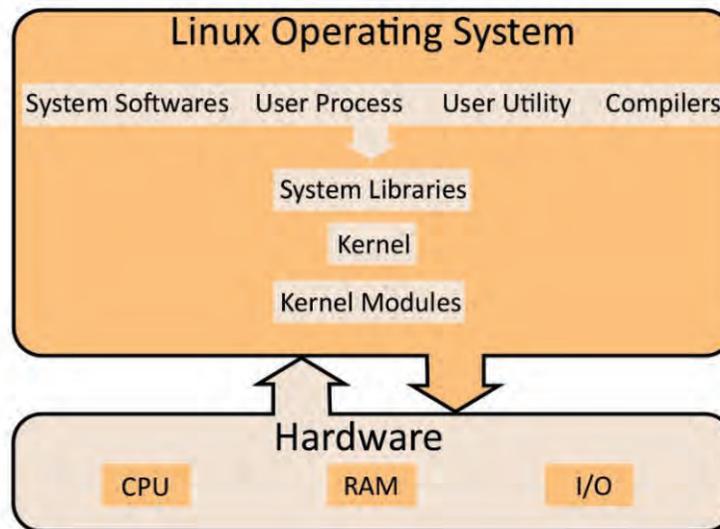
Fig. 1.1.52: Architecture of Linux

Directory Structure

The following figure lists the directories of the Linux OS:
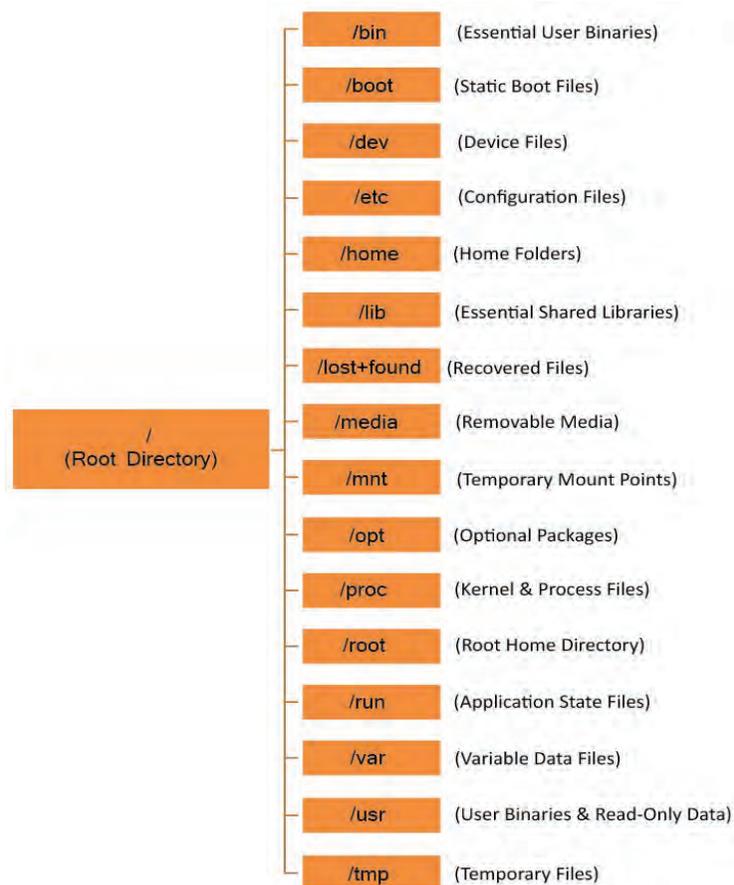
Fig. 1.1.53: Directories of Linux

U li es

The following figure lists some of the common u li es of Linux:

Linux U li es

Linux

saidar

vnmon

ncdu

slurm

dstat

Fig. 1.1.54: Some common u li es of Linux

Configura on/Installa on

To install, update or remove a so ware in Linux, certain package managers are used such as:

- Synap c Package Manager
- Package Kit
- Yum Extender

Most of the major Linux distribu ons contain extensive repositories. Users can:

- download the pre-compiled packages from websites directly,
- install the packages from uno cial repositories or
- compile the source code by themselves.

Other So ware

System so ware includes the OS and u li es. A field technician should know about the u li es that are compa ble with the OS version. The person must be able to search for the u li es that are correct for the user and install them on the system. Moreover, the technician should know the use of so ware such as:

- Commercial so ware
- Mail server so ware
- Remote access so ware
- An virus so ware

The following figure lists the general steps of installing a so ware on any opera ng system:

Download so ware from Internet or purchase a so ware CD.	→	Run the downloaded .exe file. Or Run the CD.	→	Agree to the licence agreement.
Follow the step-by-step instruc ons on the installa on screen.	→	Insert the ac va on key of the so ware when asked.	→	Click Finish a er comple ng installa on.
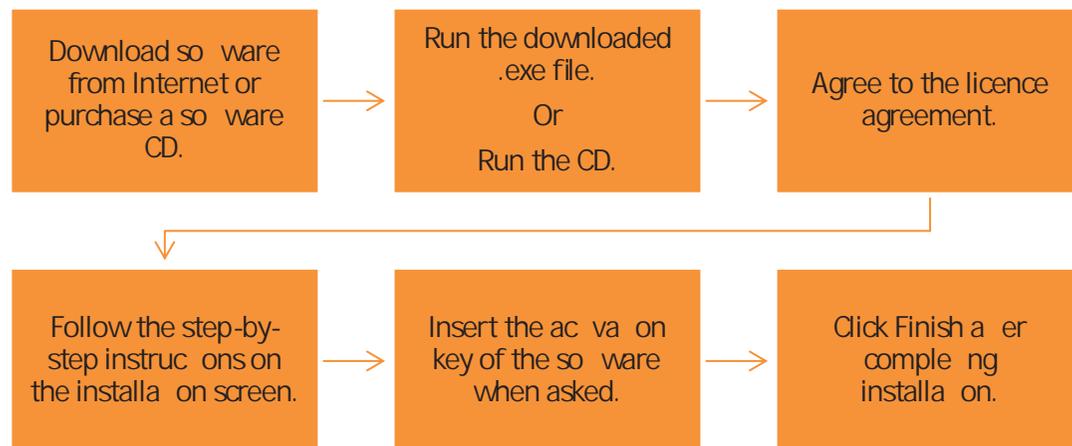
Fig. 1.1.55: General steps for installing a so ware

1.1.3 Packaged Computer Components

A computer package consists of all the necessary hardware and so ware components in a box that are required to make a system work. In general, a desktop computer consists of components such as a monitor, keyboard, mouse, CPU and so on.

Assembling and Installing a Desktop

Installing and assembling a desktop is very simple and can be performed by anyone who can read the instruc onal manual thoroughly and follow it step by step.

The following figure lists the steps to assemble and install a desktop (note that these steps may not apply to all the desktops, but are the typical steps to be performed):

```
┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐
│ Remove any plas c   │   │ Locate the two power│   │ Plug one end of the │
│ covering or protec  │   │ supply cables.      │───│ first power supply  │
│ ve tape.            │   │                     │   │ cable behind the    │
│                     │   │                     │   │ computer case.      │
└──────────┬──────────┘   └──────────┬──────────┘   └──────────┬──────────┘
┌──────────┴──────────┐   ┌──────────┴──────────┐   ┌──────────┴──────────┐
│ Place the monitor   │   │ Connect the speakers│   │ Plug the other end  │
│ and computer case on│   │ to the computer's   │   │ to a surge          │
│ the desk/table.     │   │ audio port.         │   │ protector.          │
└──────────┬──────────┘   └──────────┬──────────┘   └──────────┬──────────┘
┌──────────┴──────────┐   ┌──────────┴──────────┐   ┌──────────┴──────────┐
│ Locate the monitor  │   │ Plug the mouse PS/2 │   │ Use the second cable│
│ cable.              │   │ connector into the  │   │ to connect the      │
│                     │   │ green port behind   │   │ monitor to the surge│
│                     │   │ the computer case.  │   │ protector.          │
└──────────┬──────────┘   └──────────┬──────────┘   └─────────────────────┘
┌──────────┴──────────┐   ┌──────────┴──────────┐
│ Connect one end of  │   │ Plug the keyboard   │
│ the cable to the    │───│ PS/2 connector into │
│ monitor port of     │   │ the purple port     │
│ computer case and   │   │ behind the computer │
│ the other end to the│   │ case.               │
│ monitor.            │   │                     │
└─────────────────────┘   └─────────────────────┘
```

Fig.1.1.56: Steps to assemble and install a desktop

1.1.4 Networking Basics

A computer network is a group of computers and other devices such as printers, scanners, copiers and fax machines, connected together with the help of transmission media and various communica on devices. All electronic devices such as a computer or a prin ter a ached to a computer network for data transmission or communica on are called nodes. The transmission path between two nodes is called a link. The set of rules followed for data transmission over a network is called a protocol. These set of rules define how the data will be transmi ed between the connected nodes.

The following figure shows basic diagram of a network:
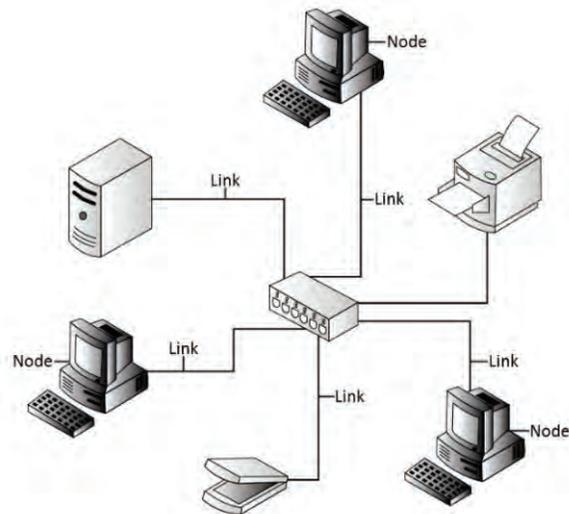
Fig.1.1.57: Basic diagram of a network

A computer network helps the end-user computers to share common resources, as shown in the following figure:
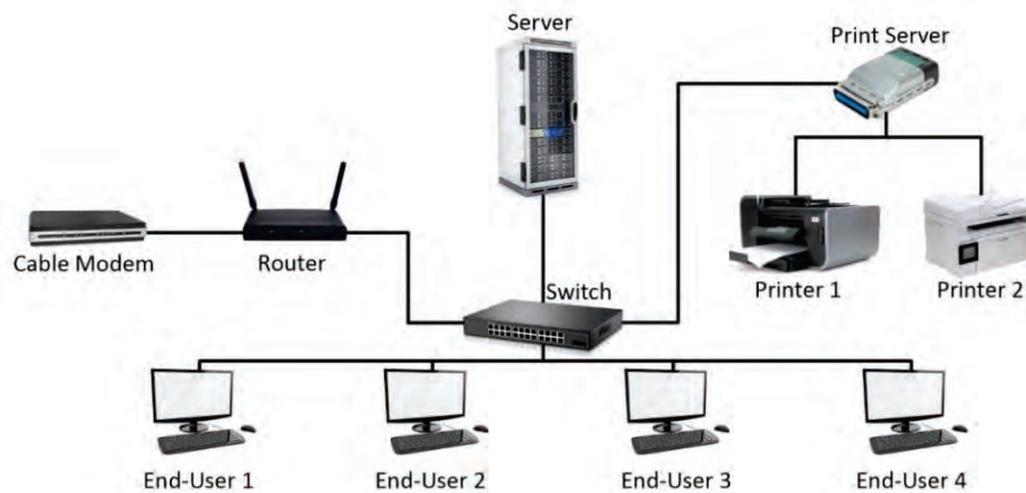
Fig.1.1.58: Computers accessing shared resources over network

In the preceding figure, the main server is connected to the end-user computers through a switch. The switch is connected to the router, which is connected to the Intern et via a modem. The switch is also connected to a print server ac ng as a medium between the end-user computer and the print server. The print server connects the two printers to the computers in the network.

Advantages of a Computer Network

The following figure lists the various advantages of a computer network:

Fig. 1.1.59: Advantages of a computer network

Network Architecture

Network architecture is a structural model that specifies the type, layout and components of a network along with data format, di erent protocols and services provided. The following figure shows the types of network architecture:
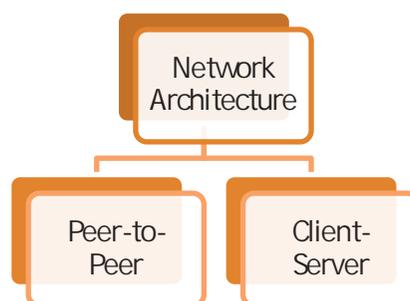
Fig. 1.1.60: Types of network architecture

Peer-to-Peer Network Architecture

Peer-to-peer is a type of network architecture in which all the computers connected to the network have similar capabili es to use the resources that are available on the network. There is no central server in this architecture and each worksta on on the network shares its files equally with the others. Peer-to-peer networks are usually simple, but they do not

o er the same performance in case of heavy network loads. The following figure shows a peer to peer network architecture:
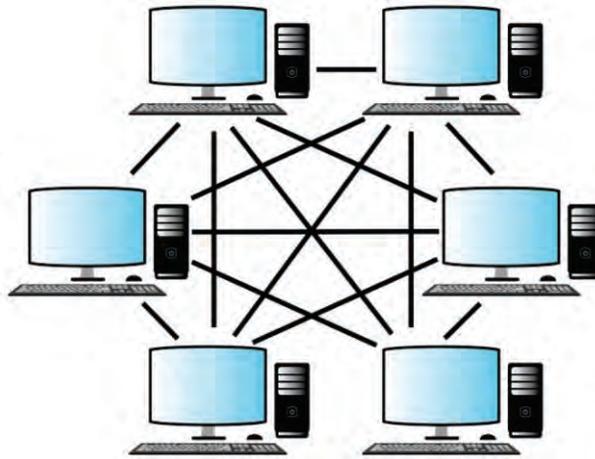
Fig.1.1.61: Peer to peer network architecture

Client-Server Network Architecture

Client-server is a type of network architecture in which each computer on the network is either a client or a server. The following figure shows a client -server network architecture:
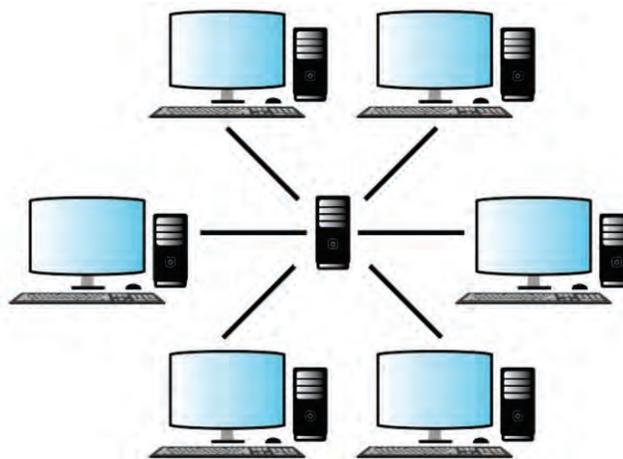
Fig.1.1.62: Client server network architecture

Server

A computer which holds programs, network opera ng systems and the shared files is called a server. Servers are computers dedicated to managing disk drives (file servers), printers (print servers) or network tra c (network servers). They provide access to the network resources to all the devices which are using the network. There are di erent kinds of servers such as file servers, communica on servers, print servers, database servers, mail servers, fax servers and so on.

The following figure lists some of the servers along with their description:

File Server

- It provides data such as data files, e-mail and printer access programs which are shared among various clients in the network.
- It has large hard disks which all users in the network share.
- Application softwares and shared data reside on this server.

Print Server

- It acts as a buffer for the print jobs sent by the users to the shared printers or centralised printers.

Communication Server

- It grants the outside users access to the network through a telephone line.

Mail Server

- It provides electronic mails (e-mails) to users of the network.

Fig. 1.1.63: Different types of servers

Clients

Client computers access the network and use various shared resources in the network. They rely on servers for resources, such as files, devices, and even processing power. They receive services from the servers as per their request.

Types of Network

There are mainly three types of network classified according to the area covered for transmission, as shown in the following figure:

| Local Area Network (LAN) | Metropolitan Area Network (MAN) | Wide Area Network (WAN) |

Fig. 1.1.64: Types of network

LAN

The network that is distributed over a small area, such as within a building, school, or home is called LAN. It allows a number of users to share common resources. Generally, a LAN is limited to 255 users per LAN. The following figure shows a LAN:
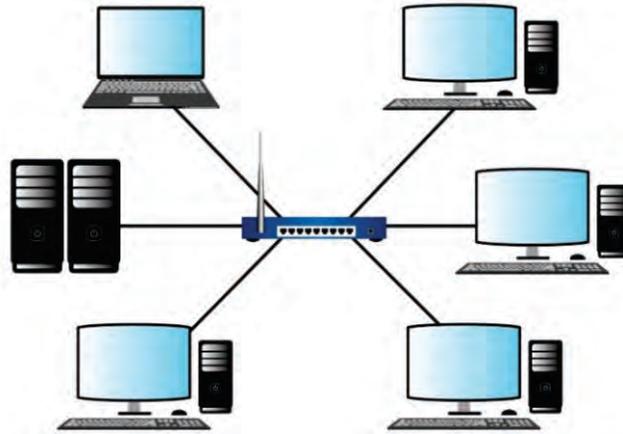
Fig.1.1.65: LAN

LANs generally employ Ethernet cables for connec ng various devices within the network. It can connect to mainframe or the minicomputers through network devices such as routers or bridges.

TIPS

Ethernet is a network protocol which defines a standard way to connect computers on a network over a wired connec on (LAN).

MAN

MAN is a network that interconnects the nodes or computers with resources within a geographic area or region which is larger than the area covered by a LAN but smaller than that of a WAN. The following figure shows a MAN:
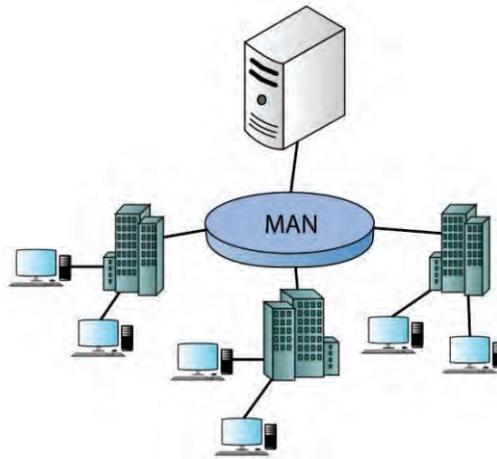
Fig.1.1.66: MAN

A MAN typically includes one or more LAN but covers a smaller geographic area than a WAN. It can also be defined as the interconnec on of several local area networks by bridging them with backbone lines. This usage of MAN is also some mes referred to as a campus netwo rk.

WAN

WAN is used to connect devices over much larger distances than LANs. A WAN is established by connec ng LANs using routers. WAN is not limited to a single person or organiza on, for example, Internet, which is a network of networks spread across the globe for exchange of informa on and services. The following figure shows a WAN:
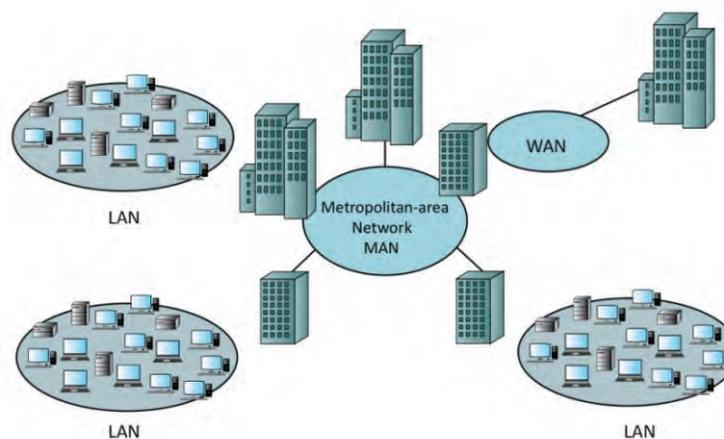
Fig.1.1.67: WAN

Network Communica on Technology

Network communica on technology deals with the technology aspects of networking communica on. Communica on is the process of sharing informa on and ideas through speech, symbols, signals, or signs. Sharing of data and resources among di erent computers in a network needs a transmission system, communica on protocols and technology. Communica on network can be wired or wireless. Computers transmit and receive informa on across the communica on links. The elements that are required for network communica on are:

- Network Interface Card: Each computer requires a special card, called network interface card (NIC) to be connected to a network. The NIC prepares data to be sent, receives data and also controls the data flow between computer and network. The following figure shows network interface card:

Fig.1.1.68: Network interface card

- Data communica on so ware: It enables the computers to communicate with each other. It tells the computers how to exchange informa on with other computers.
  - o Protocol: The data transmission protocols perform the following func ons:
    - Data Sequencing: breaking up of a long message into smaller packets
    - Data Rou ng: finding out the best route for sending the packet to des na on
    - Flow Control: regulates the speed of transmi ng data between fast sender and slow receiver
    - Error Control: detec ng error and recovering the data

Various types of network communica on technologies are as follows:

- Internet is a wide range of computer network with unlimited number of users. It contains a large number of intranets.

- Intranet is a network of computers that is designed for a group of users. It serves as a private Internet for an organiza on. The authorized users or the employees of an organiza on can access intranet from Internet, but the number of users is less. For example, intranet is used in an organiza on to share informa on with its employees only.

- Extranet refers to an intranet which can be accessed by authorized users outside the intranet, but par ally. It enables business to share informa on in a secure way over the Internet. For example, when an organiza on wants to exchange some informa on with another organiza on such as their customers or vendors, it may provide access to its intranet to the employees of the other organiza on.

The following figure shows the intranet, extranet and the Internet:
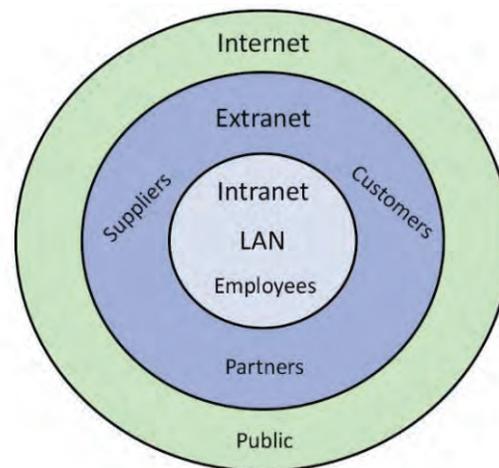
Fig.1.1.69: Intranet, Extranet and Internet

Mode of Transmission

Communica on technology also deals with the mode of transmission of data. Mode refers to the direc on of data flow over the network. There are three types of modes:

- Simplex: Communica on is unidirec onal. Data can be sent in one direc on only, from the sender to the receiver.
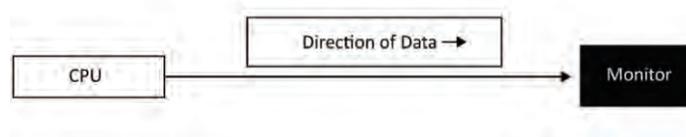
Fig.1.1.70: Simplex mode

- Half Duplex: Data can be sent in both the direc ons but not at the same me.
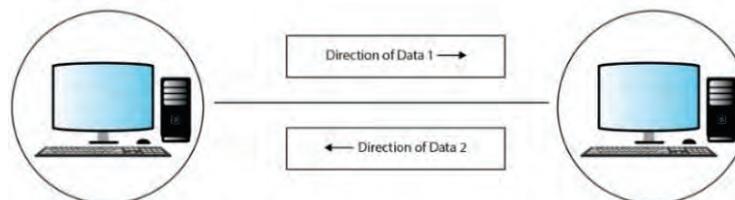
Fig.1.1.71: Half duplex mode

- Duplex: Data can be sent in both the direc ons simultaneously. A device can send as well as receive data. Example: Telephone network

Network opera ng System (NOS)

An opera ng system dedicated to networking which:

- Allows shared file and printer access among the computers connected to the network
- Enables sharing of data, security, applica ons, and other networking func ons

The common func onali es of NOS are as shown in the following figure:

User administra on and management

System maintenance ac vi es like backup and upda ng so wares

File management

Monitoring network resources

Managing and priori zing the print jobs in the network

Internet working capabili es such as rou ng
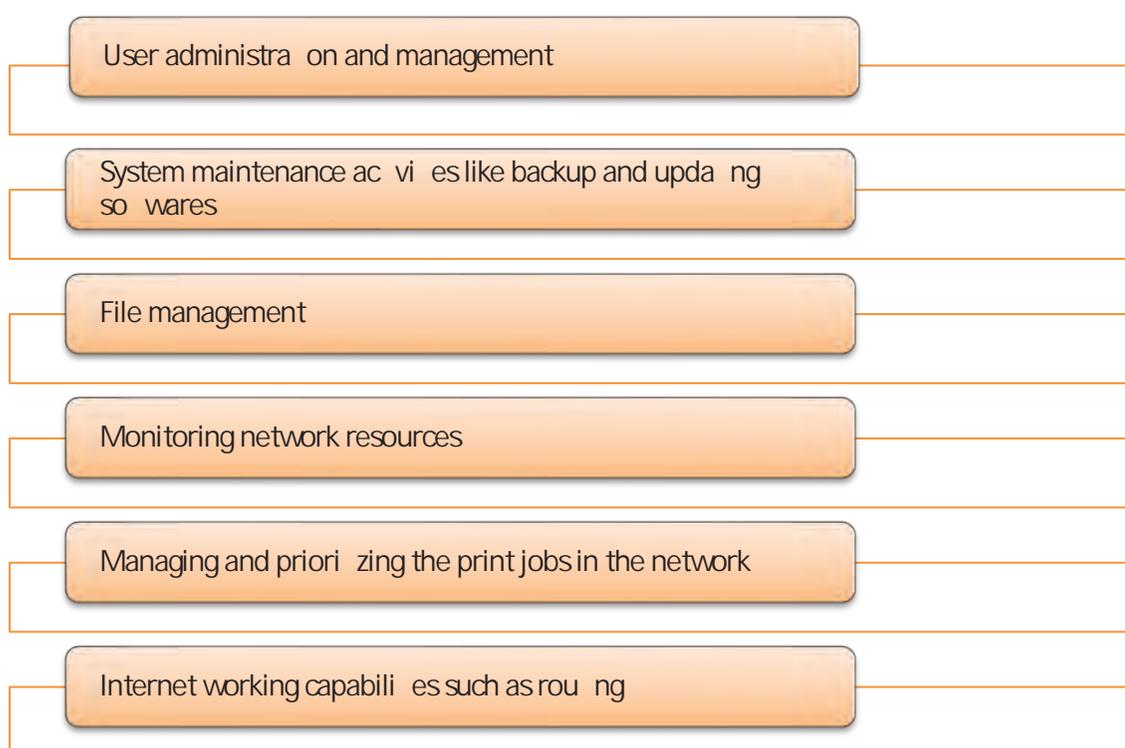
Fig.1.1.72: Func onali es of NOS

Based on its architecture, there are two approaches to network opera ng system:

- Network opera ng system based on a peer-to-peer architecture: Users can share resources and access files from each other. This system does not have a file server or centralized management resource. For example, AppleShare is used for connec ng Apple products.

The following figure lists the advantages and disadvantages of peer-to-peer NOS:

Advantages	Disadvantages
• Easy setup • Less hardware needed	• No central server for storage • Less security provided

Fig.1.1.73: Advantages and disadvantages of peer-to-peer NOS

- Network opera ng systems based on client–server architecture: It allows the networks to centralize the applica ons and various func ons in one or more dedicated servers. The server allows access to resource and maintains security. This system allows mul ple users to share the same resources simultaneously regardless of their physical loca on; for example, Novell NetWare.

  The following figure lists the advantages and disadvantages of client -server NOS:

Advantages	Disadvantages
• It has greater stability • Security is maintained by the server • New hardware and technology can easily be integrated into the system • Hardware and opera ng system may be specialized • Servers can be accessed remotely from di erent loca ons	• Higher cost • Dependent on a central server for any opera on • Regular maintenance required

Fig.1.1.74: Advantages and disadvantages of client-server NOS

1.1.5 Troubleshoo ng

Opera ng system problems can be a ributed to hardware, so ware, networks, or some combina on of the three. There will be needing to resolve OS problems more o en than others. A stop error is a hardware or so ware malfunc on that causes the system to lock up. An example of this type of error is known as the Blue Screen of Death (BSOD) and appears when the system is unable to recover from an error. The BSOD is usually caused by device driver errors.

The problems related the OS can be due to one or more of the following:

- the hardware,
- the so ware,
- the networks

Certain errors are more common than the rest. A stop error occurs due to the malfunc oning of a hardware or a so ware and results in the lock up of the system. Blue Screen of Death (BSOD) is one such error and takes place when the system becomes incapable of recovering from an error. It generally happens because of device driver errors. The cause can be researched by using the Event Log or other diagnos c methods. Preven on of such errors entails:

- Verifying that compa ble hardware and so ware drivers have been used
- Ensuring that the latest patches and updates of Windows have been installed

If the system stops working during startup, it can begin to reboot due to the auto restart func on of the Windows. The error message, then, cannot be read properly. One needs to go to the Advanced Startup Op ons menu and disable this func on.

A few commonly occurring opera ng system problems and their solu ons are shown in the following chart:

The Problem	Possible Causes	Possible Solu ons
"Invalid Boot Disk" error displayed on the computer screen a er the POST.	- A drive has a media which does not have an OS. - The BIOS has incorrect boot order se ngs. - The hard drive is not detected, or the jumpers are not set correctly. The hard drive cannot be seen, or the jumpers are incorrectly set. - The hard drive is without an OS. - The MBR has become corrupted. - The computer is infected with a boot sector virus. - Hard drive failure is detected.	- Media should be taken out from all the drives. - The boot order within the BIOS se ngs should be altered to start the boot drive. - The cables of the hard drive should be re-joined, or the jumpers of the hard drive should be reset. - An OS should be installed. - The bootrec /fixmbr command present in the System Recovery op ons of Windows 7 or Vista should be used - The fdisk /mbr command present in the CLI of Windows XP only should be run. - The virus removal so ware should be run.

"Inaccessible Boot Device" error displayed on the computer screen a er the POST.	• The device driver has been replaced and the new one shows incompa bility with the boot controller. • BOOTMGR has been corrupted in the Windows 7 or the Windows Vista. • NTLDR has been corrupted in the Windows XP.	• A previous good configura on should be used for boo ng the computer. • The computer should be booted in the safe mode a er which a restore point from the me prior to the installa on of new hardware should be loaded. • BOOTMGR file from the installa on media of the Windows 7 or the Windows Vista should be restored. • NTLDR from the installa on media of the Windows XP should be restored.
"BOOTMGR is missing" error is displayed on the computer screen a er the POST in the Windows 7 and the Windows Vista.	• BOOTMGR has been removed or is impaired. • Boot Configura on Data has been removed or is impaired. • The BIOS has incorrect boot order se ngs • The MBR has become corrupted. • Hard drive failure is detected. • Hard drive jumpers are incorrectly set.	• BOOTMGR should be restored from the installa on media. • Boot Configura on Data should be restored from the installa on media. • The boot order within the BIOS se ngs should be altered to start the boot drive • chkdsk /F /R command present in the recovery console should be run.

"Missing NTLDR" error is displayed on the computer screen a er the POST in the Windows XP.	• NTLDR has been removed or is impaired. • ntdetect.com has been removed or is impaired. • boot.ini has been removed or is impaired. • The BIOS has incorrect boot order se ngs • The MBR has been corrupted. • Hard drive failure is detected. • Hard drive jumpers are incorrectly set.	• NTLDR from the installa on media should be restored. • ntdetect.com from the installa on media should be restored. • boot.ini from the installa on media should be restored. • The boot order within the BIOS se ngs should be altered to start the boot drive • fdisk /mbr command present in the Cmd prompt should be run. • chkdsk /F /R command from the recovery console should be run. • Hard drive jumpers should be reset.
Failure of a service to start a er the computer has been booted	• The service has not been enabled. • The service has Manual se ngs. • Failed service needs some other service to get enabled.	• The service should be enabled. • The service should be set to Automa c. • The appropriate service should be re- enabled or re-installed.
Failure of a device to start a er the computer has been booted	• The power for the external device has not been switched on. • The device is not joined to the data cable or the power cable. • The BIOS in its se ngs has the device as disabled. • Device failure is detected. • A device lacks compa bility with a recently installed device. • The driver has become corrupted. • The installa on of the driver is s ll in process.	• The power for the external device should be switched on. • Both the cables should be checked, and the required connec ons should be done. • The BIOS se ngs should be opened, and the device should be enabled. • The device should be replaced. • The recently installed device should be removed. • The driver should be re-installed or rolled.

A program documented in the registry cannot be located	• Some program files have been removed. • A program did not get uninstalled correctly. • The installa on directory got deleted. • The hard drive has become corrupted. • The computer is infected with a virus.	• The program should be re-installed. • The program should be re-installed then again uninstalled. • chkdsk /F /R command should be run to rec fy hard drive file entries. • Scanning for virus should be done and the virus should be removed.
The desktop is not displayed though the computer keeps on restar ng	• The computer has been restarted when there was a failure. • A start up file is corrupted.	• F8 bu on should be pressed for the Advanced Op ons Menu. Then, Disable, automa c restart on system failure op on should be chosen. • chkdsk /F /R command present on the recovery console should be run.
BSOD is displayed on the computer	• There are compa bility issues between a driver and the hardware. • The RAM is failing. • The power supply is failing. • The CPU failure is detected. • The motherboard failure is detected.	• The STOP error and the module that caused the error should be checked. • Failing devices should be replaced with devices of good repute.

The computer freezes without showing an error message	• The se ngs of the CPU or the FSB on the motherboard are faulty. • The computer gets overheated. • The opera ng system has been corrupted by an update. • RAM failure is detected. • Hard drive failure is detected. • The power supply failure is detected. • The computer has become infected with a virus.	• Examine the se ngs and reset them. • Examine the cooling devices and replace if required. • A System Restore should be done or the update should be uninstalled. • chkdsk /F /R present on the recovery console should be run. • Failing devices should be replaced with devices of good repute. • Scanning for virus should be done and the virus should be removed.
An applica on fails to get installed.	• The applica on installer which has been downloaded is infected with a virus and has been obstructed from ge ng installed by the virus protec on so ware. • The installa on disk or the file has been corrupted. • The installa on applica on lacks compa bility with opera ng system. • Lack of memory for installing an applica on due to excessive number of programs running • The hardware cannot cope even with the least requirements.	• A new installa on disk should be obtained, or the file should be deleted, and the installa on file should be downloaded again. • The installa on applica on should be run in the compa bility mode. • The new program should be installed a er closing all the applica ons • Hardware should be installed according to the least number of installa on requirements. • The installa on should be run again.

Aero not running on a computer with Windows 7	• The computer lacks the minimum hardware requisites for running Aero.	• The processor, the RAM and the video card should be upgraded to meet the minimum Microso requisites for Aero.
Results are delayed on the search feature	• The index service has not been running. • Indexing by the index service is not taking place at the correct loca on	• The index services should be started using services.msc. • The se ngs of the index service should be altered by going to the Advanced Op ons panel.
No promp ng by the UAC to the user for permit.	• The UAC is turned o .	• The UAC should be turned on by going to the User Account applet place in the Control Panel.
Gadgets cannot be seen on the desktop.	• The missing gadgets were not installed or were uninstalled. • The XML required for the gadget has been broken, got corrupted, or was not installed.	• Click right on the desktop and opt for Gadgets. Click right on the gadget and opt for Add. • The file msxml3.dll should be registered by entering regsvr32 msxml3.dll > Enter at the command prompt.
The computer has slowed down and the response is delayed.	• Some process is u lizing the maximum CPU resources. • The computer lacks the minimum hardware requisites for running Aero.	• The process should be restarted with services. MSc. • If there is no need of the process it should be ended using the Task Manager. • The computer should be restarted. • Aero should be disabled.

The OS cannot be detected.	• The par on has not been set to ac ve mode. • The start-up files for Windows are missing.	• The ac ve par on should be set up by u lizing the diskpart tool of the System Recovery Op ons. • The Windows Startup Repair should be run.
On running a program, there is a display of a missing or corrupt DLL message.	• Some program or programs working with the DLL file was uninstalled. This resulted in the removal of the DLL file required by some other program. • The DLL file had not been registered. • The DLL file had been corrupted during an improper installa on.	• The program having a missing or a corrupt DLL file should be reinstalled. • The applica on that had uninstalled the DLL should be reinstalled. • The DLL file should be registered by using the Regsvr32 command. • sfc /scannow command should be run in the Safe Mode.
RAID is missing during installa on.	Proper drivers required to recognize RAID are absent. • The RAID se ngs in the BIOS are wrong.	• Install the proper drivers. • The se ngs in the BIOS should be changed to enable RAID.
A system file has been corrupted.	• Computer had been shut down improperly.	• The computer should be repaired by going to the advanced start-up op ons menu. • The computer should be booted in the Safe Mode and sac /scannow should be run.

GUI is not detected for all the users or the GUI does not load.	• The start-up files for Windows are missing. • The opera ng system has been corrupted by Window updates.	• The computer should be repaired by going to the advanced start-up op ons menu. • The Windows Start-up Repair should be run. • The OS should be reinstalled.
The computer abruptly shuts down.	A program is responsible for the sudden shut down of the Windows OS.	• The computer should be booted to Safe Mode and start-up applica ons should be managed by using Ms-config command.
Computer boots to the safe mode.	• A program that has been installed leads to the computer boo ng to the safe mode. • The computer has been configured to boot in Safe Mode.	• The start-up se ngs of the program should be adjusted by using the msconfig command. • The computer should be configured to boot normally by using the msconfig command.
Computer boots just to the VGA mode.	• There is a corrupt video driver.	• The video driver should be reinstalled.

Fig.1.1.75: Troubleshoo ng

UNIT 1.2: Computer Peripherals

Unit Objec ves

At the end of this unit, you will be able to:
1. List the di erent types of peripherals
2. Describe peripherals' standard installa on procedures
3. Iden fy di erent modules in the peripherals and their func ons

1.2.1 Peripheral Devices

Peripheral devices are the input/output devices that are typically used to feed informa on and instruc ons into a computer for storage or processing, and to show an output.

An input device is any hardware that gives an input to a computer. Apart from mo use and keyboard there are many other input devices such as webcam, scanner and microphone. An output device gets informa on from the CPU and displays it to the user as desired. The output is typically presented either on a display device such as a monitor, or on paper (hard copy) with the help of a printer.

The peripheral devices are categorized as shown in the following figure:
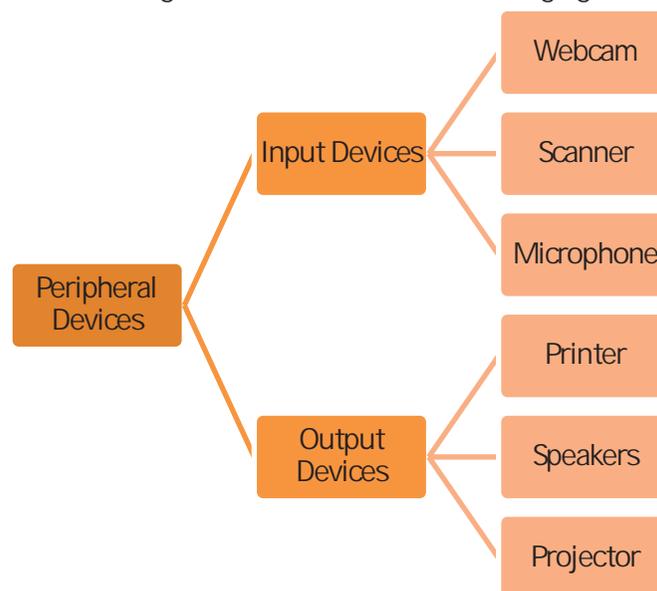
Fig. 1.2.1: Di erent types of peripheral devices

Webcam

Webcam is a video camera which streams real- me images through a computer to a network. The video data/stream may be saved, viewed and sent via the Internet. Webcams are used for video conferences, video chats, video broadcas ng, and security surveillances and so on. The following image shows a webcam:

Fig.1.2.2: Webcam

Scanner

A scanner reads documents (text and photographs) and stores it in the computer to which it is connected. The physical document is converted to digital format a er it gets scanned. The digital document can be viewed and modified on a computer. Earlier a so ware needs to be installed in the computer for scanners to work but now all the systems have inbuilt se ngs to detect the scanner automa cally. Basic scanning so ware allows the user to import data from it.

Scanners with flat scanning surface are suitable for books, pages, photographs and so on. The following image shows a scanner:
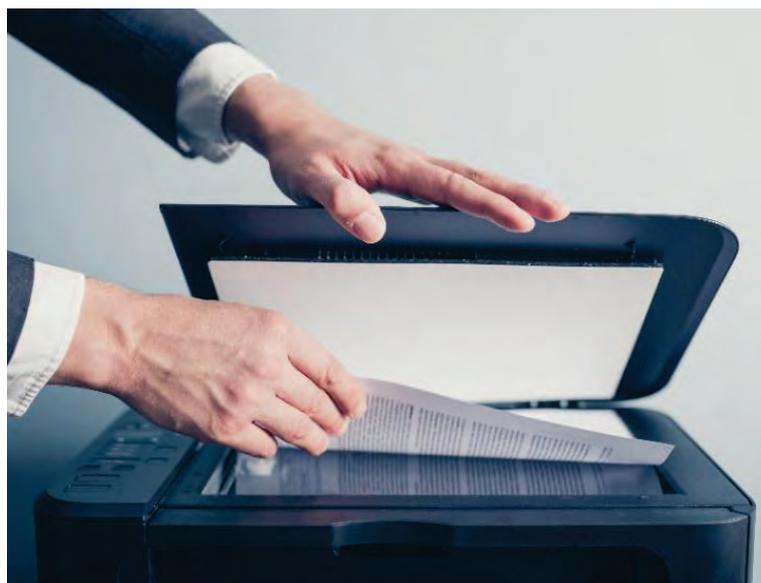
Fig.1.2.3: Scanner

Microphone

A microphone is an input device which converts sounds to electrical energy varia ons, used to record voice or interact with the computer through voice. The following image shows a microphone:

Fig.1.2.4: Microphone

Printer

Printer is a peripheral device which is used to display graphics or text on paper. They are a great resource, but they should be used in a controlled way. Their overuse puts unnecessary wear and tear on them and also uses up expensive ink and paper. The following image shows a printer:

Fig.1.2.5: Printer

The historical backdrop of prin ng goes back to the duplica on of pictures using stamps in early mes. The evolu on in prin ng has made it feasible for books, daily papers, magazines, and other readable materials to be created in appreciable numbers, and it plays a vital part in advancing literacy.

Terminology used in printers

Printers use some common terminology and acronyms that are important to understand. These terms are used to describe the characteris cs of the printer and help to determine their quality. Some of the common terms include the following:

- Pages per minute (PPM): PPM iden fies the speed at which the printer can print. For example, laser printers can print between 10 and 100 PPM. Impact printers are much slower and are some mes measured in characters per second (CPS) instead.
- Dots per inch (dpi): The resolu on or clarity of a printer is determined by dpi, or how many dots it can print per inch. This is o en the same number ver cally and horizontally. For example, a 600-dpi printer can print 600 dots in a 1-inch horizontal line and 600 dots in a 1-inch ver cal line. 600 dpi is referred to as le er quality.
- Duplexing assembly: Printers with a duplexing assembly can print double-sided print jobs. They flip the page so that the printer can print on the other side. It normally plugs into the back of the printer, but it is removed and turned over so that the rollers cab be seen. Printer se ngs o en include a se ng to enable or disable duplexing when two-sided prin ng is supported.
- Paper: The prin ng papers are available in di erent types and forms. Some of them are listed below:
  o Single-sheet paper: Laser jet and inkjet printers use single-sheet paper fed into the printer from a feeder or a paper tray. Some general -purpose paper can be used in both laser jets and inkjet printers, but there are many higher -quality papers used to print be er-quality colour pages. Low-quality paper can cause prin ng problems such as paper jams or poor printouts. Printers commonly include sensors to indicate when the paper runs out.
  o Con nuous-feed paper: This is also known as fan-fold or sprocket paper, or even paper with holes. The sheets are connected and include sprocket holes on each side of the paper. A tractor feed mechanism feeds the paper using these sprocket holes. Each sheet includes perfora ons so that the pages and the edges can be separated a er prin ng. Con nuous-feed paper is used by impact printers.
  o Thermal paper: This is used by thermal printers. It is covered with a chemical that changes colour when it is heated

One of the most serious issues with paper happens when it is exposed to humidity. The paper would not really be wet, yet it can absorb the humidity from the air, making it more troublesome for the printer to move it through the paper way. The outcome is more paper jams. So, as a best prac ce, the paper should be put away from areas that are subjected to high humidity.

Common Maintenance Tools

One of the basic maintenance tasks with any type of printer is cleaning it, and there are several common tools which can be used, such as the following:

- Compressed air: Compressed air in a can or compressed air from a compressor should be used. It is best to take the printer outside before blowing out the paper dust.
- Computer vacuum: While working inside a building, it is not always a good idea to blow the dirt and dust out of a printer into the workspaces. Instead, a vacuum should be used. Regular vacuum cleaners can cause electrosta c discharge (ESD) damage, so only ESD - safe vacuums should be used.
- Isopropyl alcohol: A considerable number of rollers inside a printer gets filthy, and they can be cleaned using isopropyl alcohol. The pickup roller in a laser printer used to get paper from a paper plate. At the point when the pickup roller gets filthy, it can have issues in ge ng the paper. So, this situa on can be handled by using the isopropyl alcohol. The advantage of isopropyl alcohol is that it evaporates immediately and does not leave any residue.

Types of Printers
There are four types of printers based on its usage:

- Personal printers: These printers are designed for personal use and may be connected to only a single computer. They are used for low-volume smaller prin ng, requiring minimal setup me to produce a hard copy of a given document.
- Networked or shared printers: These are typically used for high-volume and faster prin ng. They are shared by mul ple users on a network.
- Virtual printer: It is a piece of so ware whose user interface resembles a printer driver, but it is not connected to a computer printer. It is generally used for archival purposes or as an input for another so ware.

On the basis of modern print technology, the printer can be classified into following types:
- Laser Printers:
    - o High-quality output
    - o Used by medium to- large organiza ons
    - o Includes pickup rollers, separator pads and imaging drums
- Inkjet Printers:
    - o Send jets of ink from the print head onto the paper
    - o Print in black and white or in full colour
    - o High-quality photographs
- Thermal Printers:
    - o Heat up the paper to print the output
    - o Used to print cash register and ATM receipts and lo ery ckets
- Impact Printers
    - o Create a print using small hammer-like pins to force ink onto the paper
    - o S ll used in businesses where mul part forms are printed

Laser Printers: Laser printers give a very high-quality output and are generally used as a part of medium to-substan al associa ons that require quick, top notch printers. They have turned out to be more reasonable and are addi onally u lized as a part of li le small o ces/home workplaces (SOHOs) and even by a few individual clients. The descrip on of a few components of a laser printer is as follows:

- Pickup rollers are used to pick up a sheet of paper and begin feeding it through the printer.
- Separator pads work with the pickup rollers to ensure that only one piece of paper is picked up at a me.
- Imaging drums are round, rota ng cylinders that are covered with a photosensi ve surface; meaning it is sensi ve to light. A laser uses light to write an image onto the drum.
- Toner is an extremely fine powder that includes carbon and plas c. It is electrically charged during the imaging process, causing it to s ck to the drum where the laser wrote the image. Later in the process, it is transferred to the paper.
- Transfer rollers charge the paper. The image is transferred to the paper because the charged paper a racts the toner.
- Fuser assemblies heat the toner and melt into the paper.
- Transfer belts are used only on some high-end colour laser printers. Colours are first applied to the transfer belt and then applied to the paper.
- A high-voltage power supply provides voltages as high as -1,000 VDC. This is used only in laser printers.

As a technician, one has to work with laser printers; so it is important to understand how they work to be be er prepared to maintain and troubleshoot them. The laser imaging process includes seven stages or steps, and these steps work in a specific seque nce as the imaging drum is rota ng. The following figure shows an overview of these stages, labelled as Processing, Charging, Exposing, Developing, Transferring, Fusing, and Cleaning:
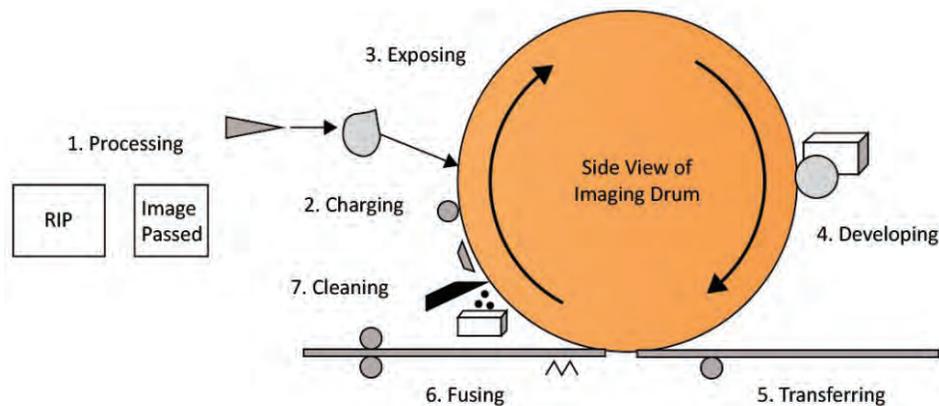
Fig.1.2.6: Laser imaging process

1. Processing: The handling stage is also called the raster image processing stage. A raster is a solitary line of spots, and a raster image is the mix of all the raster lines for a page. A laser printer recognizes the page as a raster dot images. For example, consider a 600 × 600 dpi laser printer. For a given square inch of a sheet of paper, the raster image incorporates insights about each of these 360,000 dots. These points of interest incorporate, regardless of whether it ought to be printed or not, how light or how dim the dab ought to be; and, if it's a colour printer, also, what should be the colour of the dots.

    Most laser printers incorporate a raster image processor (RIP) that makes the raster image. The PC sends the print job to the printer in a configura on the RIP comprehends, and the RIP at that point makes the raster picture. Raster images can take up a great deal of room. On the o chance that pages are printed using 600-dpi illustra ons, it takes around 4 MB of RAM for each page to hold the raster image. If it's a coloured page, it takes around 16 MB of RAM for every page. In a case when the printer doesn't have enough space to hold the print work, it will frequently give a "low memory" or "out of memory" blunder message.

2. Charging: In the charging step, an essen al charge roller applies a high-voltage nega ve charge to the imaging drum. In an old laser printer, this was connected with a corona wire that was e ortlessly broken during the maintenance ac vi es. However, most new laser printers u lize an essen al charge roller. This voltage is normally between 500 and 600 VDC, but they can be as high as - 1,000 VDC as well.

The following figure shows the process of charging the drum:
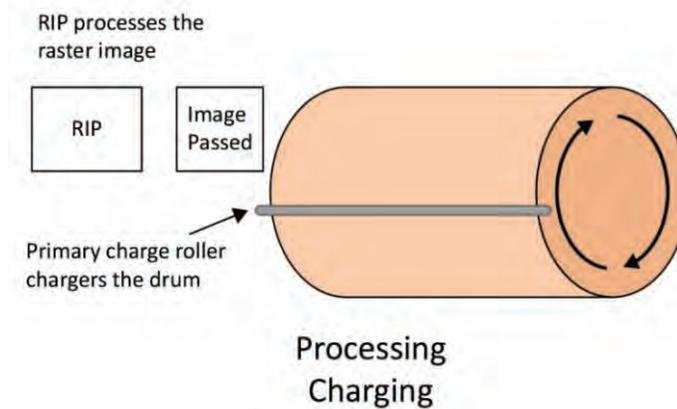
Fig.1.2 7: Processing and charging of drum

3. Exposing: A er the drum has a uniform charge, the laser exposes the imaging drum with the raster image in the exposing stage. It does this by sending a highly focused laser beam through one or more mirrors and lenses, and when the beam hits the photosensi ve drum, it neutralizes the charge applied in the previous step. However, it neutralizes the charge only where the laser beam hits the drum, as shown in the following figure:
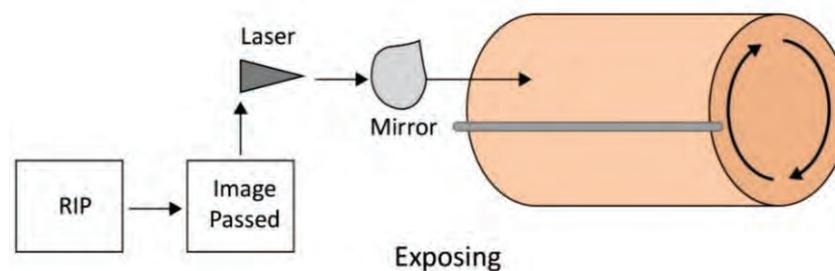
Fig.1.28: Exposing the drum

Now, the drum has a high-voltage nega ve charge everywhere, with the excep on of where it has been uncovered by the light bar. At the place where the drum has been uncovered, it develops a nega ve charge.

4. Developing: The toner is connected to the imaging drum in the crea ng stage. To start, the toner is given a nega ve charge. Now, the imaging drum has a nega ve charge with the excep on of where the picture has been uncovered, and the toner likewise has a nega ve charge. When managing power, simil ar charges repulse and opposites are drawn toward each other. In this manner, in the event that there are two parts with compara ve charges, they are pulled away from each other, while two segments with inverse charges are pulled in towards each other. Fo r this situa on, the contrarily

charged toner is pulled in to the uncovered ranges of the drum that have a nonpar san charge.

Toner is in the toner cartridge, and the designer roller makes the toner available to the drum. As the drum turns, the toner adheres to the drum where the image has been composed to the drum. The following figure shows a side perspec ve of the imaging drum:
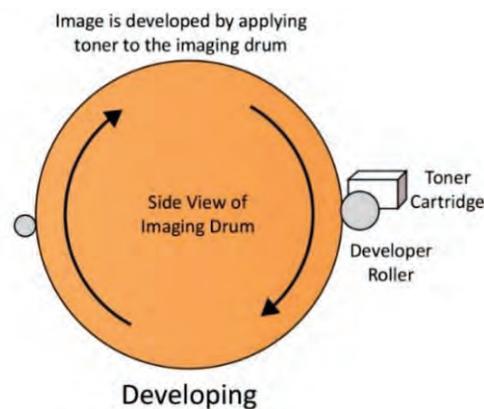
Fig. 1.2.9: The process of developing

There are a wide range of toner and toner cartridges. For instance, a few producers incorporate the engineer roller (now and then called only the designer) in the toner cartridge.

5. Transferring: The toner is connected to the paper in the exchanging stage. In the first place, pickup rollers move over the top of the paper in the paper plate to get a page. Separator cushions roll the inverse path from underneath to guarantee that just a single sheet of paper is transferred. Next, an exchange roller (now and then called an exchange crown) charges the paper, giving it an inverse charge from the toner. Similarly, as the toner was pulled in to the drum in the crea ng stage due to inverse charges, it will be pulled in to the paper in this phase due to inverse charges. A er the paper is charged, it's passed to the drum and the toner hops to the paper, as shown in the following figure:
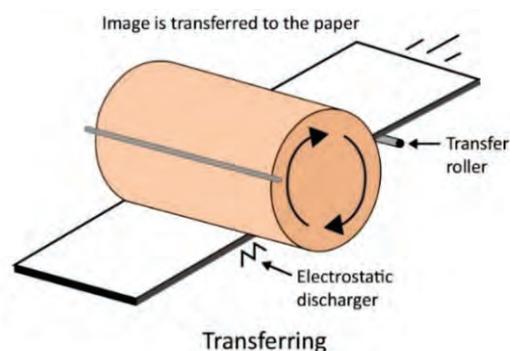
Fig. 1.2.10: The process of transferring

Laser printers have a sta c charge eliminator that expels the sta c charge from the paper instantly a er the picture is exchanged. It has been observed how socks s ck together a er they have expelled them from the clothes dryer. So also, the paper can adhere to the drum if the sta c charge isn't removed.

6. Fusing: The toner isn't joined to the paper in the exchanging stage. On the o chance that it could be li ed up and shook, the toner would simply tumble o . The toner is melded to the paper in the combining step. Toner is made out of carbon and plas c par cles, and on the o chance that plas c is warmed, it so ens. The fuser get together warms the toner with the goal that it dissolves into the paper. One of the fuser rollers is heated, and the other fuser gives grinding to press the toner into the paper as it is so ened. The following figure demonstrates how the paper is passed between two fuser rollers:

Image is fused to the paper

Fuser rollers
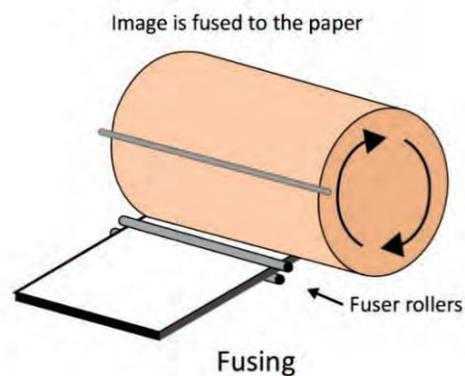
Fusing

Fig. 1.2 11: The process of fusing

7. Cleaning: In this stage, excess amount of toner is scratched o the drum and gathered for transfer. The scrubber is a li le plas c or elas c cu ng edge that scratches the toner o without harming the drum. Next, an erase light kills the charge on the drum, as shown in the following figure:

The drum is cleaned

Side View of
Imaging Drum

Erase lamp
Scraper
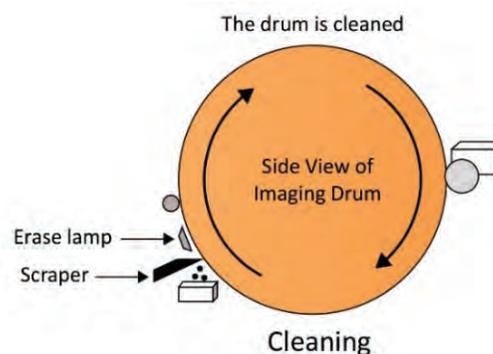
Cleaning

Fig. 1.2 12: The process of cleaning

Maintenance

Despite the fact that there are various models of laser printers, it can be seen that they share regular upkeep undertakings. Security is one of the most cri cal things to acknowledge. A laser printer incorporates a high-voltage control supply. Voltages are as high as - 1,000 VDC and can be savage. Remain safe and unplug the laser printer before playing out any upkeep. Addi onally, capacitors inside a power supply can hold a charge even a er a gadget is unplugged. Hence, even a er unplugging the printer, it should be handle d with cau on.

The fuser get together melts the toner onto the paper and achieves a temperature of around 180 degrees Cen grade (around 356 degrees Fahrenheit). Thus, a er the printer has been unplugged, it could s ll be hot. In the event that the imaging drum is uncovered amid support, care should be taken not to touch it. It could get scratched or could be le with a check that would not be cleaned amid a print cycle. These scratches or checks would show up on each printout un l the point that the drum is supplanted.

Replacing Toner

If the toner runs low, then it degrades the print quality of the printouts. Addi onally, most laser printers give programming cau ons telling that the toner is running low and its solu on is to replace the toner.
Di erent printer models have dis nc ve techniques for replacing the toner, and it is essen al to follow the maker's direc ons. Following are some broad rules that apply to most of the toner cartridges:

• Instruc ons will generally guide to shake the cartridge here and there and from side to side. This relaxes the toner and guarantees that there is full use out the cartridge.
• Most toner cartridges incorporate some kind of seal to keep the toner from spilling out. It is regularly a bit of tape or plas c that could get expelled before the new cartridge is introduced. In the event that it is not evacuated, the printouts will be clear.
• Be cau ous when dealing with the new toner cartridge. In a perfect world, you should expel the new cartridge from the bundling and embed it instantly in the printer. This implies you have e ec vely expelled the old cartridge.
• If the toner spills on you or another person, counsel the guidelines or Material Safety Data Sheet (MSDS) to figure out what to do. By and large, you can wash it o with icy water. It's intended to so en, so you ought not to flush it o with warm or high temp water. In the event that it spills on a work area, you can evacuate it with paper or material towels doused with chilly water.
• If you have to vacuum a toner spill, you should u lize an excep onal vacuum with a high proficiency par culate capturing (HEPA) channel. Without a HEPA channel, the toner par cles may very well blow appropriate over into the air.

- Recycle the old cartridge. Many organiza ons will buy these. Organiza ons revamp them, fill them with toner, and o er them at a reduced cost.

Inkjet Printers: Inkjet printers can create high quality coloured printouts and are extremely a ordable. These two advantages make them extremely well known among home clients and a few SOHOs. They don't have the same number of serviceable parts inside them, so you don't need a profound comprehension of how they func on to look a er them. The following figure shows the main parts of an inkjet printer:
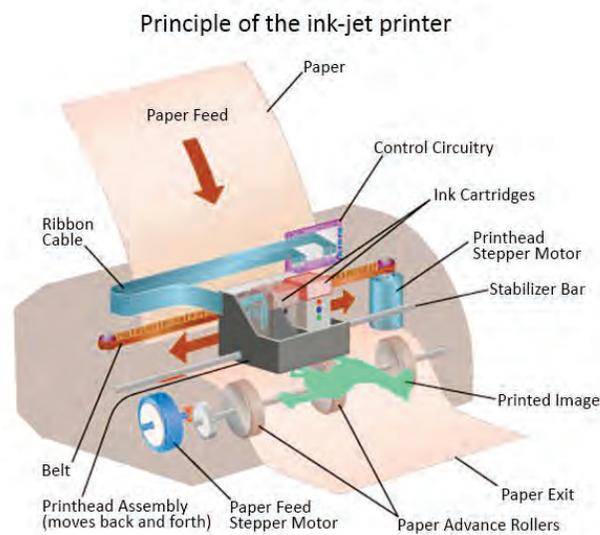
Fig.1.2.13: Basic components of inkjet printers

At least one print head is connected to a carriage and belt get together, and this gathering moves the heads from side to side as the paper is bolstered through the printer. Ink cartridges can be joined to the print head or can be found somewhere else.

A stepper motor and a pulley control the carriage and belt assembly and typically incorporates a plas c guide and sensors. The sensors iden fy the posi on of the print head and paper. The gathering addi onally incorporates an informa on link associated from a printed circuit board to the print head.

Impact Printers: These are the first printers used with the computers. Despite the fact that the innova on for a ect printers is excep onally old, they are as yet u lized as a part of organiza ons where mul part shapes are printed. Di erent spots where you may see them include back divisions.

The main components of an impact printer are the platen, the ink lace, and the print head, appeared as things 1, 2, and 3 in the figure given below. Impact printers usually u lize a tractor encourage and u lize persistent nourish paper. The paper has openings on the edges the thing 4 that fit into sprockets in a tractor bolster instrument in the printer. The tractor feeder moves a persistent fan-crease move of paper through the printer. The following figure shows the basic components of impact printers:
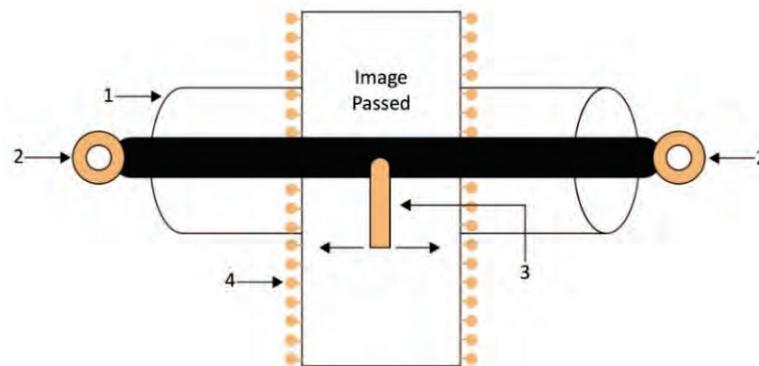
Fig. 1.2 14: Basic components of impact printers

The platen is a hard, elas c like material that gives a back to the print head. The ink lace is a long segment of fabric soaked with ink. It's associated with two rollers that relentlessly wind the strip from one roller to the next, and when it achieves the end, it switches bearings.

The print head has li le mallet like s cks that hit the strip and press the ink from the lace onto the paper. A motor and -carriage assembly move the print head from side to side as it prints. When the printer finishes a line, the tractor feed advances the paper to the next line.

Thermal Printers: Thermal printers are u lized to print money enrol receipts, ATM exchange slips, and even lo ery ckets. More established fax machines u lized warm printers as well, yet most fax machines now catch the approaching fax as a document that can be printed with a laser or inkjet printer.

Thermal printers u lize an extraordinary sort of warm paper that is secured with a synthe c. At the point when the compound is warmed, it changes shading. Most warm printers can print just a solitary shading, yet some can print two hues. The paper is typically on a move with a middle sprocket, and clerks can for the most part supplant a void come in under a moment.

Di erent segments of a thermal printer are as follows:

1. A feed assembly that encourages the thermal paper through the printer. The nourish get together uses the sprocket in the focal point of the move to propel the paper.
2. A print head that incorporates a hea ng component to heat the paper. Warm printers are generally moderate, with their speed measured in inches every second (ips). Be that as it may, they don't have to print much. Likewise, with most printers, warm printers should be cleaned occasionally with compacted air or an ESD-safe vacuum to expel garbage. You can clean the print head with isopropyl liquor and a build-up free fabric or a co on swab.

Cleaning the print head broadens its life, yet you can supplant it on the o chance that it falls flat.

Installing the printers

In order to use the printers, it is necessary to install them. The greater part of printers u lize a USB interface, and Windows will design the printer consequently when you connect it to it. In any case, you should think about some di erent poten al outcomes when introducing and designing printers.

Device Drivers

When the printer makers make printers, they, likewise, compose device drivers for various working frameworks. These drivers give the working framework the points of interest it needs to work with the gadget. When you purchase another printer, the maker inc orporates a CD with programming that you can use to introduce it.

Most of the makers also submit drivers to Microso . On the o chance that the drivers meet certain quality confirma on necessi es, Microso makes them accessible by means of Windows Update. If none of these strategies work, you can go to the maker's site to find the right driver. On the o chance that you can't locate a reasonable driver, the printer will ordinarily create an output.

Required Permissions

On Windows Vista and Windows 7, consistent users can introduce the printer with no uncommon authoriza ons as long as the print driver is accessible. If the print driver isn't accessible, the client will require managerial authoriza on to introduce an alternate print driver. Addi onally, managerial consents are required to introduce applica ons, so normal clients won't have the capacity to introduce programming applica ons that accompany a printer.
On Windows XP, clients should be in the Power Users gathering to introduce a prin ter or include an alternate driver.

Wired Connec ons

The most widely recognized way a printer is associated is by u lizing a USB associa on. Printers regularly have a USB Type B port, and you u lize a link with a USB Type A connector toward one side for the PC and a USB Type B connector on the other side for the printer.

Wireless Connec ons

Numerous printers incorporate remote capaci es that enable remote frameworks to interface with them without a wired associa on. The regular sorts of remote associa ons incorporate the accompanying:

1. Remote systems u lize one of the 802.11 conven ons, for example, 802.11a, 802.11b, 802.11g, or 802.11n.

2. Bluetooth is regularly used to make individual territory systems; PANs, for example, with a cell phone and a headset. A few printers bolster Bluetooth, and with Class 2 Bluetooth, the printer can be upto 10 meters (33 feet) away.

3. TV remotes u lize infrared, and it has been u lized with printers. A disadvantage is that it requires an observable pathway between the printer and the PC.

Adding a Network Printer

USB printers are automa cally installed when you plug them in. However, you have to take some addi onal steps to add a networked printer to a computer. You can use the following steps to add a network printer on a Windows 7based computer:

1. Click on Start and then select Devices and Printers.
2. Click on Add a Printer.
3. Then Click on Add a Network, Wireless or Bluetooth Printer.
4. Select the desired printer and then click next.
5. Windows will a empt to automa cally locate the driver. If it can't locate it, you'll be prompted to select it by first selec ng the manufacturer and then selec ng the printer model.
6. Select the printer, click on Next, and then click Finish.

Speakers

Speakers receive audio signals as input from the sound card of the computer and produce them in the form of sound waves as audio output. The following image shows speakers:

Fig.1.2 15: Speakers

Projector

A projector is also known as an image projector. It is an op cal device that sets up the images onto a blank surface, generally on a projec on screen. For example, a data projector simply connects with a laptop or any other computer system and projects/displays the output or data onto a white board. The following image shows a projector:

Fig.1.2.16: Projector

1.2.2 Mul -Func on Peripherals (MFPs)

An MFP is a type of all in one machine. It incorporates the func onality of mul ple devices into one. Hence, it can be of u lity in homes or modest businesses [the small o ce/home o ce (SOHO) market sec on] as well as in bigger o ce se ngs wher e it facilitates sharing and management of a document.

A regular MFP may serve as a blend of a few or all of the devices shown in the following figure:

E-mail

Fax

Photocopier

Printer

Scanner
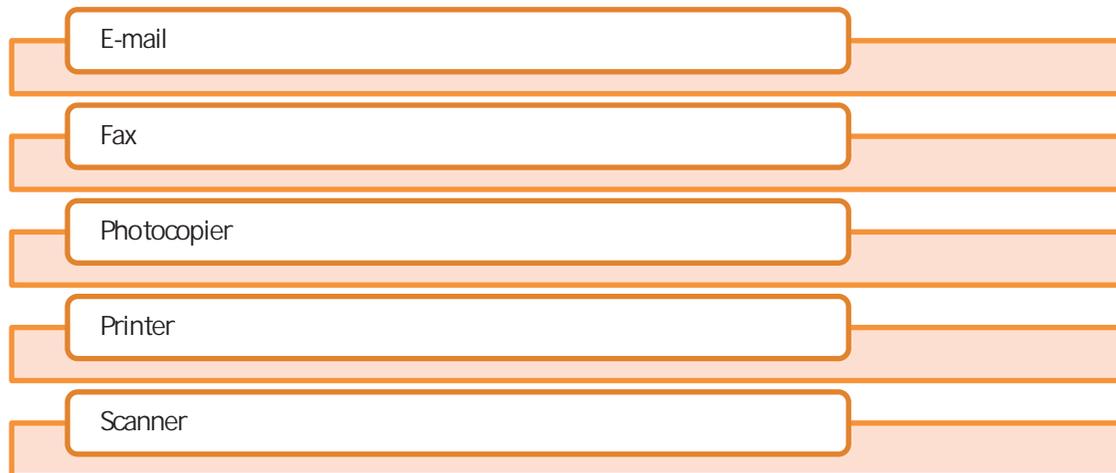
Fig.1.2.17: Devices that can be combined together to make an MFP

Types of MFPs

MFPs are divided into di erent segments, according to their speed and duty cycle. The following figure shows various segments/categories of MFPs:

All-in-one	• These type of devices are designed for home or home-o ce use. • The main focus of these devices is to provide print and scan func onali es for home use.
SOHO MFP	• SOHO stands for Small O ce/Home O ce. • In general a SOHO MFP provides a basic print, copy, scan and fax func onality only.
O ce MFP	• These type of devices are designed as a central o ce system. • These devices are the most fully featured type of MFP.
Produc on prin ng MFP	• These type of devices are desgined as central prin ng-devices or reprographic-department devices.

Fig.1.2.18: Types of MFPs

UNIT 1.3: Operating Hardware System and Peripherals

Unit Objectives

At the end of this unit, you will be able to:

1. Explain the controls of different peripherals
2. Identify safety rules, policies and procedures while operating hardware and peripherals

1.3.1 Controls of Different Peripherals

Different peripheral devices control different things on the monitor. The following figure describes the controls of peripheral devices:

Device	Description
Mouse	• It controls the movement of the cursor or pointer on a display screen.
Touchpad	• It is used for pointing (controlling input positioning) on a computer display screen.
Scanner	• It reads text that is printed on paper and translates the information into a form that the computer can use.
Printer	• It is used to produce paper (hard copy) output of the text or information that is displayed on the monitor.
Speakers	• It enables a computer to produce the output in the form of various sounds.

Fig. 1.3.1: Controls of peripheral devices

1.3.2 Safety Rules, Policies and Procedures

As a field technician, there are certain guidelines that must be followed to ensure own safety and that of the co-workers. These guidelines provide a sound, safe and flexible environment to work.

The following figure represents the general guidelines to be followed while working with electrical/electronic systems:

Follow the correct procedures to ensure zero accidents at work.

Obey safety signs, s ckers and tags on the equipment/devices.

Use an appropriate tool for the respec ve task.

Read labels and instruc ons given on the components.

Wear appropriate clothing and remove metal objects before working.

Use prescribed protec ve safety equipment only.

Follow electrical safety rules when working with electrical machinery/equipment.

Report all unsafe acts or unsafe condi ons to the supervisor.

Fig. 1.3.2 Safety guidelines

Electrical Safety

It is of utmost importance to remove the power while disassembling the computer except while measuring voltages. Removing the power not only includes turning o the power switch but also unplugging it from the socket.

Ensure that the power plug should be unplugged to ascertain that there is no power in the computer. This is required as certain power providers need to provide service to the motherboard even when the power has been switched o .

The following two important points should be kept in mind whil e working with power supplies:
* Refrain from opening it when it is plugged in.
* Even a er unplugging, the capacitors con nue to hold, in which case, if the capacitor is touched, it can discharge and give a shock.

Earthing the Equipment

Earthing means connecting an electrical system, through its non-current carrying conductor part, with the ground. The earthing or grounding of a system plays a vital role in maintaining the stability and safety of the system. With poor earthing, electrical systems are prone to damage or accidents. The following figure lists the purpose of earthing:

Purpose of Earthing	Fix the potential of active conductors with respect to the earth
	Limit the voltage in electrical system between non-current carrying parts and the earth
	Remove risk of electric shocks by implementing protection devices
	Limit rise in potential because of medium voltage faults in network with low voltage

Fig. 1.3.3: Purpose of earthing

Earthing can be mainly classified as follows:
- Equipment grounding
- System grounding

Equipment Grounding

In this type of earthing system, all the metal parts that are not carrying current are interconnected and then they are connected to the earth. Hence, there is no potential or voltage between:

- The metal parts that are not carrying current, such as the enclosure body, cable channels, metal race way and equipment frame.
- The non-current carrying metal parts and the earth

System Grounding

System grounding is used to protect an electrical/electronic system from any kind of superimposed voltages that are caused by an accidental contact with systems with high voltage and lightning. This is also required to prevent building up of static charge on the equipment. System grounding establishes a reference point with zero-voltage for the system.

The components of a ground electrode are listed in the following figure:

Electrode resistance	Rod-earth contact resistance	Ground resistance
Caused due to connec on of grounding electrode to grounding wire	Caused due to interface between ground and electrode	Caused due to soil resis vity, which occurs because of the grounding electrode
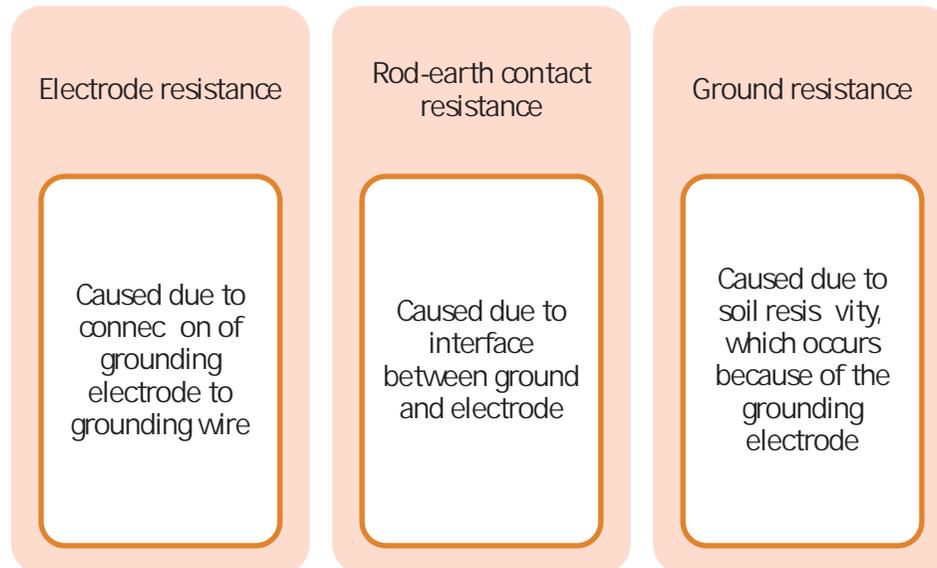
Fig. 1.3.4: Components of a ground electrode

The resistance of ground electrode connec on influences the levels of transient voltage during any event of switching and lightning. The body of earth may be considered as several concentric shells surrounding the electrode. The shells, near the electrode, are of small cross-sec onal area and rela vely of high resistance. For example, some of the screws which connect motherboard to the computer case also connect the motherboard to the ground case. The ground case is further connected to the earth by the help of power cables.

Electro Sta c Discharge (ESD)

ESD is the sudden build-up of sta c electricity when two di erently charged objects are brought together. While repairing electronic products, ESD is one of the issues that arises, as it can cause damage to the electronic devices and components.

The following figure represents some causes of ESD:

Absence of electrosta c wrist strap

Use of synthe c materials

Unshielded cables and components

Causes of ESD

Movement of air

Improper grounding

Human negligence
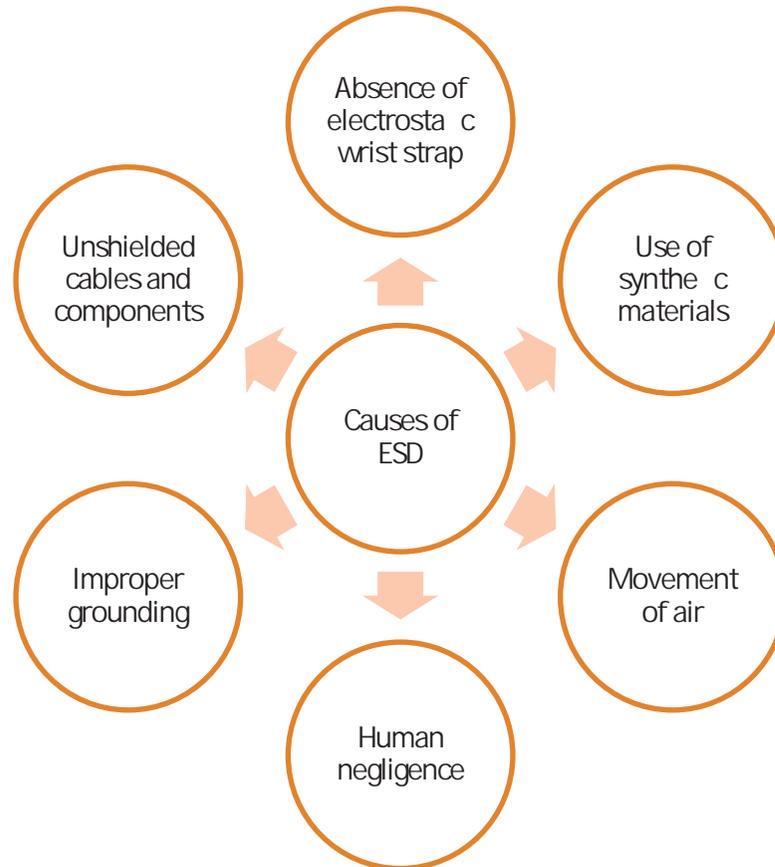
Fig. 1.3.5: ESD causes

ESD protec on is essen al for sensi ve components during assembly of a device and in the finished device. It can cause severe damage to components such as microchips. Grounding is impera ve for ESD preven on. An ESD simulator having special output circuit called human body model (HBM) is generally u lized to test the vulnerability of electronic devices to ESD from human contact.

The following figure list a few points that should be kept in mind in order to reduce ESD damage:

Use an ESD wrist strap

Use an sta c bags

Use ESD mats

Prac se self-grounding

Refrain from touching components or pins

Fig. 1.3.6: Steps to be taken for ESD damage reduc on

- Use an ESD wrist strap: It wraps around the wrist and contains a metal component touching the skin. A wire leads from the strap to an alligator clip that can be clipped to the computer case. This results in the user and the case being at the same poten al and prevents sta c discharge.
- Use an sta c bags: For handling electronic components, use an sta c bags. These bags prevent sta c from building up and thus helps in preven ng ESD damage to the components.
- Use ESD mats: These prevent sta c build-up at work benches. Technicians usually use computers on an sta c mat.
- Prac se self-grounding: Usually self-grounding is used to ensure that the body is at the same ground poten al as the case.
- Do not touch components or pins: If any circuit cards are removed, do not touch the components or the pins. Hold the outside edges or the plas c handles.
- Control humidity: When humidity is very low, sta c builds up faster.
- Avoid placing computers on carpets: Sta c can build up on rugs or carpets easily than on other surfaces.

Material Safety Data Sheets (MSDSs)

MSDSs are available with most of the products which have a poten al to cause damage to the equipment or some sort of harm to the humans while dealing with them. A few examples of these products are:

| Cleaning solu ons such as LCD cleaner | Ba ery | Printer cartridge |

Fig. 1.3.7: Examples of harmful products

Cleaning solu ons such as LCD cleaner, ba ery, adapter and printer cartridge.

MSDS provides informa on about the safety factors of handling the products and includes their characteris cs, handling strategy, storage instruc on and disposal method.

It is the responsibility of the technician to read the MSDS sheets which are available with the products. For example, while using a cleaning product to clean the LCD screen of the monitor, if that product is leaving some patches on the screen, then the MSDS sheet should be immediately checked. To avoid such kind of situa ons, it is advisable to read the MSDS sheets prior to using the product.

2. Basics of Electronics

Unit 2.1 – Fundamentals of Electronics

Unit 2.2 – Other Electronic Concepts

Unit 2.3 – Inside a Computer

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain the fundamentals of electronics
2. Define electronic circuits and components
3. Iden fy di erent types of electronic circuits
4. Define fundamentals of electricity
5. Explain other electronics concepts

UNIT 2.1: Fundamentals of Electronics

Unit Objec ves

At the end of this unit, you will be able to:
1. Define electronics
2. Explain the basics concepts of electronics
3. Iden fy electronic circuits and their components
4. Explain the fundamentals of electricity

2.1.1 Introduc on to Electronics

Electronics is the branch of science which involves the study of flow and control of electrons (electricity) and their behaviour and e ects. This branch deals with electrical circuits involving ac ve electronic components such as vacuum tubes, transistors, diodes and integrated circuits and passive electronic components such as resistors, capacitors and inductors, along with interconnec on technologies.

The following figure shows some concepts that form the basics of electronics:

Components and Devices	• Ac ve • Passive
Circuits	• Analog Circuit • Digital Circuit • Basic Circuitry
Electricity	• Ohm's Law • Kircho 's Law • AC • DC
Measuring Instrument/ Equipment	• Digital mul meter • Clamp meter • Power supplies • Voltage source • Current source • Oscilloscopes • Generators
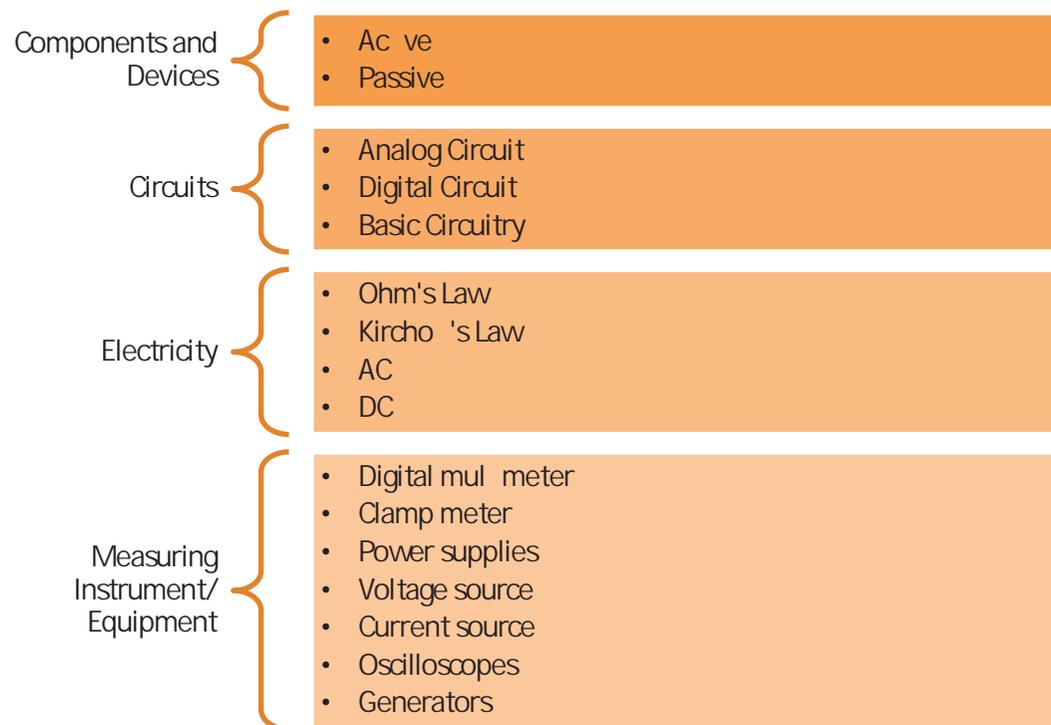
Fig. 2.1.1: Basic concepts of electronics

2.1.2 Electronic Circuits and their Components

All the circuits of a computer are made up of various basic electronic components. These components are the fundamental building blocks of the electrical/electronic circuits. They are generally found on the hard disk drive, motherboard and on the other parts of a computer and its peripherals. For a field technician, it is necessary to iden fy these components correctly.

The electronic components are embedded on PCBs. A PCB acts as a base for the components that are mounted on its surface and soldered. The components are generally soldered on the circuit board according to a specified design. The circuits are ini ally build and tested on a breadboard before being embedded on a PCB. The following image shows a mother board PCB and a few electronic components embedded on it:
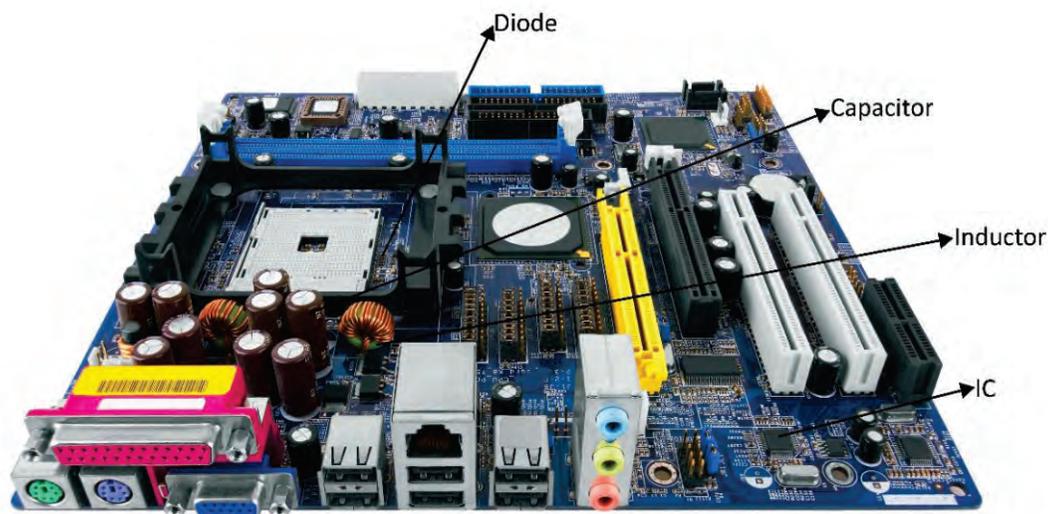
Fig. 2.1.2: Electronic components on motherboard's PCB

Electronic components that may be embedded on a PCB are of two types:

- Ac ve
- Passive

Ac ve Components

These components depend on a source of energy to perform their func ons. They can amplify current and produce a power gain.

The following figure represents a list of ac ve components:
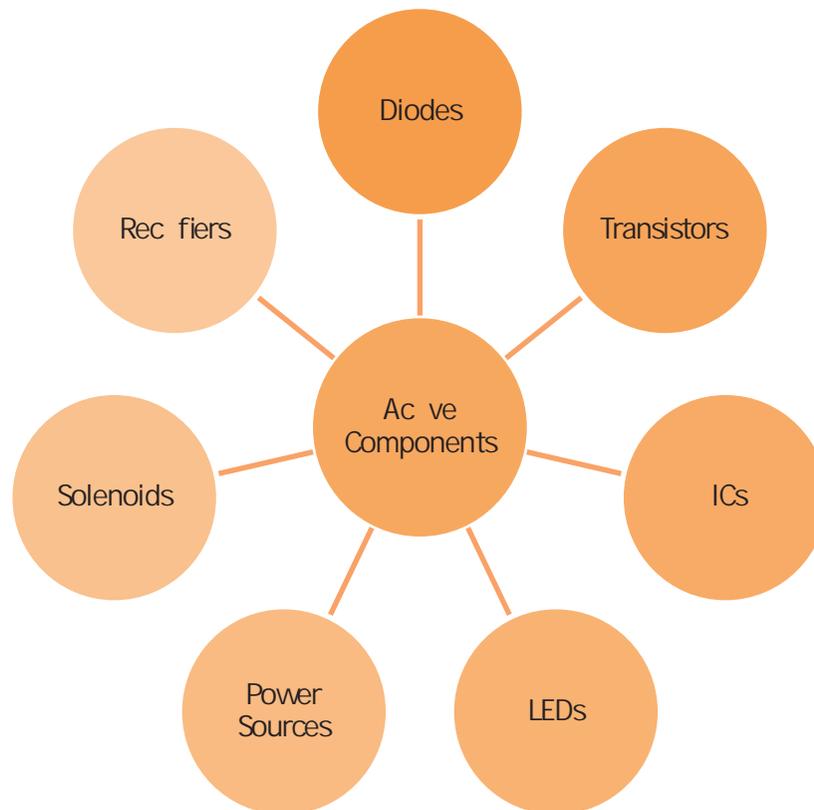
Fig 2.1.3: Ac ve components

Diode

A diode is a specialized electronic component with two terminals known as the anode and the cathode. It has asymmetric conductance, which means that it conducts mainly in one direc on. It has very less resistance (ideally zero), to the flow of current in one direc on. It has high resistance (ideally infinite), in the other direc on. Diodes are usually made up of semiconductor materials such as germanium, silicon or selenium. The following image shows diodes:

Fig. 2.1.4: Diodes

Transistor

A transistor is an electronic device, made up of semiconductor material. Usually, it has at least three terminals to connect to an external circuit. It is used to amplify or switch electrical power and electronic signals.

The following image shows a transistor:

Fig 2 1.5: A transistor

IC

An IC, also known as a microchip, is a semiconductor wafer on which a number of small resistors, capacitors and transistors are fabricated. It can work as an oscillator, an amplifier, a mer, a counter, a microprocessor or as computer memory. The followin g image shows an IC:

Fig 2 1.6: An IC

LED

An LED is a p-n junc on diode which gives out light when it is ac vated. It is a two-lead semiconductor source of light. Energy is released as photons when a suitable voltage is applied to the leads. The following image shows an LED:

Fig.2 1.7: An LED

Power Source

A power source is a source which provides power to a circuit. Generally, it is a generator or a ba ery. The following image shows a ba ery:

Fig. 2 1.8: A ba ery

Solenoid

A solenoid is an insulated or enamelled wire coil wrapped around a cylindrical solid core. The solid core may be of iron, steel or powdered iron. Solenoids can be used as electromagnets and inductors in electronic circuits. The motherboard contains solenoids to perform different func ons. The following image shows a solenoid:

Fig. 21.9: A solenoid

Passive Components

These components do not require any power source to perform their specific func ons. They are not capable of controlling current.

The following figure lists di erent passive components in a circuit:
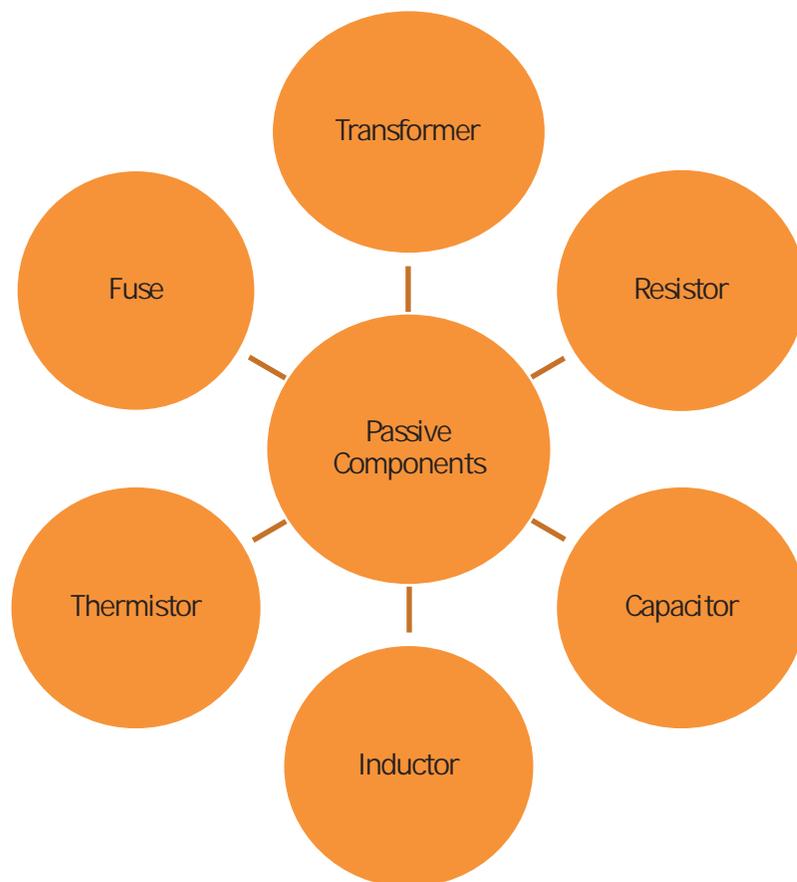
Fig. 2.1.10: Passive components

Transformer

A transformer consists of a metal core with coils of wire around it. It is a device used to convert AC to the required values by decreasing or increasing the alterna ng voltages in an electronic or electric system. The following image shows a transformer:
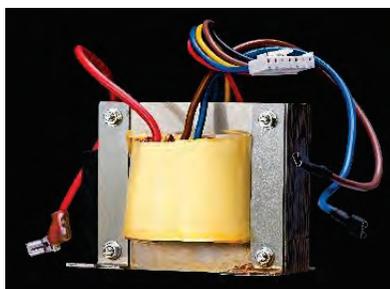
Fig 2.1.11: A transformer

Resistor

A resistor is a component in an electronic circuit which is built to resist or limit the flow of current in that circuit. It may be a small carbon device or a big wire-wound power resistor. Its size varies in length from 5mm up to 300mm.

The following image shows di erent types of resistors:
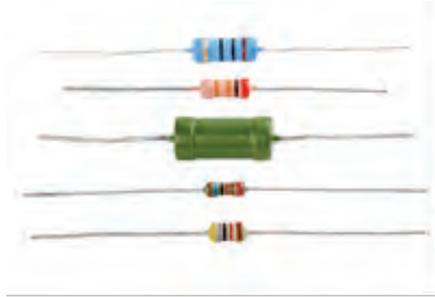
Fig. 2 1.12: Resistors

Capacitor

A capacitor is a device which is made up of one or more pairs of conductors and an insulator separa ng them. It is used to store electric charge. The following image shows capacitors:

Fig. 2 1.13: Capacitors

Inductor

An inductor consists of a coil or a wire loop. This component is used to store energy in the form of a magne c field. The more the turns in the coil, the more will be the inductance. The following image shows inductors:

Fig. 2 1.14: Inductors

Fuse

A fuse is a device which is used to protect electrical systems against excessive current. The following image represents a fuse:

Fig 2 1.15: A fuse

Types of Electronic Circuits

An electronic circuit is a combina on of electronic components that are connected to provide flow of current. The di erent combina on of wires and components allows di erent opera ons, such as amplifica on of signals, computa on and transmission of data, to be performed. The following figure represents types of electronic ci rcuits:
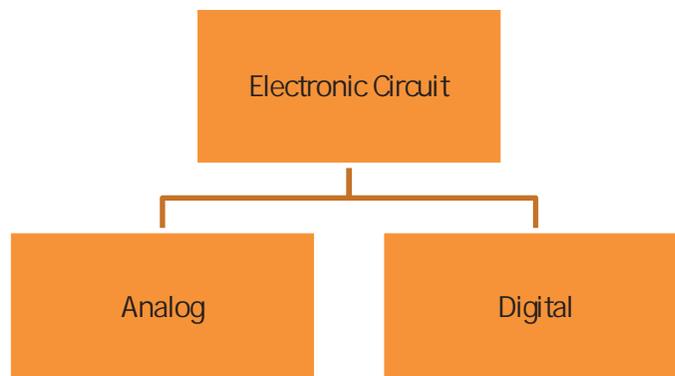
Fig. 2 1.16: Classifica on of electronic circuits

Analog Circuit

In analog circuits, there is a con nuous varia on of voltage or current with me. These circuits are a combina on of basic components such as resistors, capacitors, dio des, inductors and transistors.

The following figure represents an analog circuit:
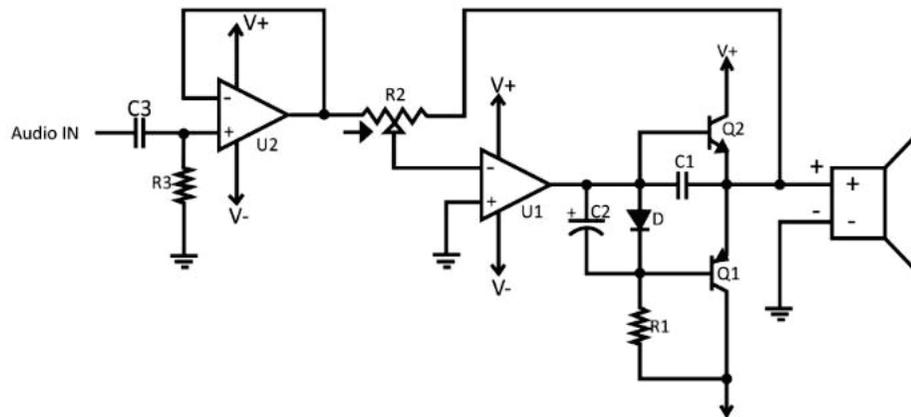
Fig 21.17: An analog circuit

The fundamental building blocks of analog circuits are:

- Series connec on
- Parallel connec on

Series Connec on

In series connec on, the magnitude of current is same through all the connected components. The following figure shows a series circuit and, in the figure, R = R1 + R2 + R3, where, R represents the resistance in the circuit:
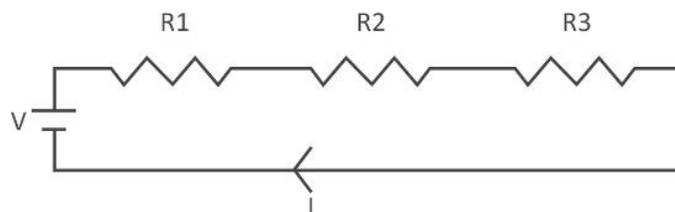
Fig. 21.18: A series circuit

Parallel Connec on

In a parallel connec on, the magnitude of voltage is same through all the connected components and the current is divided among the various components. The following figure represents a parallel circuit. 1/R = 1/R1 + 1/R2 + 1/R3, where, R shows the resis tance in the circuit and I represent the current:
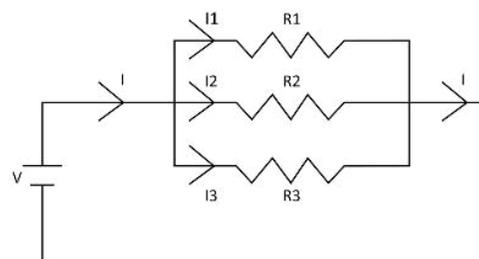
Fig. 21.19:A parallel circuit

Digital Circuit

Digital circuits use a binary scheme for digital signalling. Two di erent voltages (high or low) are represented by di erent logic levels. High voltage, generally 5V, represents one value and the other value represents low voltage that is generally 0V. T he following figure shows a digital circuit:
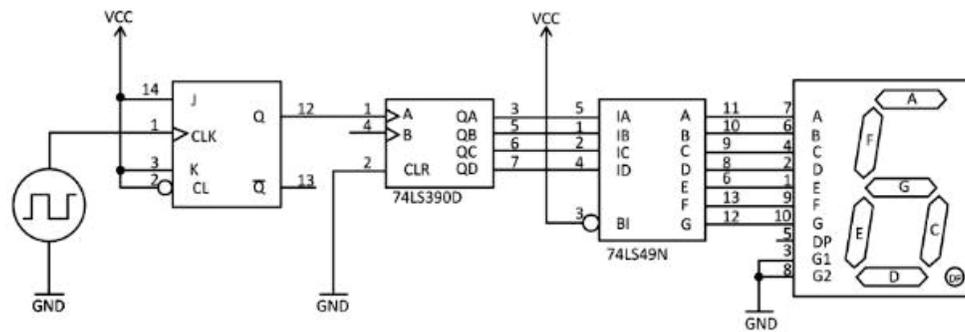
Fig. 2.1.20: A digital circuit

The following table describes basic building blocks of digital circuits:

Logic Gates	OR Gate	
These are elementary blocks of a digital circuit. At any moment, the terminal voltage level is either high represented by 1 or low represented by 0	The output terminal is at 1 when any of the inputs is 1 and is at 0 when all the inputs are at 0.	
	AND Gate	
	The output terminal is at 1 when all the inputs are at 1, otherwise the output is 0.	
	NOT Gate/Inverter	
	The output is 0 when the input is 1 and vice-versa.	
Microprocessor/Chip	An IC containing all the func ons of a computer's CPU.	
Microcontroller	A small computer on an IC which controls devices that contain the microprocessor such as remote controls, o ce machines and appliances	

Fig. 2.1.21: Building blocks of digital circuits

Basic Integrated Circuits

When an electronic circuit array is created by the fabrica on process of di erent electrical and electronic components on a silicon wafer, then that circuit is known as Integrated circuit or simply IC. These circuits have opera ons similar to the large discrete electronic circuits made of discrete electronic components. The following table describes some basic integrated circuits:

Circuit	Image	Descrip on
Digital Integrated Circuit		These types of integrated circuits do not operate at all the levels of the signal. They operate only at some defined levels. The basic building blocks of these circuits are logical gates, mul plexers, de-mul plexers, flip flops and other electronic components of circuits.
Analog Integrated Circuit		These types of integrated circuits operate over a con nuous range of signals. These circuits can be further classified as linear integrated circuits (Linear ICs) and radio frequency integrated circuits (RF ICs).
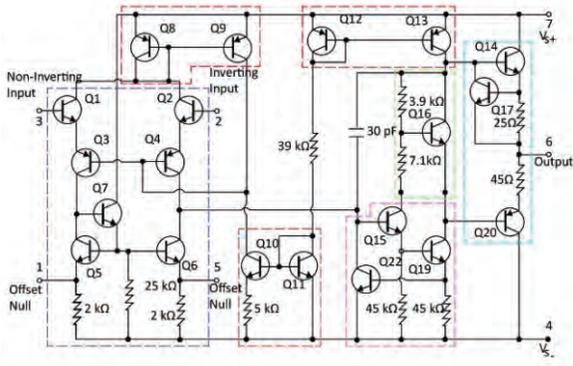
Participant Handbook

		A commonly used analog integrated circuit is an operational amplifier (op-amp). The basic building block of these type of circuits are integrated circuits (analog ASICs).
Mixed Integrated Circuit		These type of circuits are formed by the combination of analog integrated circuits and digital integrated circuits on a single chip. These circuits are mainly used as digital to analog converts (DAC) and analog to digital converters (ADC).
General type of Integrated Circuit		These type of circuits include: • Logic Circuits • Comparators • Switching IC • Timer IC • Audio Amplifiers
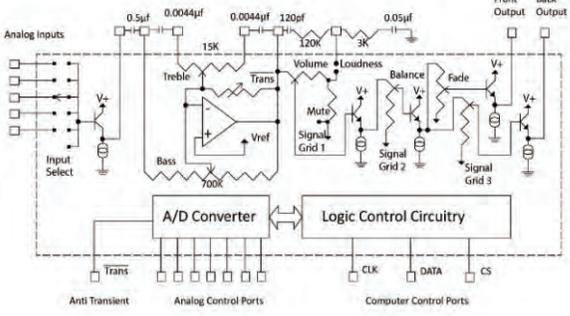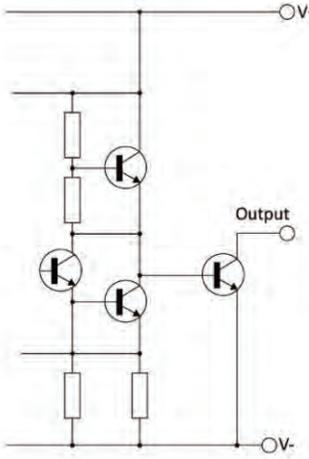
Fig. 2.1.22: Basic integrated circuits

Activity

Categorise the following components as active or passive:

1. Resistor
2. Transistor
3. Capacitor
4. Diode
5. Fuse
6. Transformer
7. Battery
8. Solenoid

UNIT 2.2: Other Electronic Concepts

Unit Objec ves

At the end of this unit, you will be able to:

1. Define voltage and power
2. Iden fy voltage and power requirement for di erent hardware devices

2.2.1 Voltage and Power

Voltage is the poten al di erence between a nega vely charged component and a component with posi ve charge. It is a measure of the energy carried by the charge and is the "energy per unit charge". The proper name for voltage i s poten al di erence or p.d. in short and it is measured in volts.

Power is the amount of electrical energy per unit me given by an electric circuit. It is measured in wa s (W) or joules per second.

Voltage and Power Requirement by Hardware Devices

Computer is an electronic machine and hence it can only be operated with a source of energy. It requires a standard power and voltage range for its opera on. Every electronic device or circuit is fed by the PSU.

2.2.2 Computer Power Supply Voltages

All the hardware components present in a computer, require some amount of DC voltage to run. This amount may di er from component to component. The following table lists a few components and their voltage requirement:

Component	Voltage Requirement (in volts)
Mainboard or motherboard	12
CPU	3.3
Graphic cards	12
CPU fan	5
USB ports	5

Fig. 2.2.1: Components and voltage requirement

So, in a computer broadly three types of DC voltages are required, which are $\pm$12V, $\pm$5V and +3.3 V.

TIPS

Power ra ngs and voltages outside the permissible range can cause system failure.

PSU

A PSU draws the AC voltage from the source (generally from the socket) and converts it to the desired level of DC voltage. It is usually found at the back side of a computer case. The following figure lists the parts found on the back of a PSU:

A connec on for the power cord to the computer.

A fan opening to draw air out of the PSU.

A red switch to change the power supply voltage.

A rocker switch to turn the power supply on and o .

Fig. 2.2.2: Components of a PSU

The following image shows a PSU:

Fig. 2.2.3: Interior view of a PSU

There are di erent types of power supplies available in the market but switched-mode power supplies are globally used today in personal computers.

There is also a stack of di eren t coloured cables inside a PSU.

The following figure lists the colour codes of the PSU cables:

Black Wires
- These wires are used to provide grounding.
- Every other color should be paired with a black wire.

Yellow Wires
- These wires denote +12V

BlueWires
- These wires denote -12V

Red Wires
- These wires denote +5V

White Wires
- These wires denote -5V

Orange Wires
- These wires denote 3.3V

Green Wires
- These are control wires to check the DC voltage

Purple Wires
- These wires denote +5V on standby mode

Fig. 2.2.4: Colour codes of PSUr cables

TIPS

Power supply and computer can be protected from a surge and voltage drops by simply adding a UPS (backup) to the computer.

Ac vity

Write the voltage requirement of the given components:

1. USB ports
2. CPU fan
3. Motherboard
4. Graphic cards
5. CPU

Activity

Match the following:

1.	Red Wires		a. +12V
2.	Blue Wires		b. -5V
3.	White		c. 3.3V
4.	Orange		d. -12V
5.	Yellow		e. +5V

UNIT 2.3: Inside a Computer

Unit Objec ves

At the end of this unit, you will be able to:

1. Explain the di erent modules inside a computer system such as SMPS, drivers, hard disk, ba ery and mother board

2.3.1 Internal Hardware Components

Inside a computer, there are various small electrical and electronic components. These form the internal hardware parts of a computer. The components such as the keyboard, mouse, speakers and printers are called peripherals and form the external hardware parts of a computer. The following image shows some internal hardware components of a computer:
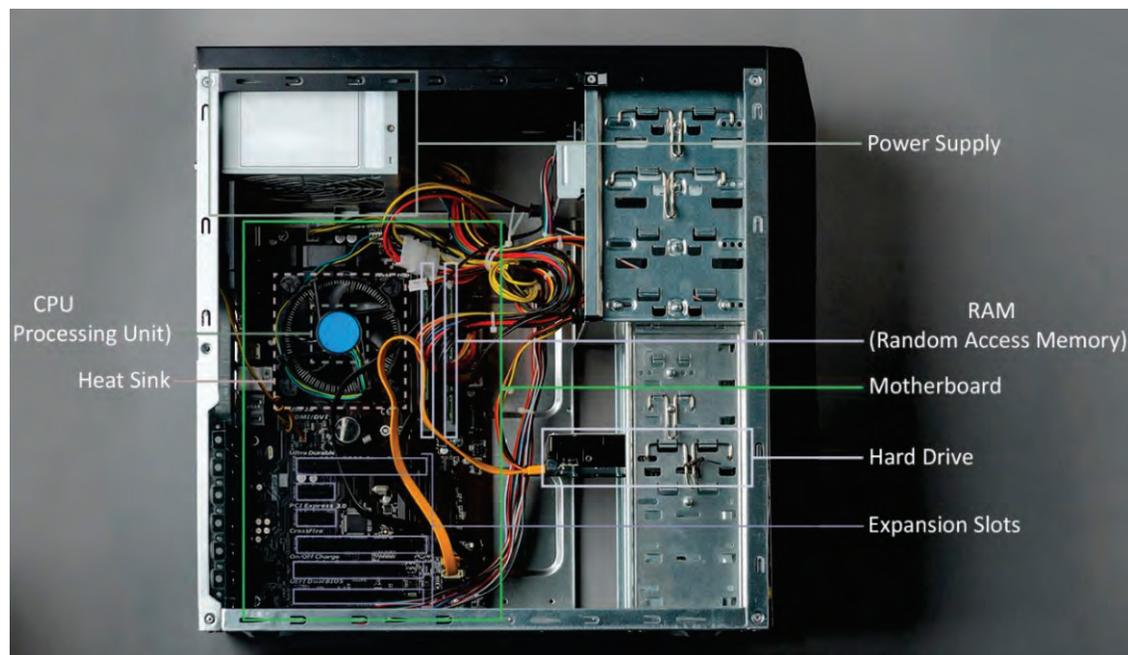
Fig. 2.3.1: Internal hardware components

Motherboard

A motherboard is the main PCB of a computer. It contains the CPU, memory, expansion cards to regulate the audio and video, the a achments for the hard drive and op cal drives and links to ports of the computer such as the USB port. There is a direct or an indirect connec on between the motherboard and every other part of the computer.

CPU

A CPU, also called as the processor, is posi oned on the motherboard, inside the computer case. It is called the brain of the computer. This unit takes data and instruc ons from the storage unit and processes it as per the instruc ons given and the type of data provided. It is then sent back to the storage unit. Whenever any keyboard key is pressed, or the mouse is clicked or any applica on is started, the instruc ons are send to the CPU.

The CPU chip (processor chip) can be iden fied by the processor type and the name of the manufacturer. This informa on can be found on the chip itself. For example, Intel 386, Advanced Micro Devices (AMD) 386, Cyrix 486, Pen um MMX, Intel Core 2Duo and iCore7.

RAM

RAM is the short-term memory in a computer that is used to store documents while they are being processed. It is available as a chip and is an IC soldered on the motherboard.

RAM slots are present on the motherboard and provide slots for inser ng RAM chips. These can be easily removed and replaced.

BIOS

A motherboard also has a provision for ini al set up of a computer a er the power is turned on, which is called BIOS or boot firmware. The BIOS consists of a so ware code that gives a computer the basic instruc ons to start. Whenever the computer is turned on, it runs the program within BIOS to do some basic system checks, locates the opera ng system on the disk and starts the computer.

PSU

A PSU converts the input AC to low-voltage regulated DC power for the internal components of a computer. The most commonly used PSU in modern computers is Switched-mode Power Supply SMPS.

SMPS

An SMPS is also known as switching-mode power supply, switch-mode power supply, switched power supply or simply a switcher. It is an electroni c power supply which e ciently converts electrical power, i.e. transfers power from a DC or AC source to DC loads, such as a personal computer. The conversion process of electrical power becomes more e cient with high input voltage and synchronous rectifica on.

The following images shows an SMPS:

Fig. 2.3.2: An SMPS

The following figure shows the block diagram of a mains operated AC/DC SMPS with output voltage regula on:
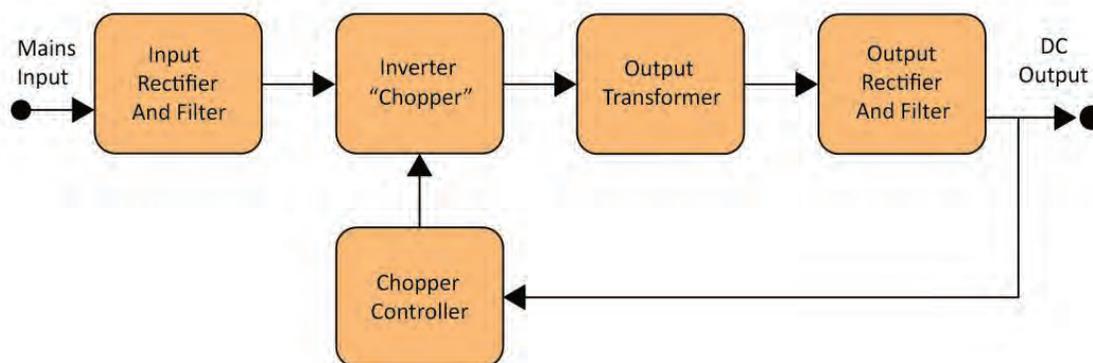
Fig. 2.3.3: Block diagram of a mains operated AC/DC SMPS

In the process of output voltage regula on by SMPS, there are certain stages involved which are:

Input rec fier stage: This is the first stage of voltage regula on known as rec fica on. In this stage an AC input is converted into DC. If the input is already in the form DC, then there is no requirement of this stage.

Inverter stage: The second stage of voltage regula on converts the input DC, which comes either directly from the source or from the rec fica on stage, into AC. DC is converted into AC by passing it through a power oscillator.

Voltage converter and output rec fier: The inverted AC should drive the primary winding of a transformer, if the output needs to be isolated from the input. This in turn makes the voltage high or low to reach the desired output level on the secondary winding of the transformer. The AC output is rec fied from the transformer if the desired output is DC.

Regula on: The output voltage is monitored by a feedback circuit and is compared with a reference voltage. An addi onal power supply is used because the feedback circuit needs power to func on before it can generate it.

Expansion Cards

The motherboard also contains slots and provision for expansion cards. The circuit boards which are inserted in the slots are called expansion cards. These cards allow a computer to connect and communicate with various input and output devices. The various types of expansion cards are video card, sound card, graphic card, network interface card and Bluetooth card.

2.3.2 Electronic Components found in a Computer

The following figure lists a few common electronic components present inside all the hardware devices:

Diode
Capacitor
Inductor
Resistor
IC
Switch
LED
Switch

Fig. 2.3.4: A few electronic components present inside the hardware devices

Ac vity

Given below is an electronic circuit. Iden fy all the basic electronic components embedded in the circuit.
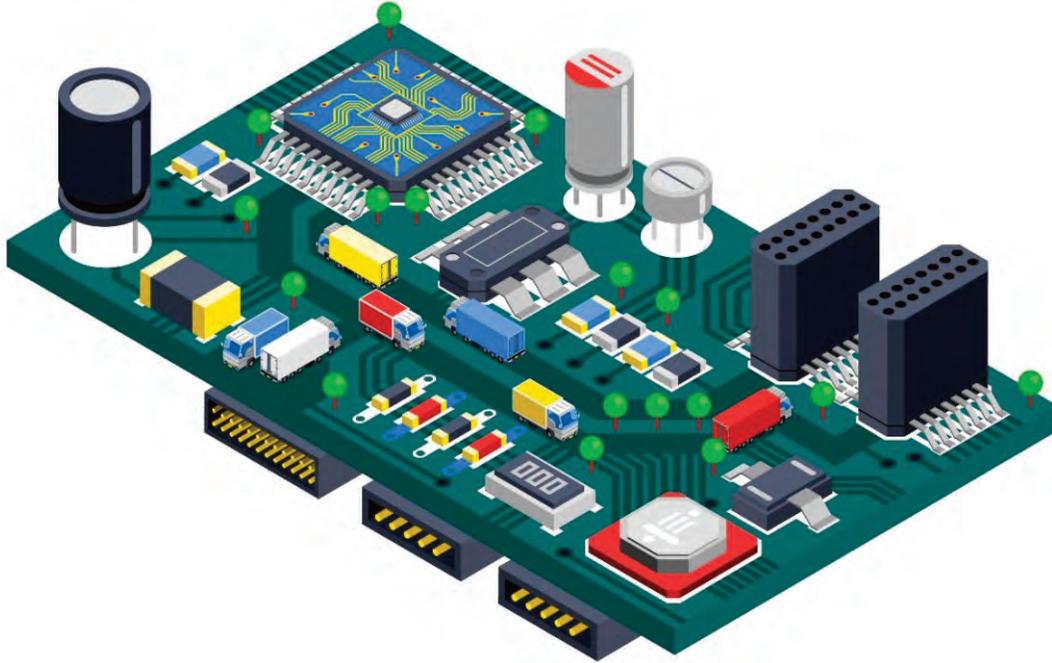
3. Installing Hardware and So ware

Key Learning Outcomes

At the end of this module, you will be able to:

1. Install the hardware
2. Configure and set up peripherals
3. Set up the so ware
4. Verify the installa ons

UNIT 3.1: Installing Hardware

Unit Objec ves

At the end of this unit, you will be able to:

1. Explain the installa on procedures given in the manuals
2. Iden fy the specifica ons for se ng up the system
3. Check site condi ons and customer requirements
4. Connect the system
5. Follow standard opera ng procedures

3.1.1 Reading the Product Manuals

A field technician is responsible for visi ng a customer's site, reading the product or equipment manual and understanding how the equipment works and should be installed. Reading the manual plays a vital role in the correct installa on/repair of the product. One of the common causes of non-func oning of components of a system may be its improper installa on, which may happen due to non-compliance of user manual instruc ons. Hence, it is of utmost importance for a field technician to always follow the process and guidelines men oned in the manual.

The product manuals are also known as user manuals. They contain all essen al informa on for the user to make full use of the computer system. They include a descrip on of the system func ons and capabili es, con ngencies and alternate modes of opera on and step -by-step procedures for system access and use. The following image shows a typical motherboard instruc on manual with a CPU:
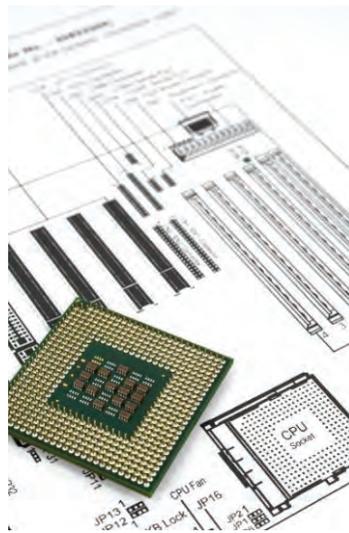
Fig. 3.1.1: Example of a user manual

A user manual generally has five sections. The following figure shows the five segments of a user manual:

Sections of a user manual

Introduction	System capabilities	Description of system functions	Operating instructions	Error handling
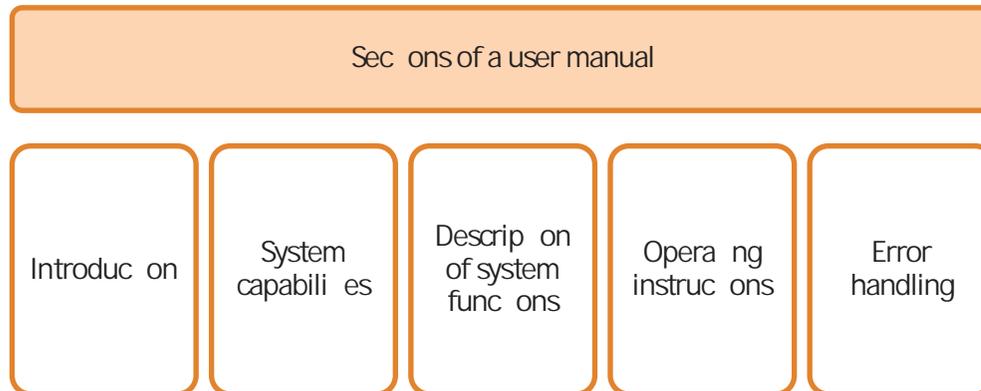
Fig. 3.1.2: Sections of a user manual

There is a help facilities section also available in the manual which describes a help desk facility that the user can contact for error resolution. Help desk telephone numbers are also included.

There are various sections in a typical help book of a particular equipment.

The following figure lists the contents of a user manual:
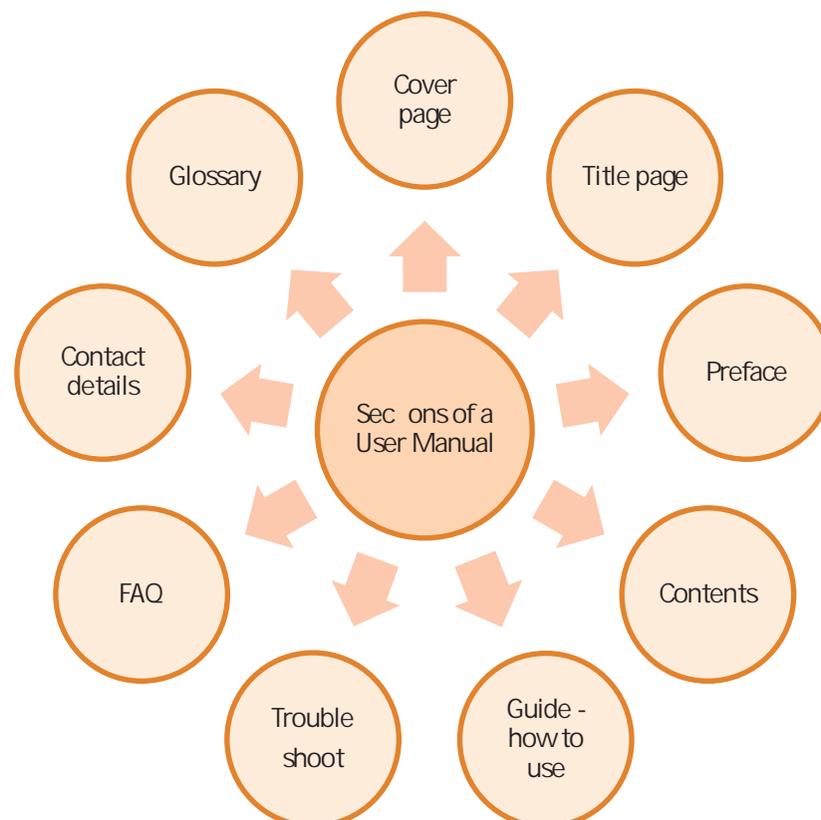
Fig. 3.1.3: Contents of a user manual

- Cover page: Shows the image of the equipment along with the manufacture's name. The tle page shows the name of the equipment.
- Preface: Gives a brief introduc on to the equipment.
- Contents page: Lists down the table of contents, that is, the list of topics along with the page numbers.
- Guide: Includes all the instruc ons that enable a user to operate the equipment.
- Troubleshoot sec on: Includes all the issues and the resolu ons for them, which the users can handle at their end.
- FAQs sec on: Covers all possible ques ons related to the product and the answers to them.
- Contact details sec on: Provides a call centre or service centre number where the users can call and register their complaints and seek assistance to their grievances.
- Glossary sec on: Includes terms which have been men oned in the manual along with their defini ons. Their page numbers are men oned alongside.

3.1.2 Specifica ons for Se ng up a System

To be u lized produc vely, all computer so ware need certain hardware components or other so ware assets to be available on a computer. These essen als components are known as computer system necessi es and are frequently u lized as a guideline as o pposed to an absolute rule. Most of the so ware specify two types of system necessi es that are the minimum requirement and recommended. With expanding interest for higher processing power and assets in latest versions of so ware, system necessi es ten d to need some increment a er some me. Industry experts recommend that this pa ern has a greater influence in driving upgrades to exis ng computer systems than technological advancements.

Recommended System Requirements

Some manufacturers of a so ware o en provide the consumer with a set of requirements that are di erent from those that are needed to run a usual so ware. These requirements are generally known as the recommended requirements. They are always at a level above that of the minimum requirements. They show an ideal situa on which is required to run the so ware.

Along the same lines, it is recommended that a field technician, prior to a client visit, checks the site condi ons. This will help in the analysis and iden fica on of the actual condi ons at a customer's site.

3.1.3 Check Customer Requirements

A field technician is responsible for the installa on or repair/maintenance of the computer and its peripherals. When work is allocated, it is important to understand and analyse the requirement before going ahead with the plan of ac on or visi ng the customer's site.

The following figure shows the workflow for the role of a field technician:

New Installa on:	Carry the needed equipiment, manual and warranty
	Carry the bill/invoice for new purchase
	Confirm the address and inform about the me of visit
Maintenance/Re pair:	Ask about the service, repair, maintenance and Annual Maintenance Contract (AMC) of the equipment
	Carry the required tools and equipment parts
	Confirm the address and inform about the me of visit
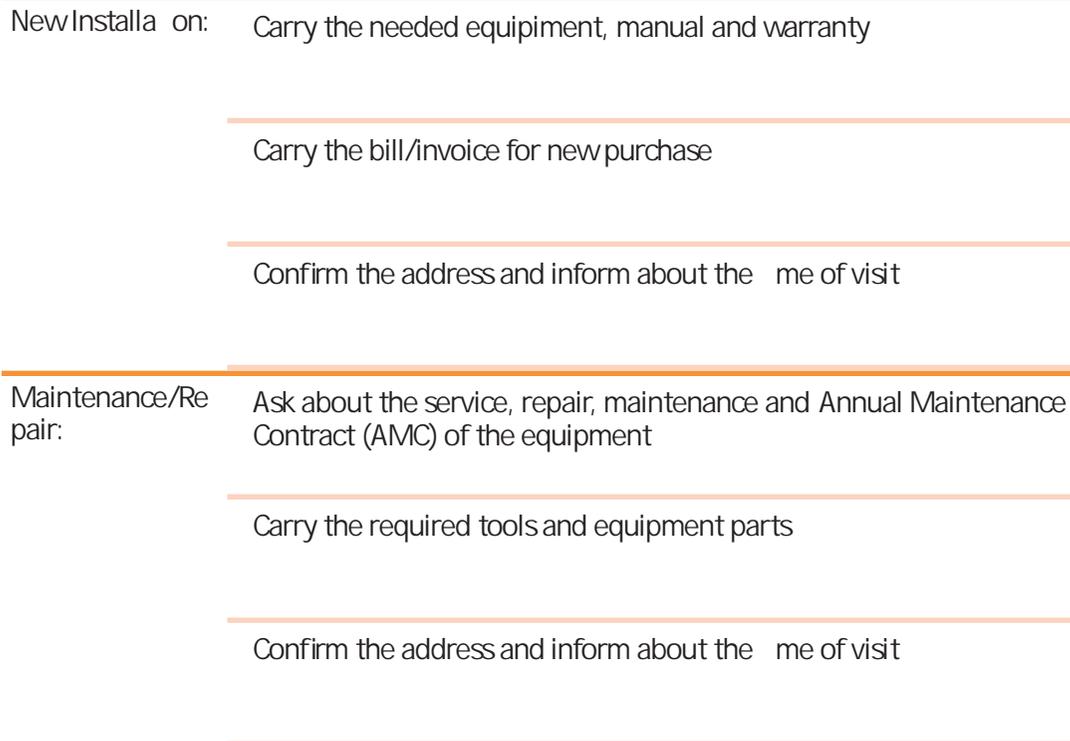
Fig.3.1.4: The workflow for installa on and repair

Before visi ng the customer for installa on or repair, it is important to understand the requirement of the customer. The following figure represents the various ac vi es which should be done before a visit to the customer's site is scheduled:

Check the new requests or complaints registered by the customer → Based on the requests/complaints and loca on of the customer, make a route plan for the day → For repairs, an cipate the problem → Call the customer to confirm the visit me → Carry tools and parts accordingly → Greet the customer and confirm the request/problem registered by the customer → For repairs, check the warranty status of the appliance and the annual maintenance

Fig.3.1.5: To-do list for a field technician

3.1.4 Se ng Up the System

There are certain steps involved in complete se ng up of a system. The following figure lists the main steps involved in a system set up:

- Open the packaging of the new product
- Take out the hardware/modules carefully
- Check the modules inside the package
- Connect all the hardware devices such as the central processing unit (CPU), monitor, keyboard and mouse
- In case of a laptop, connect the ba ery, plug in and switch on the system
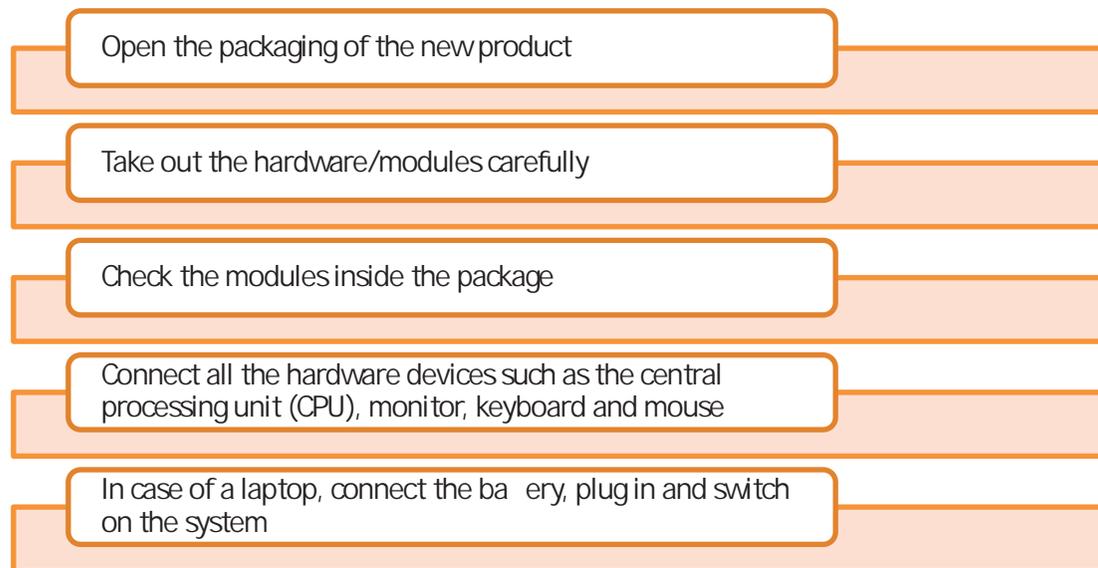
Fig. 3.1.6: Steps involved in se ng up a system

Open the Packaging

A er ge ng the system to the site, remov e the package carefully and check the modules inside it. They should match the checklist. The following figure represents the steps involved for unpacking the system to ensure proper installa on:

| Inspect outer packaging for any damage | → | Move the package to a convenient place to unpack | → | Ensure proper levelled space for the product's removal from the package |
| Cut bands around the cardboard covering the cabinet | → | Remove the cardboard covering from the cabinet, using scissors or a knife | → | Remove plas c bag and the foam packing material |
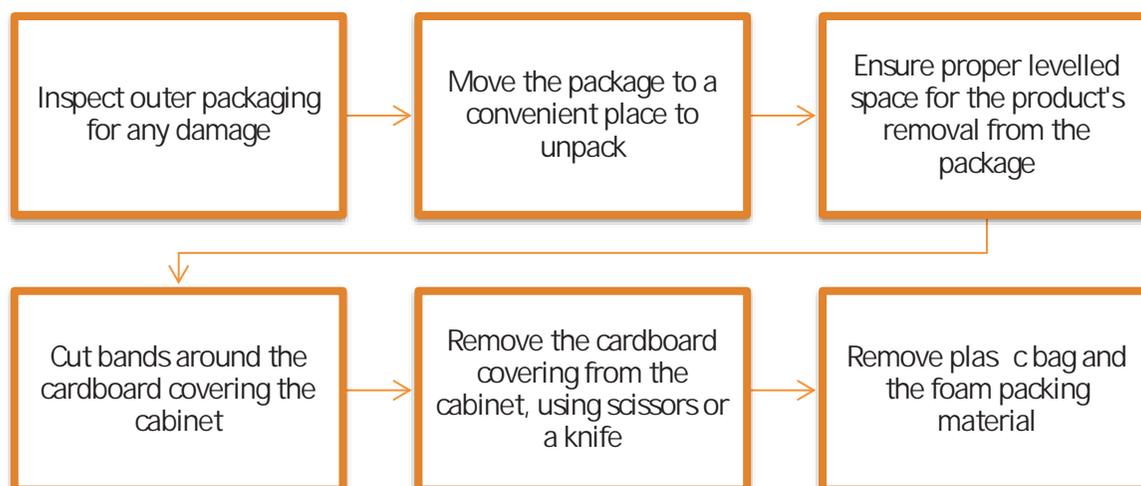
Fig. 3.1.7: Steps for unpacking a system

The tools used for handling and unpacking the system are shown in the following figure:

U lity knife   Cu er

Fig. 3.1.8: Tools used in handling and unpacking a system

Take out the Hardware/Modules

Take out all the hardware/modules carefully from the package. Check and understand the symbols on the package to know about the cau ons and warnings related to the installa on.

The following figure depicts some common warning symbols along with their meanings:

A triangle with an exclama on mark within it represents a warning or a no ce that is important. .

A triangle with a hand that is crossed out is the symbol used to represent a product that is sensi ve to electroSta c discharge (ESD).

A triangle with a lightning bolt is a symbol used to represent a warning for the poten al of an electrical shock.

An F with two C's represents the FCC and is a symbol found on a package that meets the FCC (Federal Communica ons Commission) guidelines.

An umbrella icon on a package warns that the contents of the package are sensi ve to water and should be protected.

A wine glass with a crack is a symbol used to indicate that the contents of a package are fragile.
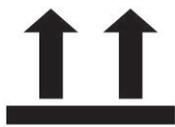
One or two arrows with a line underneath them indicate the direc on in which the box should be posi oned. The line shows the bo om and the arrows point upwards.

Fig. 3.1.9: Common warning symbols on a package

Check the Modules

To ensure smooth installa on, the modules inside the package must be checked so that if there is any module missing or any damage found, it can be informed to the company as early as possible. In addi on, do the following things:

- Check all the modules for any damage that may be caused during shipping. If any damage is found, it should be reported to the carrier and the dealer
- Check for any cracks on the monitor screen
- Match the accessories against the delivery checklist

Connect all the Hardware Devices

A er checking all the modules, the next step is to connect all the hardware devices such as mouse, keyboard, Ethernet and so on to their respec ve ports. Computer ports are connec ng points or interfaces with peripheral devices that work to communicate with the computer. For making the connec on, correct iden fica on of these ports is necessary. These ports are usually located at the backside of the CPU (in case of desktop computers). The following image shows the di erent connec on ports for connec ng mouse, keyboard, USB and so on:

Fig. 3.1.10: Di erent connec on ports in a desktop computer

In the case of laptop computers, the keyboard is attached to the monitor and other connection ports are located on the side of the laptop as shown in the following image:
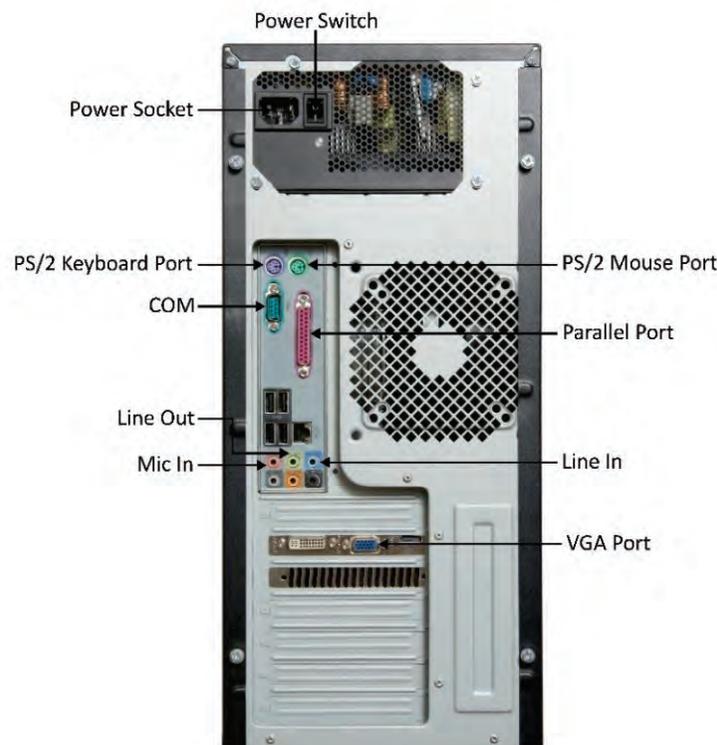
Fig. 3.1.11: Different connection ports in a laptop computer

Provide Power Source

The last step of the assembling process is to provide power to the computer. In case of a desktop computer, the power can be provided by simply inserting the power plug into the socket and turning it on. In case of laptops, first the battery should be placed into its correct location. It needs to be charged after getting drained. For this purpose, an adapter is used, which generally comes along with the laptop.

3.1.5 Standard Operating Procedures

Standard operating procedures provide a stable platform for performance measurements. All companies, be it small or large, have documented work standards to ensure consistent progress. It is the responsibility of the field technician to follow these standards. The technician should adhere to work standards to meet the targets and achieve sustainability in the workplace. He/she should also follow the safety standards to stay safe while working with electrical and electronic components.

The following figure lists a few standard opera ng procedures for a field technician:

Handle PCB with ESD safety standards

Use other specific devices for installa on of peripherals

Place the system at a loca on as preferred by the customer

Carry tools and manuals

Ensure that appropriate device and model specific procedure is followed as per the installa on manual

Maintain zero-material defect during installa on

Fig. 3.1.12: Standard opera ng procedures for a field technician

ESD

ESD is the sudden build-up of sta c electricity when two di erently charged objects are brought together. While manufacturing electronic products, ESD is one of the issues that arises, as it can cause damage to the electronic devices and components.

The following figure represents some causes of ESD:
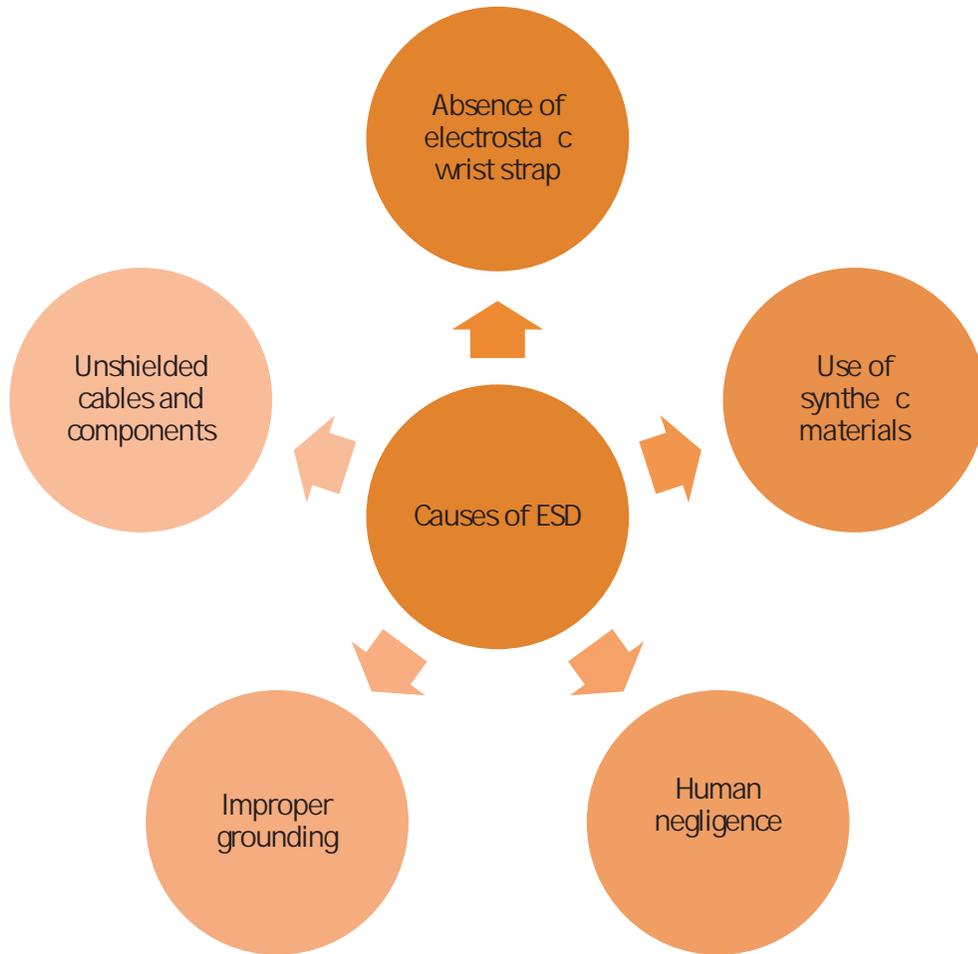
Fig. 3.1.13: Causes of ESD

Ac vity

Match the following:

1.	⚠	a.	The contents of the package are sensi ve to water and should be protected.
2.	⚡	b.	A package that meets the FCC guidelines
3.	☂	c.	A product that is sensi ve to ESD.
4.	FC	d.	A warning for the poten al of an electrical shock.
5.		e.	A warning or a no ce that is important.

UNIT 3.2: Configuring and Se ng up Peripherals

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the customer's peripheral requirements and their placement
2. Connect all the peripherals
3. Install the peripherals

3.2.1 Customer Requirements

Understanding the needs of a customer is one of the foremost parts of a technician's job role. This includes the following prac ces:

- Greet the customer and talk politely
- Understand the customer's requirement
- Provide the best possible and cost e ec ve solu on to the customer
- Ensure that the customer is sa sfied with the service

When work is allocated, it is important for the field technicians to understand and analyse the requirement before going ahead with the plan of ac on or visi ng the customer's site. This means that they should be able to understand what their customers want and also know how to sa sfy their needs. They need to know how to deal e ec vely with the customers.

Requirement of some customers is such that they ask for addi onal peripherals apart from those which are provided by the manufacturer. A few of the peripherals which they want are printers, scanners, webcams, microphones, tape drives and speakers. It is important to understand which peripherals should be carried while visi ng the customer's site. This can be achieved by talking to the customer prior to the visit.

Further, the technician should place all the peripherals as per the customer's need. Primarily, the field technician must listen to the customer, even if the viewpoint is the same – let the customer vent it o . A er the customer has finished, express feeling and then respond accordingly.

Provide immediate response to the problem detailed by the customer, if possible. At mes, it may mean bending the rules, but customer sa sfac on is the key to success and going out of the way can just hit the nail on its head.

3.2.2. Connec ng and Installing the Peripherals

A er the correct placement of the peripherals, the next step is to connect them with the computer. Most printers, scanners, speakers and other peripheral devices are connected to the system via USB ports. The following figure shows how to connect various peripheral devices to the system:

Locate the monitor cable.

Connect one end of the cable to the monitor port and the other end to the monitor.

Use the second cable to connect the monitor to the surge protector.

Plug the keyboard PS/2 connector into the purple port behind the computer.

Plug the other end to a surge protector.

Plug the mouse PS/2 connector into the green port behind the computer.

Plug one end of the first power supply cable into the port behind the computer case.

Connect the speakers to the computer's audio port.

Locate the two power supply cables.

Fig. 3.2.1: Connec on of peripherals

Installing a Printer

A typical printer includes components such as a cord, cable, ribbon and cartridges. Papers placed in the printer's tray are a part of the prin ng sta onary and not of the printer.

The following figure lists the steps to install a printer:

Install the cartridges in the printer and place paper on its tray	Insert installa on CD. Run the set up applica on.	Connect the printer to the PC using the USB cable.

Turn it on.	Print a test page
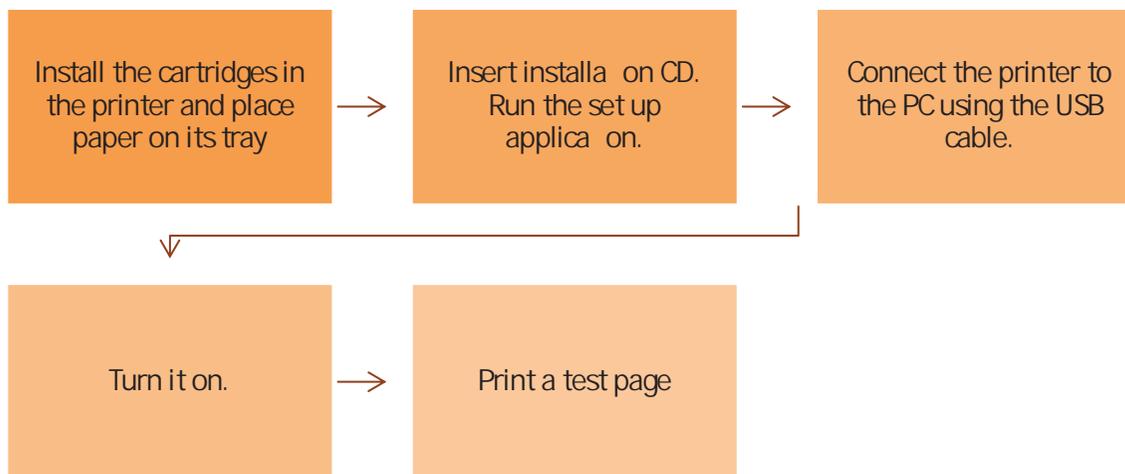
Fig. 3.2.2: Steps to install a printer

Installing a Scanner

The following figure lists the steps to install a scanner:

Turn the scanner on

Click on Found New Hardware pop-up and then click Next.

If scanner CD is avalaible, insert the CD and then click Next.

Click on Start then select Control Panel and type scanners in the Search box.

Click on View Scanners and Cameras link.

Click on Add Device bu on and then click Next.

Click on Manufacuter list and then click on the model name.

Click on Finish.

Scan a test document to check its func onality.

Fig. 3.2.3: Steps to install a scanner

Installing a Modem

Before installing a modem, it should be ensured that it can work with the service provider of that area. In addi on, compa bility of the modem with the current version of the OS should be checked.

The following figure lists the steps to install a modem:

Read the instruc on manual carefully.

Place the modem in a loca on which has good air circula on.

Switch on the power of the modem.

Connect the computer to the Internet or WAN port by using Ethernet cables.

Run a setup program.

Fig. 3.2.4: Steps to install a modem

Installing a Webcam

A very small amount of user input is required to install the modern webcams. Most of the webcams automa cally get installed a er being plugged in. If they do not get installed automa cally, then the driver file from the manufacturer's website needs to be downloaded. The following figure lists the steps to install a webcam:

| Plug the webcam into any USB port on the computer. | Let the webcam be installed automa cally. | Insert the CD. (packaged along with the webcam). |
| Install the so ware and click on Next. | Agree to terms and condi ons and then click on Next. Then click on Finish. | Run the applica on and click a photograph to check if it is working. |
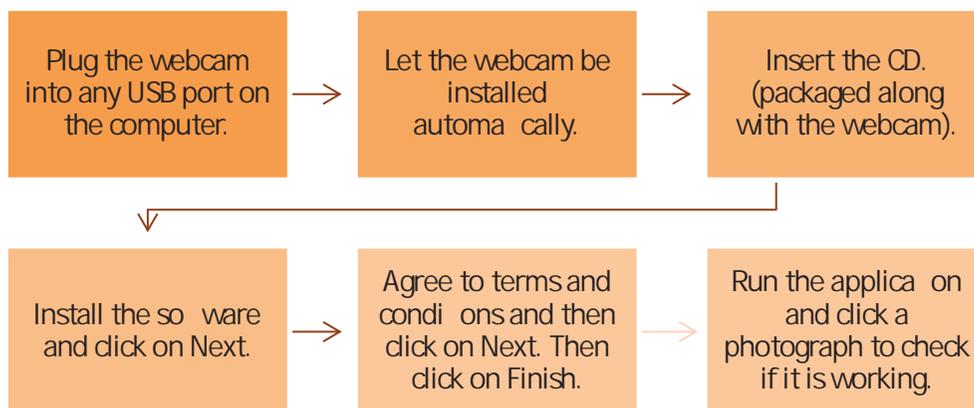
Fig. 3.2.5: Steps to install a webcam

Installing Speakers

There are two types of speakers that can be installed in a system, that is, USB speakers and headphone jack speakers.

The following figures list the steps to install both the types of speakers:

Locate the USB slot. ⟹ Plug the USB connector into that slot. ⟹ Set the speakers volume to a desired level.

⟱

Play a song to ensure the working of the speakers.
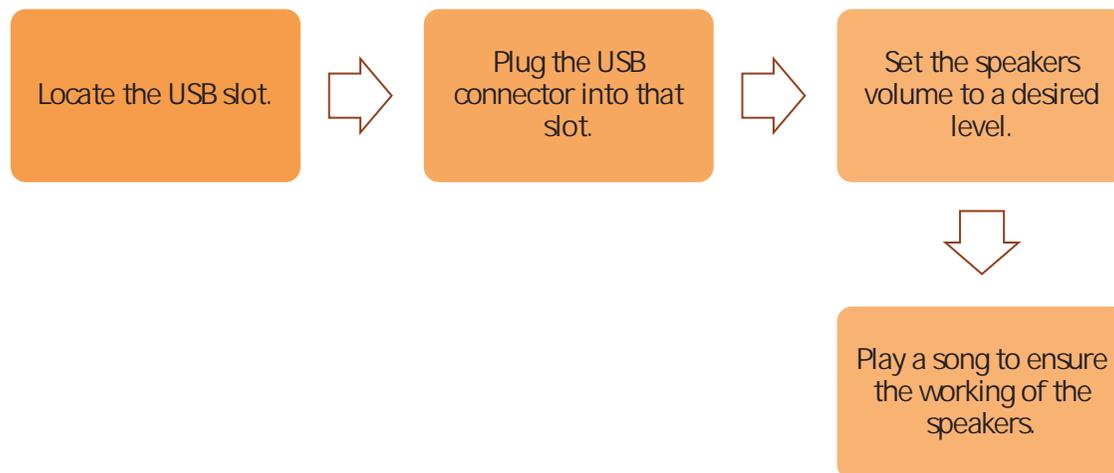
Fig. 3.2.6(i): Steps to install USB speakers

Locate the headphone jack. ⟹ Plug the connector into the headphone slot. ⟹ Set the volume to the desired level.

⟱

Play a song to ensure the working of the speakers.
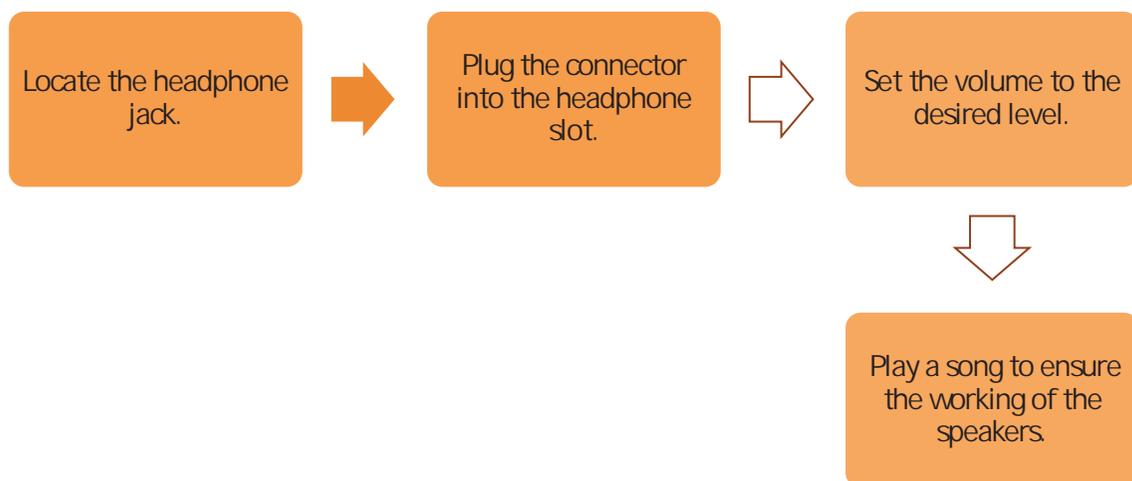
Fig. 3.2.6(ii): Steps to install headphone jack speakers

3.2.3. Installing So ware

A so ware is a part of a computer which helps the hardware to func on properly. It also helps the input/output devices to communicate with the CPU. It comprises of the opera ng system along with various programs of the computer.

A field technician is responsible for installing the opera ng system so ware on the customer's system. Prior to the installa on process, it is mandatory to check the system requirements which include the storage capacity of the hard disk and random-access memory (RAM). In addi on, he/she should be able to install addi onal so ware as per standard customer requirement.

Installing the An -Virus So ware

An an virus so ware, also referred to as an -malware so ware, is a so ware that helps to prevent, detect and remove unwanted, malicious so ware from a computer. Malicious so ware of malware is used to harm the computer and disrupt its func oning with the inten on of gathering personal informa on from it. In absence of a good an virus so ware, hackers can infect the computers with malware and steal sensi ve data such as passwords, personal data and iden ty. The following figure shows the steps for standard an virus installa on:

Download the an virus from its parent website. In case of a CD/DVD, insert it into the computer's CD tray.	→	Click Install.
Read the license agreement, and accept the terms and condi ons.	→	Wait un l the install is completed, and then click Finish.
A er the an virus is installed, ac vate it. The computer may now request a 'restart.'	→	Restart the computer and the an virus is ready to clean the computer.
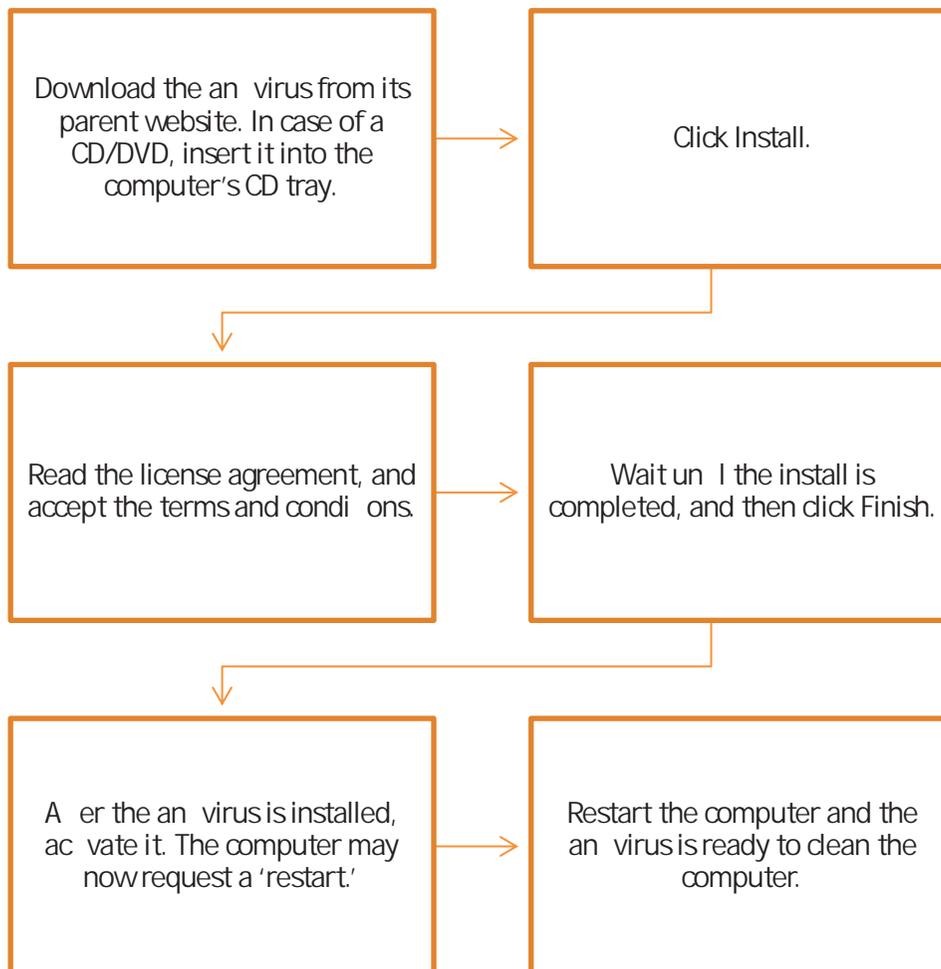
Fig. 3.2.7: Steps for standard an virus installa on

3.2.4. Safety Procedures

The field technician must adhere to the safety procedures. There are certain guidelines that must be followed to ensure own safety and that of the co-workers. These guidelines provide a sound, safe and flexible environment to work.

The following figure explains the general safety guidelines that must be followed by a field technician:

Check if the tools and equipment are in a good working condition

Wear personal protective equipment

Keep the work area clean and free from clutter

Maintain proper body posture at work

Follow safety rules and guidelines

Report any breach of safety

Fig. 3.2.8: Safety procedures

The PPE needed by a technician includes:

PPE	Description	Image
Safety goggles	It protect eyes from any kind of spark or dust.	
Rubber (safety) gloves	It protects the wearer from abrasion, electric shock and vibrations.	
Safety boots	It protects the wearer from electrostatic build-up and slipping.	

Fig. 3.2.9: PPE

Prac cal

Perform the steps to install a printer and connect it to a desktop. Test its func oning a er installa on.

Equipment:

- Working system/Desktop
- Printer and cartridges
- Paper

The par cipant must be able to perform the following steps:

- Install the cartridges in the printer and place paper on its tray
- Insert installa on CD. Run the set up applica on.
- Connect the printer to the PC using the USB cable.
- Turn it on.
- Print a test page

Practical

Perform the steps to install Microsoft Office (MS Office) 2016 on Windows 10.

The participant must be able to perform the following steps:

- Start the system.
- Insert the MS Office media disc into the DVD drive.
- The Windows will launch setup automatically.
- Enter the product key when prompted and click "Continue." Read the license terms and then check "I Accept the Terms of This Agreement."
- Click "Continue."
- If there is need to install some of the products, click "Customize."
- Select the first program or tool from the list.
- Repeat the previous steps for each application or feature.
- Click "Install Now" to install MS Office on the laptop.

Ac vity

While tes ng the laptop you realize that it is not giving audio output. How would you troubleshoot the problem?

Components:

- System with faulty sound card
- Flat/Phillips screwdrivers
- Screws
- Sound card
- Correct drive cables [Integrated Drive Electronics (IDE) or Small Computer System Interface (SCSI)]
- Audio cable to a ach CD-ROM drive to sound card
- Installa on disk for the new sound card

UNIT 3.3: Comple ng the Installa on Process

Unit Objec ves

At the end of this unit, you will be able to:

1. Check the func oning of the system
2. Check the func oning of the installed so ware such as an virus
3. Ensure product func ons are tested
4. Provide demo to the customer
5. Resolve customer queries
6. Take feedback from the customer

3.3.1 Check the System's Func oning

A er installing all the required peripherals and so ware, it is mandatory to check the working of the system, to iden fy problems (if any) and to ensure its smooth func oning. For compu ng and display systems, keeping a check on problems at the ini al stage ensures the longevity of hardware and so ware applica ons. The following figure lists some basics ques ons that must be answered to ensure the proper func oning of a system:

Is the computer switching on?

Are there any error messages?

Has any new hardware or so ware been added?

Has the computer been shi ed?

Have there been any power outages or electrical storms?

Have all the power cords been reconnected and checked?

Is it a hardware/so ware issue?

Is there any malware or virus in the computer?

Fig. 3.3.1: Basic ques ons to answer to ensure the system's proper func oning

In addi on, tes ng should also be performed to check the performance of a system as shown in the following figure:

Hardware Tes ng	So ware Tes ng	Func onal Tes ng
■	■	■

Fig. 3.3.2 Tes ng required for checking the system's func oning

Hardware Tes ng

Hardware failures are responsible for problems, such as the computer not ge ng switched on by the user, it ge ng overheated or appearance of a blue screen. A computer can func on only when all the components work well together. Consider a scenario, there is a broken hard drive, which implies that it doesn't work. Alterna vely, it can also mean that it is slow or gives an error message on the screen informing that one of the hardware components is having an issue.

As compared to so ware issues, hardware issues are harder to tackle, as a process is needed to find out exactly which component is not working properly. Hardware diagnos cs is run on most computers. It is used to check the health of the system and detect faults in normal opera ons of computers.

So ware Tes ng

When tes ng the so ware of a computer, the field technician should ensure that correct drivers are installed on that system. The technician should know how to use hardware troubleshooter, how to configure a device and how to download as well as install and update device drivers.

Using Windows 7 Troubleshooter

To run the Hardware and Devices Troubleshooter in Windows 7:

- Select the Start bu on and click on Control Panel
- Type 'troubleshooter' in the search box and click on Troubleshoo ng
- Select Configure a device under Hardware and Sound tab

Download and Install a Driver

- Select the Start bu on, enter "device manager" in the search box, and then click on Device Manager.
- Find the device that needs to be updated.
- Double-click on the device name.
- Click the Driver tab and select Update Driver.

Update a Device Driver Using Windows Update:

- Select the Start bu on, type "Windows Update" in the search box
- Select Windows Update
- In the le pane, click on Check for updates
- Select the updates that needs to be installed. Then select the check box for the driver that needs to be installed, then select OK.
- On the Windows Update page, select Install updates.

Func onal Tes ng

Func onal tes ng can be done at the end. This implies that the computer should be used as desired and then checked to see if its performance is up to expecta ons. For example, boot up the computer and browse the internet a er connec ng it to a network through a wireless fidelity (Wi-Fi). This ac on will check the working of the browser, the func onality of the Wi-Fi hardware and the configura on of the network connec on.

3.3.2 Check the Func oning of the Installed So ware

A er installing the so ware, it is mandatory to check its func oning. If there is any so ware problem, it will manifest itself into various issues: freezing of the computer, pages not ge ng loaded, glitches during playing games or movies from the computer. A computer needs device drivers to perform these func ons. If the correct drivers are not installed, it will lead to so ware issues. The only way to resolve such a situa on is to install correct drivers followed by re-installing the so ware or upgrading the Windows program.

Check the Func oning of an An -Virus So ware

The typical steps to run an an virus are shown in the following figure:
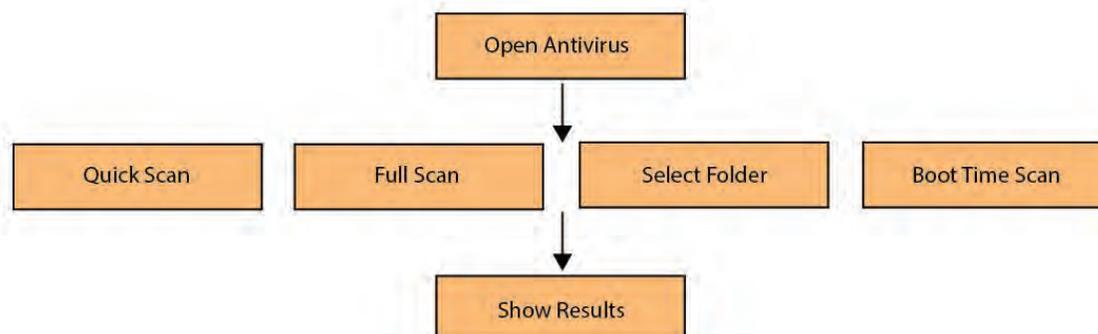
Fig. 3.3.3: Steps to run an an virus so ware

Open the an virus user interface by double-clicking the icon on the computer and select any of the following op ons:

- Quick scan - This will guide the an virus to perform a scan on the area on the computer most suscep ble to malware infec on.
- Full scan – This performs an in-depth scan of the computer. All the files are scanned. It can take me to complete as it is a detailed scan.
- Select folder scan – If malicious files are only in a par cular folder, select the folder(s) and perform scan on the specific or mul ple folders.
- Boot- me scan – Some viruses are in the system but they do not show up a er the computer is started. Perform a boot- me scan to detect and remove such viruses while boo ng.

A er the scanning is complete (irrespec ve of the op on), a no fica on will appear with the scan result. If threat(s) is detected, click 'show result' to view the automa c ac on taken by the so ware. Ac on on a threat(s) can also be taken manually .

Providing Guidance to the Customer

Demonstra ng a product is a way of promo ng or showing the opera on of an equipment to the users. The goal of demonstra ng the workability of an equipment, such as a newly installed desktop, peripheral device, software or hardware, to the customer is to make them aware of the opera on of that equipment and answer their queries related to its opera on.

There is nothing be er than a good demonstra on session. It is only a er a demonstra on (demo) that the users understand the opera on of a par cular equipment.

There are a few rules which must be considered while preparing for the demo. The following figure lists these rules:

Customize your demo

Rehearse before presen ng

Test everything beforehand

A er the demo, close the deal
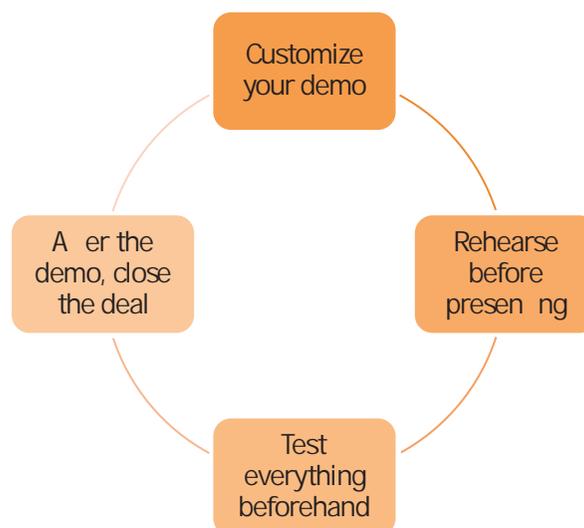
Fig. 3.3.4: Rules to be followed to prepare for an e ec ve demo

In addi on, it is the responsibility of a field technician to make the customers aware of the user manual and tell them how to read it.

It can be a user manual which contains instruc ons for the installa on of a so ware/hardware or it may be a help book giving solu ons to common problems that may arise with an equipment. The following figure lists the steps for reading a manual:

Step 1: Determine informa on	One must be able to determine and read as per the specified requirement rather than reading the en re document.
Step 2: Scan the document	Scan the document to determine its layout style and get a be er idea about the manner in which the content is presented.
Step 3: Find informa on	Look up for the required informa on using headings, index or the table of contents.
Step 4: Take notes	It is essen al to take notes for any important topic that one may come accross while reading the document. Tips and warnings men oned in the manual should also be noted.
Step 5: Use glossary	A person may come across technical terms while reading the document. Meanings of such terms can be looked up in the glossary sec on at the end of the manual.

Fig. 3.3.5: Steps to read a manual

Customers can have varied queries and issues. It the core responsibility of the field technician to respond to them.

Take Feedback from Customer

Just like it is essen al to address issues within the facility, it is also important to get feedback of the customer. The customer is always special and the customer's feedback is the most important thing for an organiza on.

The procedure as shown in the following figure should be followed:

Fig. 3.3.6: Procedure to be followed for taking customer feedback

The me taken to resolve an issue and the di cul es that a customer encountered while communica ng the problem should be understood. The misunderstandings observed during the interac on should be clearly documented.

The methods of interac on and behavioural aspects also need to be considered in drawing conclusions a er each task or problem handling rou ne. Ge ng honest feedback from the clients helps to improve the organiza onal func oning.

The field technician can get a feedback form filled by the customer at the facility.

The following figure shows a typical template for a customer feedback form:

Customer Feedback Form

Please fill the form. We value your feedback.

Date: _____			Loca on: _____	
Serv ice:	Compla int		New Connec on	
1. How would you rate our service?				
		Very Good		
		Good		
		Poor		
2. Did the technician come with all the necessary tools and equipment to do the job?				
	Yes		No	
3. Did the technician behave politely with you?				
	Yes		No	
4. Did the wireman have knowledge of the work to be done?				
	Yes		No	
5. Any sugges on which you would like to share.				
_____ _____ _____				

Fig. 3.3.7: A sample customer feedback form

Prac cal

Perform the steps to set automa c updates of an an virus.

Components:

- Desktop/laptop
- An older version of an installed an virus

4. Repairing and Replacing Faulty Modules

ELE/N4603

Key Learning Outcomes

At the end of this module, you will be able to:

1. Classify customer complaints
2. Iden fy system level problem on field
3. Replace faulty module
4. Complete the repairs
5. Report to superior

UNIT 4.1: Understanding Customer Complaints

Unit Objectives ⌖

At the end of this unit, you will be able to:
1. Identify the concerns of the customers
2. Interact with the customers on phone
3. Commence field trip based on the type of complaint
4. Explain product warranty, terms and conditions
5. Identify the type of problem and carry relevant tools and equipment
6. Assess the issue to decide between replacement and repair
7. Carry approved and verified replaceable parts

4.1.1. Identify the Concerns of the Customers

A field technician is responsible for the installation or repair/maintenance of the computer and its peripherals. When work is allocated, it is important to understand and analyse the requirement before going ahead with the plan of action or visiting the customer's site. The following figure shows the main tasks involved in the role of a field technician:

| New Installation | Carry the needed equipment, the manual and the warranty |
	Carry the bill/invoice for new purchase
	Confirm the address and inform about the time of visit
Maintenance/ Repair	Ask about the service, repair, maintenance and AMC of the equipment
	Carry the required tools and equipment parts
	Confirm the address and inform about the time of visit
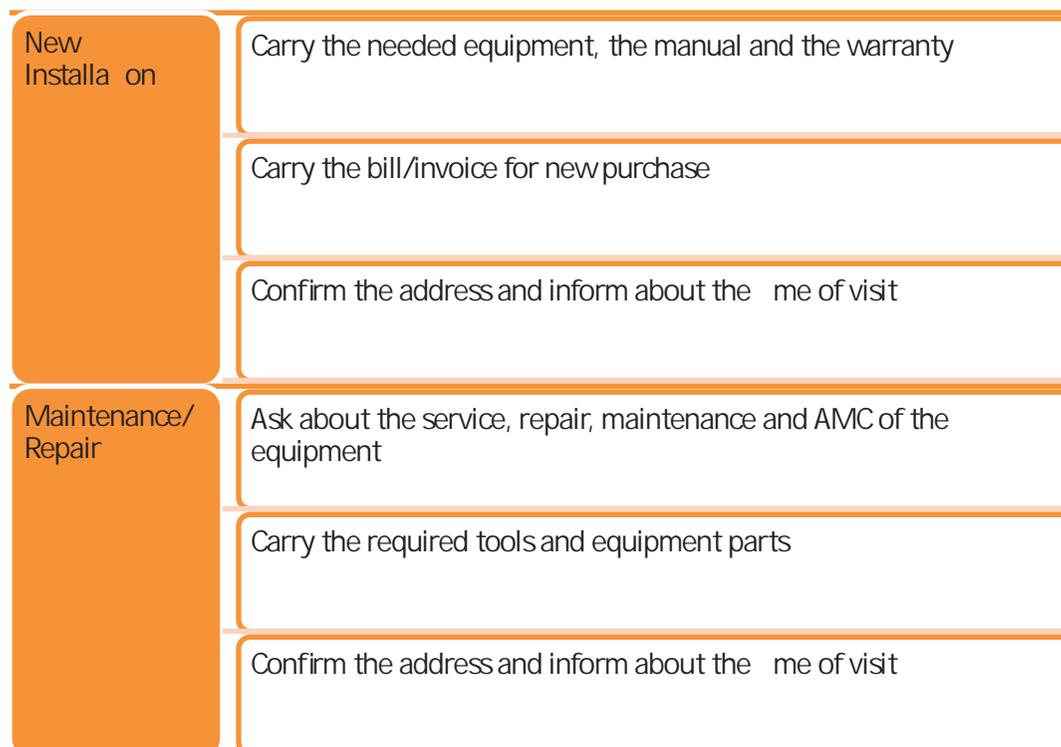
Fig. 4.1.1: Workflow for installation and repair

Before visiting the customer for installation or repair, it is important to understand the requirement of the customer.

The following figure represents the various activities which should be done before a visit to the customer's site is scheduled:

```
┌──────────────────────┐     ┌──────────────────────┐     ┌──────────────────────┐
│ Check new requests or│     │    Based on the      │     │                      │
│ complaints registered│ ──▶ │  requests/complaints │ ──▶ │ For repairs, anticipate│
│   by the customers   │     │   and location of the│     │     the problem      │
│                      │     │   customers, make a  │     │                      │
│                      │     │ route plan for the day│     │                      │
└──────────────────────┘     └──────────────────────┘     └──────────────────────┘

┌──────────────────────┐     ┌──────────────────────┐     ┌──────────────────────┐
│  Call the customer to│     │ Carry tools and parts│     │  Greet the customer  │
│ confirm the visit time│ ──▶ │     accordingly      │ ──▶ │  and confirm the     │
│                      │     │                      │     │   request/problem    │
│                      │     │                      │     │     registered       │
└──────────────────────┘     └──────────────────────┘     └──────────────────────┘

┌──────────────────────┐
│ For repairs, check the│
│ warranty status of the│
│    appliance and the │
│  annual maintenance  │
└──────────────────────┘
```
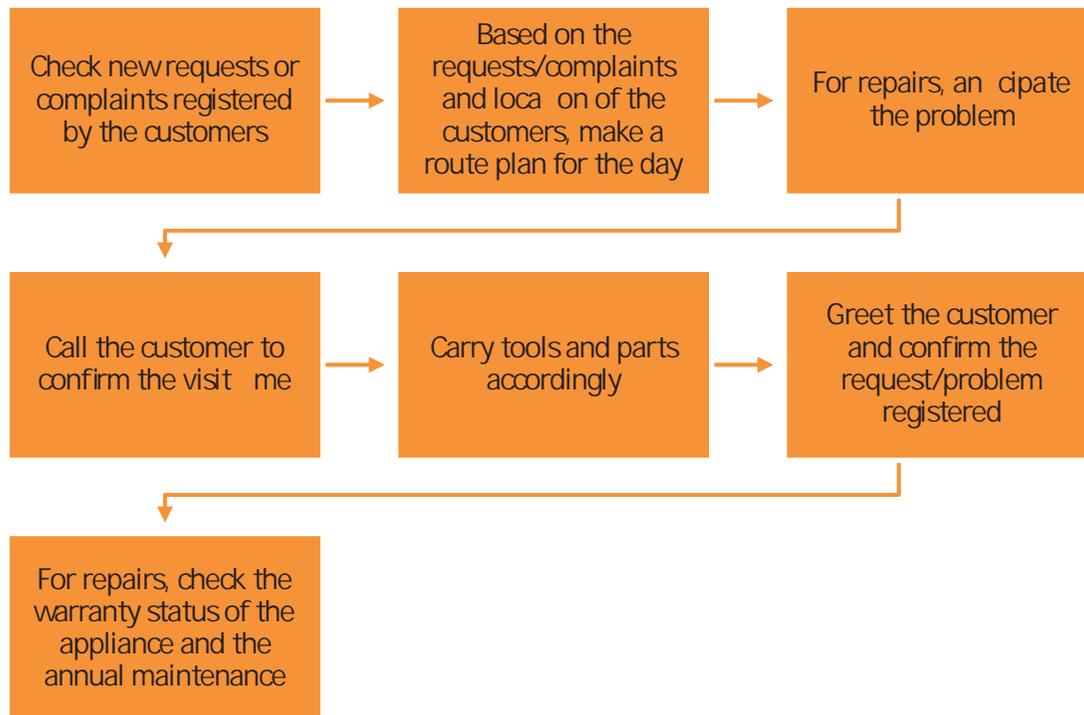
Fig. 4.1.2: To-do list for a technician

4.1.2 Interact with the Customers on Phone

Prior to visiting a customer's premises for repairing/servicing a computer, it is important to know the details of the problem and accordingly suggest a corrective measure. This can be achieved by calling the customer and asking about the problem in detail and then suggesting a possible solution. It is also important that the customer should be satisfied with the suggested solution.

The following figure highlights the to-do list to be followed when on a call with a customer before visi ng the premises:

During a call with a customer:

- Enquire about the symptoms and history of the problem in the computer/peripherals
- Ask about the year of purchase, service and warranty of the computer/peripherals
- Iden fy the problem based on the customer's informa on
- Communicate the problem iden fied to the customer and inform about the possible reasons along with a suggested solu on
- Ensure the suggested solu on achieves 100% customer sa sfac on
- Inform the customer about the approximate cost involved
- If the problem can be resolved over the phone, try to do it otherwise commence a field trip

Fig. 4.1.3: To-do list to be followed when on a call with a customer

4.1.3. Troubleshoo ng

Troubleshoo ng refers to repair of faulty products or processes. It begins with searching for the source of a problem and ends with finding the solu on for that problem to ensure that the product or process func ons properly. Good troubleshoo ng consists of the following four steps:

- Iden fica on of the symptoms
- Elimina on of the causes of a problem
- Verifica on of the solu on
- Restora on of the product or process

In other words, the first thing to do is to iden fy the symptoms that are causing a failure in the system. The next step is to diagnose the cause of that malfunc on, ll a solu on is reached. This is followed by returning the product to its original state.

Proper knowledge and understanding of the behaviour of each of the components that make up a computer system is necessary.

A field technician should follow some simple steps for troubleshoo ng as shown in the following figure:

| Iden fy the exact nature of the problem by observing the symptoms | Isolate the cause of the problem by tes ng the likely causes | Resolve the problem |
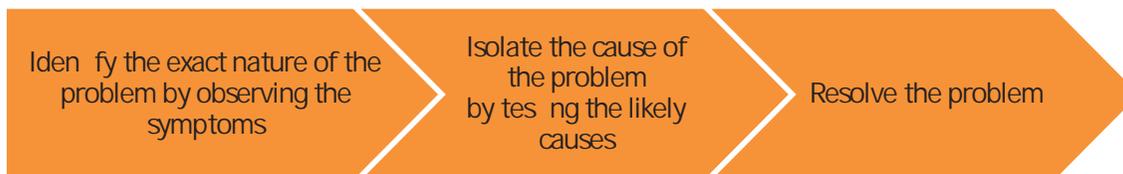
Fig. 4.1.4: Steps for troubleshoo ng

4.1.4. Understanding Product Warranty and ID

A field technician should know the terms and condi ons at which a product has been bought and should be able to read and understand the warranty provided. The technician should search for informa on such as shown in the following figure:

Tenure of the warranty

Time of beginning and expiring

The condi ons that may void the coverage

The contact details to get warranty service

Ac on the company will take if the product fails–replace the product or refund the cost

Parts and issues covered

Coverage of consequen al damage

Condi ons or limita ons of the warranty (some warran es provide coverage only if the product is maintained or used as directed)

Fig. 4.1.5: Required warranty informa on

In addi on, the field technician should be able to make the customer understand about the warranty details.

Reading Serial Number and Product ID

A field technician should have knowledge of product labelling of all so ware or hardware components. Serial number and product id give a unique iden ty to a component. The format of the serial number varies with the type of product and its manufacturers. The series of le ers and numbers in a serial number may give informa on about the manufacturer, country of origin, year of produc on and number of unit. The following image shows the serial number of a product:

Fig. 4.1.6: Serial number of a product

The following image lists some examples of serial number and product id of di erent products:

Fig. 4.1.7: Serial number and product id of di erent products

The field technician should be able to find the product iden fica on label for di erent products. For a notebook, the iden fica on label may be at di e rent loca ons, depending upon the manufacturer, as shown in the following images:

At the back   Inside the ba ery compartment   Under a cover on the back

Fig. 4.1.8: Iden fica on label at di erent loca ons

So ware serial numbers, also known as product keys, are included with the CD inside its packaging.

4.1.5. Problem Iden fica on

The most important step of iden fying a problem is to determine whether the problem is caused by a failure of hardware or so ware.

So ware Problems

A so ware problem manifests itself as freezing of the computer, pages not ge ng loaded or glitches during playing games or watching movies on the computer. A computer needs device drivers to perform these func ons. If the correct drivers are not installed, it will lead to so ware issues. The only way to resolve such a si tua on is to install correct drivers followed by re-installing the so ware or upgrading the Windows program.

Hardware Problems

Hardware failures are responsible for problems such as the computer not ge ng switched on by the user, it ge ng overheated or appearance of a blue screen. A computer can func on only when all the components work well together. Consider a scenario where there is a broken hard drive. This implies that the computer could stop working. Alterna vely, it could also mean that the computer becomes slow or gives an error message on the screen informing that one of the hardware components is having an issue.

As compared to so ware issues, hardware issues are harder to tackle as a process is needed to find out exactly which component is not working properly.

A er iden fying the type of the problem, the field technician must do replacement or repair of the faulty part. It is also important to carry approved and verified replaceable parts.

Ac vity

A customer has recently purchased a new hard disk for a computer since the old one had crashed. Perform a task of installa on of the new hard disk on the computer.

Components:

Hardware:

1. Phillips and flat blade screwdrivers (small and medium size)
2. A 3-claw part grabber
3. A chip inserter and chip extractor
4. A TORX head screwdriver
5. A 1/4" and 3/16" nut driver
6. A container to hold small parts and screws

So ware:

1. Opera ng system
2. Bootable disk with FDISK.EXE and FORMAT.COM copied onto the disk
3. Disk Manager

UNIT 4.2: Iden fying System Level Problem on Field

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy customer problems at their premises
2. Use appropriate tool and equipment
3. Perform root-cause analysis
4. Disassemble and check each part of a compu ng system
5. Follow standard opera ng procedures
6. Iden fy the solu on design

4.2.1. Iden fy the Customer Problems

Within an organiza on, customers' issues are reported to the field technician either through an email or through a telephone call. These issues are logged into the system by the technician or by the repor ng person. Depending on the severity of the issue, the issues are resolved by the field technician.

There are many cases where the issues cannot be resolved remotely and need the field technician to visit the customer's facility for resolu on. When the technician visits a customer's facility there are certain work processes that need to be adhered to.

The following figure lists these work processes:

Read and understand the service request to know the problem of the customer.

Be aware of the policy and restric ons to be followed at the customer's facility.

Seek details of the problem/issue.

Understand the configura on of di erent systems, architecture and layout.

Check the IT hardware such as storage, network devices, computers and server systems.

Resolve the issue by replacing the faulty module. If any external support is required, contact the appropriate person.

Fill the required documents such as service bill, service report, log book and so on.

Take feedback from the customer in the organiza on's feedback form.

Fig. 4.2.1: Common work processes at the customer's facility

4.2.2. Assess Applica ons and Equipment in Use

The field technician should be aware of the types of applica ons that run on the systems of the customers and the importance of these applica ons to them. Furthermore, they also need to be aware of the cri cal hardware used at a customer's facility. Typ ically, server systems and network configura ons are the most cri cal equipment and hardware in any organisa on.

To analyse and iden fy the cri cal applica ons and hardware at a customer's site, the field technician should follow some key points, as shown in the following figure:

Acquire knowledge about the work processes and support service policies of the organisa on

Iden fy the type of applica ons that are generally run on the computers by the customer

Iden fy the hardware and peripheral devices used

Iden fy and assess the cri cality of the issue that the customer is facing

Assess the impact of the faulty module on other hardware

Assess the probable loss that may happen if there is a system breakdown

Fig. 4.2.2: Key points for assessing cri cal issues

Also, the field technician should check the call log database to be aware of similar problems faced by other customers. This helps in faster resolu on of issues and thus saves me and e ort. Therefore, it is impera ve that based on the log database, th e technician should stock replacement spares for regularly occurring problems.

For example, a customer reports that the printer is not prin ng anything on the paper. The customer has also tried switching the printer on/o and unplugging it. The field te chnician has tried to resolve the issue remotely by sugges ng to the customer to check the print queue. But the problem has not resolved. The print queue shows that the file is prin ng, but the paper is blank.

In this case, the field technician would typically check the log database and from there the person would come to know that the primary issue in such cases is that the ink cartridge is empty and the printer driver is not able to iden fy this problem. Therefore, when the technician visits the customer's site to resolve this issue, it would be ideal to carry new cartridges for the printer along with the invoice. Since, this is a very common problem and the possible resolu on is to replace the cartridges with new ones, therefore, the field technician should keep the spare ready and take them along for site visits.

4.2.3. Perform Root Cause Analysis

A field technician needs to iden fy whether the root cause of the problem lies in hardware or so ware. Hence, they need to troubleshoot the related components to look into the details of the problem.

For example, the client's printer is not working properly. To resolve the problem, the field technician should check:

- Whether there is problem in the connec on
- Or in the printer
- Or in the driver installa on

In addi on, a field technician should be aware of fault tolerance and fault handling techniques. It becomes easy to troubleshoot a device when the system is equipped with these techniques.

Fault tolerance means the ability of a system to con nue working in the event of a fault that may be due to hardware or so ware.

Fault handling means that once the fault has been iden fied, the field technician should be aware of all the possible causes and their corresponding resolu ons.

The overall ac on plan for handling so ware faults is shown in the following figure:


Fig. 4.2.3: Ac on plan for handling so ware faults

The overall action plan for handling hardware faults is shown in the following figure:
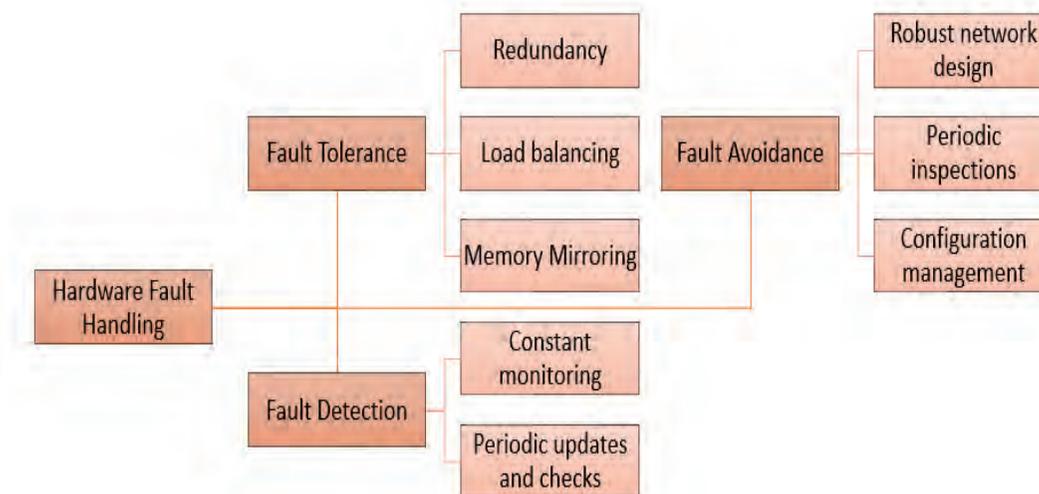
Fig.4.2.4: Action plan for handling hardware faults

Software Fault Tolerance

Software fault tolerance refers to the ability of a software to continue operation even if there are system or hardware faults present in the system. It provides the software the ability to detect a fault while it is occurring, or which has already occurred, and recover from it.

Software fault tolerance techniques can be used to lessen the impact of the software faults. The objective of these techniques is to nullify the damage that is caused by them.

A field technician should be aware of these techniques so that it becomes easy for him/her to troubleshoot issues at the customer's facility. The following figure lists some techniques of software fault tolerance which a field technician should know.

Timeouts

Audits

Incremental Reboot
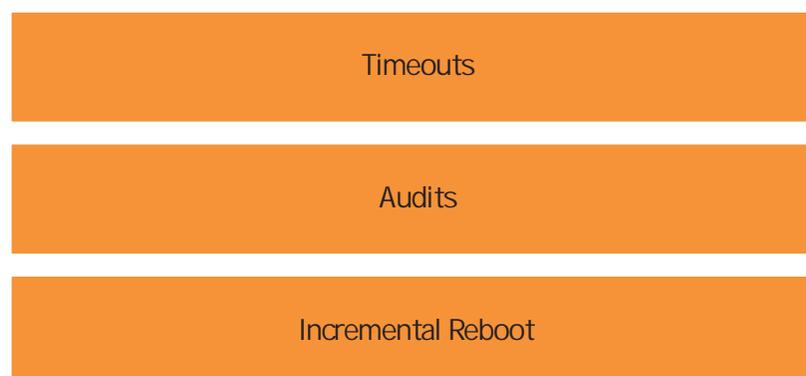
Fig. 4.2.5: Software fault tolerance techniques

Timeouts

Timeout is used by most of the real- me systems that process data which comes in without any bu ering. A meout signals that some components which are involved in the process have faulted and a fix is required. There are two possible ac ons for this process, Retry or Abort (cancel).

The following figure shows how Retry and Abort work:

Retry

> Sends the message again by reinvoking the same feature.
> If an applica on level message is resent and it is unable to reach the feature as the system is under reboot., Timeout will Retry sending the message ll the system gets rebooted.

Abort

> This leads to abor ng the feature when meout is reached.
> When the system is clogged up as a result of errors, Abort is the safest and simplest op on in recovering and clearing the errors.

Fig. 4.2.6: How Retry and Abort work

The Timeout messages vary from one pla orm to another. The following images show typical meout messages on di erent pla orms:

C:\Windows\system32\ping.exe

Pinging 10.3.3.169 with 32 bytes of data:
Request tined out.
Request tined out.
Request tined out.
Request tined out.

408 Request Time-out

This request takes too long to process; it is timed out by the server. If it should not be timed out, please contact administrator of this web site to increase 'Connection Timeout'

Powered By

is not responsible for administration and contents of this web site!

Error

The request timed out.

Cancel   Retry

Fig. 4.2.7: Timeout messages on di erent pla orms

Whether a request should be cancelled or retried depends on several factors. The following figure lists a few of these factors:

How important is system stability	When system stability is important, the Retry op on should be used.
	For example, one should not abort a system startup feature on a single meout.
How important is system performance	When system performance is the main concern, star ng and stopping of opera ons frequently may lower it.
	So, abor ng the feature is the be er op on on meout of the feature.
Implementa on of complexity level	If the user keeps on retrying without considering the abort op on, the whole design may go beyond debugging because of the code ge ng complicated.
	So, abor ng is the be er op on

Fig. 4.2.8: Factors for choosing Retry or Cancel

Most of the mes the two op ons, Retry and Cancel, are used together. If no response is received a er retrying a feature a certain number of times, then it might be aborted.

Audits

An audit is a method of checking the consistency of data structures across mul ple processors in a system.

A field technician should be able to read the audit log files. These files are the output of the Audit programs that are defined in a system. For example, an Enterprise Resource Planning (ERP) system has more than one layer and contains mul ple processors. Hence, any break in signals because of hardware failures, so ware bugs, protocol failures or any independent processor reboot may lead to data inconsistency.

The following screenshots show some sample audit log files:
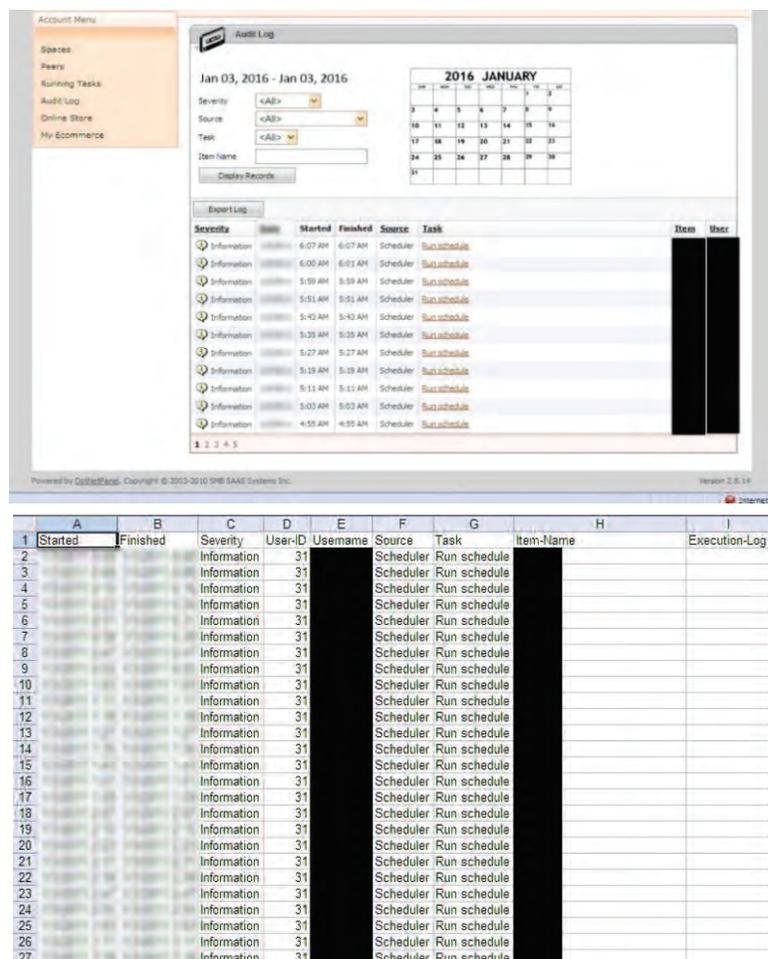
<p align="center">*Fig. 4.2.9: Sample audit log files*</p>

Incremental Reboot

Rebooting the software processors repeatedly is time consuming. To save time, as well as work disruptions, real-time systems use incremental reboot procedures. The following figure shows the system reboot levels:


First Level Reboot

Operating system reboot only

Second Level Reboot

Operating system reboot + configuration data download

Third Level Reboot

Program reload + operating system reboot + configuration data download
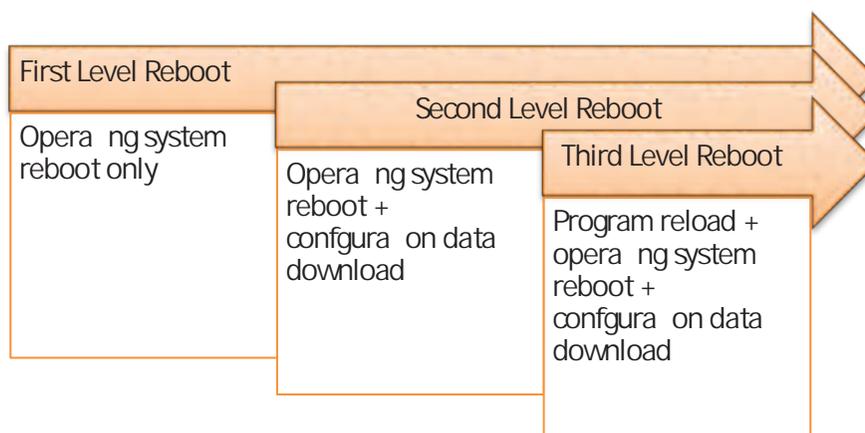
Fig. 4.2.10: System reboot levels

Generally, first level reboot resolves the issue. However, some mes, the processor keeps first level reboo ng of the system due to some hardware fault. This results in overflowing of the first level reboot counter, which in turn leads to second level reb oot.

Typically, second level reboot resolves the issue. In case, even the second level reboot is unable to resolve the issue, then the processor keeps second level reboo ng of the system. This results in overflowing of the second level reboot counter, wh ich in turn leads to third level reboot.

Hardware Fault Tolerance Techniques

Hardware fault tolerance provides a real- me system the ability to run even when there is hardware failure. Cri cal systems, such as servers, should have this arrangement incorporated to nullify loss. The techniques used to incorporate hardware fault tolerance are redundancy, load balancing and memory mirroring.

Redundancy

Real- me systems are installed with redundant hardware so that whenever a fault takes place, they takeover and thus prevent down me and loss. Some methods of hardware redundancy are:

- One for One redundancy – Each hardware module contains a redundant module, the Passive module. The primary module (Ac ve module) and the secondary module (Passive, redundant module) are exact replica of each other. The Passive module monitors the Ac ve one and takes over if there is an Ac ve module failure. The probability of failing of both the modules at the same me is very low.
- N+X Redundancy – Similar to the One for One Redundancy method, this method uses a specific number (say, X) of Passive modules for N number of Ac ve modules. Moreover, there is also a main hardware module which monitors and tracks the Ac ve N modules. This main module decides which Passive module will take over in case an Ac ve module fails.

Load Balancing

In ideal condi ons, the hardware modules share the load. There is a top-level module, the main module, which distributes the load evenly and maintains the health status of the hardware modules simultaneously.

If any hardware module fails, the main module enables the distribu on of the load among the rest of the modules. This setup makes a compromise with the system performance but ensures availability of system at all mes.

Memory Mirroring

In this technique, the system setup contains two parity based memories and two CPUs – one ac ve and one passive. The passive CPU does not have any memory and the ac ve CPU keeps wri ng on both the memories. The passive CPU monitors the ac ve CPU con nuously. If a fault is detected, it takes over. When the memory is read, both the memories are compared. If there is any mismatch, the processor considers the output of the correct memory and tags the other one as faulty.

4.2.4. Disassembling the System

A desktop or a laptop needs to be disassembled and then again assembled if the components inside either of them need to be repaired or cleaned. The steps to disassemble a desktop are shown in the following figure:

Shut down the system.

Remove the power cable, then remove the cable from the switch mode power supply(SMPS) from the back of the CPU cabinet.

Remove the external devices such as keyboard, mouse, monitor, printer or scanner from the back of the CPU cabinet.

Remove the adapter cards (video and sound cards) and loosen the card screw. Hold the card (front and back edges) and gently rock it lengthwise to release it.

Pull data cables o from the hard disk drive, CD/DVD/Blue-ray drives, floppy disk drive as well as the motherboard connector.

Remove the screws and slide the drive out of the back of the bay

Memory modules are mounted on the motherboard. Handle the chip only by the edges

The power supply is a ached into the tower cabinet at the top back end of the tower. Detach it from the switchboard

Remove the motherboard's power connector, including the CPU fan power connector, the cabinet fan and the front panel of the cabinet power bu ons.

Remove the screws of the SMPS from the back of the cabinet and detach it from the tower cabinet

Remove the screws from the back of the motherboard and detach it from the cabinet

Remove the CPU fan from the motherboard. Remove the heat sink by pulling the tab upward

Finally, remove the processor by pulling back the plas c tab and stretching it sideways.

Fig. 4.2 11: Steps for disassembling a desktop

The steps to disassemble a laptop are shown in the following figure:

Remove the ba ery and the power adapter	→	Undo the screws and remove the back cover	→	Remove the hard drive by pulling it in the opposite direc on to its data pins

Li the RAM to an approximately 30-degree angle from the bo om surface of the laptop. Gently slide the RAM out of its connector and out of the slot	→	Li the wireless card to an approximately 30-degree angle and gently slide it out of its connector and out of the slot	→	Remove the 'Hinge Cover Plate' and the keyboard

Remove any other cable under the keyboard	→	Remove the display unit	→	Remove the motherboard and the motherboard peripherals

Fig. 4.2.12: Steps for disassembling a laptop

4.2.5. Iden fy the Faulty Module and Perform Troubleshoo ng

The following table lists some common hardware problems and their solu ons:

Issue	Diagnosis	Solu on
Printer Error (Orange or Blinking Light)	No Light in Power Indicator of Printer	• Ensure that the printer is switched on. • Reconnect all the printer cables. • Switch o the printer and turn it on again.

	No Paper or Paper Jam	• Ensure that the printer has paper. • Remove any paper stuck in the roller. • Restart the printer. • Try prin ng again.
No Flashing Light but Cables Properly Connected	No Printer Driver	• Check the printer driver. • If needed, update the driver. • Check the connec vity of the printer using the print manager. • If the printer is a parallel port printer, verify the following se ngs: • Enter the computer's CMOS setup. • Enable the parallel port. • Ensure that the printer is on parallel port mode. • Disconnect devices such as scanner or zip drive if they are parallel with the printer to ensure that they are not causing issues with the printer.
A Program is Not Responding.	The Computer is Frozen	• Press the Ctrl +Alt and Delete keys simultaneously. • Open the Task Manager and highlight the program's name. Then press the End Task bu on. • Manually turn=o the computer by pressing the on/o bu on. • Once the computer responds again, run a virus check.
The Keyboard is Not Working	Improper Connec on	• Ensure that the keyboard is connected to the computer. • In case of a wireless keyboard, try changing the ba eries.

	Key Got Stuck	• Switch o the computer. • Clean the keyboard with a damp cloth. • Restart the computer using the mouse.
New Hardware or So ware is Working Incorrectly.	Incompa bility Issue with System Configura on	• Check that the computer meets the requirements of the program or u lity. • Uninstall the program and then reinstall it.
The Mouse is Not Working Correctly.	Improper Connec on	• Ensure that the mouse is securely plugged into the computer. • Ensure that the cord is not damaged. • If the mouse is plugged into a USB hub or USB switch box, remove it and plug it directly into the computer. • In case of a cordless mouse, re- establish the connec on by pushing the connec on bu on on the underside of the mouse. • Clean the mouse thoroughly.
The Computer has No Sound.	Problem in the Sound Card or the Audio Driver Improper Sound Se ngs	• Go to the volume control in the system tray and check the volume and the mute check boxes. • Check the input and output wires of the speakers. • Check the func oning of audio drivers. • Check the func oning of the sound card.

PC Not Connecting to the Network through LAN	Problem in Network Configuration	• Go to the network setting and check if the Ethernet is enabled. • Check the working of the modem. • Check all the wires and connections. • Check the LAN card. • Check the IP Address and DNS settings.
No Power	Improper Connection Faulty PSU or SMPS Unit	• Ensure that the power cord is plugged into the supply. • Check whether PSU is putting out enough voltage. • Switch off the computer and detach all devices. • Reinstall each device one by one. • Switch on the computer after each device. • If the system does not switch on after installing a particular component, replace it. • Check the SMPS unit. • If the system does not switch on after reinstalling all the devices, it may be a motherboard or CPU problem.

Blank Screen (Nothing Appears on the Screen)	Improper Connec on or Display Se ngs	• Check if the monitor and the CPU power is in On posi on. • Check if the monitor is plugged into the CPU. • Ensure that the power cable is plugged into the monitor and is not loose. • Some CPUs have mul ple ports for display. Check each port by plugging in securely. • When the power bu on on the monitor is pressed, some status is displayed. This means that the power to the monitor is in On posi on and the screen display is okay. • Check the cable runing from the CPU to the monitor. • Check the brightness level using the menu bu on on the monitor. It may have been set to dark. • Check that the computer is not in the screensaver or sleep mode.
Computer Doesn't Show Power		• Ensure that the power cable is connected to the CPU and to the monitor. • Check the power socket. • Replace the power socket with a di erent one or if power extension board is used, plug the power directly into the socket. • Replace the power cable. • Check if the LED at the front of the monitor is in On posi on. If yes, then the CPU must be at fault. • If LED at CPU is in On posi on then it might be a monitor issue. • If none of the LED is in On posi on, then it may be a local power issue.

Fig. 4.2.13: Hardware problem and their solu ons

The following table lists some common system problems and their solu ons:

Problem/ Symptoms	Ac on
Devices Not Listed in BIOS	• Ensure that the drive is installed properly • Ensure that the cables are connected properly.
No Opera ng System(OS) Found or Similar Message	• Ensure that the system is set to boot from the right device. • Ensure that the proper boot order is listed under the Boot menu. • Remove any non-bootable DVD from the drive. • Ensure that the boot drive is the first op on. • Once boot drive is found, the OS begins to load it.
Non-Working Devices/Device Not Recognized	• Ensure that the cables are plugged in. • Ensure that the cables are firmly connected to the device. • Check that the add-on cards are seated in their slots. • Check the device drivers. • Try to reinstall the device driver or download the latest version. • Try to uninstall and reinstall the device.
Problems A er Installing New So ware or Device Driver	• Uninstall the so ware or driver • Return the system to a previous working state by using System Restore. • Try to boot to Safe Mode and then perform a restore. • Restart the system. • Press the F8 key con nuously. • Select Safe Mode from the menu displayed and press enter. • Start system restore.
Spontaneous Reboots	• A computer that reboots o en is an indica on of a bad power supply. • Check PSU and SMPS unit. • Check if there is a loose connec on.

System Time Keeps Changing	• If the me/date clock needs to be set constantly, replace the CMOS ba ery.
Nothing Happens when Power Bu on is pressed	• Check the power connec on. • Ensure that the wire from the case power bu on is connected to the right connector on the motherboard. • Check all the power connec ons to the motherboard. • Check the floppy power cable. • Unplug everything from the motherboard except the power cable, the power bu on wire, video card, memory and the processor. • If it does not show power it means that the motherboard or the case power supply is defec ve.
System Turns On, but Begins to Boot Up	• Double check all connec ons and try again. • Unplug everything from the motherboard except the power bu on wire, video card, memory and the processor, • Test again. • If the computer starts, turn the power o and reconnect the components one by one. • If it does not boot up, one or more parts are defec ve.
System Turns On, Beeps Irregularly, Does Not Boot	• Ensure that the random access memory (RAM) chip is installed correctly. • Try to remove and re-install it.
System Turns On, Gives Quick Beeps, Does Not Boot	• Check that the video card is inserted properly in its AGP or PCI slot.
System Freezes Intermi ently while Installing the OS	• Verify that the heat sink fan is spinning. • Ensure that the heat sink is firmly mounted. • Check that the heat sink is parallel to the surface of the processor.
Problems in Installing OS, Blue Screens	• Check the memory (RAM). • Check the hard-drive.

Fig. 4.2.13: System problem and their solu ons

Some Basic Troubleshoo ng Tips

The following table lists some basic troubleshoo ng ps a er installing new components:

New Component	Issue	Ac ons
Monitor	Picture is not visible	• Check the signal cable connec ons. • Ensure that the computer is switched on. • Check the brightness control.
	Screen not in the centre posi on	• Adjust the H-Size, H-Phase or V-Size, V-Centre controls. • Check the signal ming of the computer
	Too bright or too dark screen	• Check the brightness or contrast control. • Check the specified voltage. • Check the signal ming of the computer system. • Check the horizontal frequency.
	The screen is shaking	• Move all objects such as a motor or transformer, which emit magne c field, away from the monitor. • Check the specified voltage. • Check the signal ming of the computer system.

Hard Drive	Computer does not boot and no error message appears on the screen	• Check whether the BIOS supports drives. • Turn o the computer and remove the new drive. • Shi the jumper onto the alternate-capacity jumper. • Remount the drive in the computer. • Insert a bootable system diske e into drive A and turn on the computer. • Insert the Disc Wizard diske e into drive A. • Type A: XDM and press ENTER. • Follow the Disk Manager instruc ons. • Install the dynamic drive overlay and par on and format the new drive • Reboot the system.
	Blank screen when the system is powered	• Plug-in the monitor. • Check all the cards. • Ensure the video card is in its slot. • Secure it with moun ng screws. • Turn o the computer. • Remove the drive host adapter. • If the screen turns on a er reboot, the host adapter may be incompa ble or defec ve.

	The system does not recognize the drive	• Check all the cables. • Check the power supply. • Reboot the computer. • Check whether the drive motor starts up. • If the drive motor does not start up, recheck all drive cables. • Check the drive-type listed in the system setup program for each drive. • Press the CTRL+ALT and DELETE keys simultaneously to reboot the computer. • If the computer has a turbo switch, set it to slow speed before turning the computer on. • If there is no turbo switch, use keyboard commands. • Return the processor to fast speed after the computer is running, • Alternatively, warm-boot the computer after every power-on. • Check for input/output address conflicts. • Ensure that the drive and host adapter are compatible with the computer. • Turn off the computer • Take out the peripheral adapter cards except for the video card and host adapter. • If the computer recognizes the drive after rebooting, turn off the computer. • Reinstall the other peripheral cards, one at a time, until the conflict reoccurs. • Isolate the source of the address conflict.

		• Resolve the conflict by changing the I/O address of the peripheral that appears to cause the conflict. • Check that there is no diske e in drive A and reboot.
	The system hangs in FDISK or fails to create/save the par on record	• Check all the cables. • Ensure that the setup system diske e is not corrupted. • Use a backup diske e. • Make smaller par ons. • Change the interrupt jumper se ng on the host adapter. • Disable the Track 0 protec on feature in the system setup program before using FDISK. • Re-enable this feature when FDISK is done.
	The disk opera ng system(DOS) message "Disk Boot Failure," "Non-System Disk" or "No ROM Basic - SYSTEM HALTED" appears	• Use the DOS SYS u lity to reinstall the DOS system files. • Check all the cables. • Use FDISK to verify that the primary par on is ac ve. • Check for viruses.
	The system error message, "HDD controller failure" appears	• Confirm the jumper se ngs on the drive. • Verify the drive-type se ngs in the system setup program.

	System in-opera ve. Keyboard lights are on, power indicator lights are lit and hard drive is spinning.	• Expansion card is par ally dislodged from expansion slot on the motherboard.
		  o Turn o the computer.
		  o Ensure all expansion cards are securely seated in slots.
		  o Press down firmly on expansion card, using even

		• pressure on both ends of the expansion card. • Defec ve floppy disk drive or tape drive. • Turn o the system. • Disconnect the cables from one of the floppy drives. Turn on the system and check to see if the keyboard operates normally. • Repeat un l the defec ve unit has been located.
	System does not boot from the hard disk drive and can be booted from the floppy disk drive	• Check the connector between the hard drive and the system board • Check the cable running from the disk to the disk controller on the board. • Check that both ends are securely plugged in. • Check the drive type in the Standard CMOS Setup. • Damaged Hard Disk or Disk Controller. • Format the hard disk. • If unable to do so, the hard disk may be defec ve. • Hard Disk directory or FAT is scrambled. • Run the FDISK program • Format the hard drive. • Copy the backup data back onto the hard drive.

	System only boots from floppy disk. Hard Disk can be read and applications can be used, but booting from the hard disk is impossible	• Hard Disk boot program has been damaged. o Create back up of the data and the applications files. o Reformat the hard drive. o Re-install applications and data using backup disks. o Check the cable running form disk to disk controller on the board. o Make sure both ends are securely plugged in. o Check the drive type in the Standard CMOS Setup
	Screen message says "Invalid Configuration" or "CMOS Failure"	• Check the configuration program. • Replace any incorrect information.
	Cannot boot the system after installing another hard drive.	• Ensure that the master /slave jumpers are set correctly. • Run SETUP program and select correct drive types.
New Network Card	Unable to connect to a server	• Load the driver and ensure that the protocols are bound. • Check the Device Properties list. • Use the diagnostic utilities to test the NIC adapter. • Check if additional networking software needs to be installed.

Fig. 4.2.14: Basic troubleshooting tips

Ac vity

You received a customer complaint that a laptop is not giving audio output. How would you troubleshoot the problem?

Components:

- System with faulty sound card
- Flat/Phillips screwdrivers
- Screws
- Sound card
- Correct drive cables (IDE or SCSI)
- Audio cable to a ach CD-ROM drive to sound card
- Installa on disk for the new sound card

Prac cal

You have gone to a customer site to solve an issue with a faulty computer that on start -up is repeatedly giving out four beeps at very short intervals and nothing appears on the screen. However, the fan running sound is there.

Component:

1. Screw driver set repair toolkit
2. Spare RAM, Processor and Motherboard
3. ESD wrist band
4. A computer system with a faulty motherboard

Practical ⚙

There is an apparent failure of the motherboard or a system device on the motherboard.

Component:

1. Screw driver set repair toolkit
2. Spare Motherboard as per the system compatibility
3. ESD wrist band
4. A computer system with a faulty motherboard.

Prac cal

Troubleshoot a system in which there is no POST.

Component:

1. Screw driver set repair toolkit
2. ESD wrist band
3. Spare CMOS ba ery
4. A computer system with a faulty BIOS.

Practical

You have received a customer complaint that their computer loses its time and date settings on every restart. You have called the customer and after fixing a time to visit, you have gone to the customer's facility to fix the issue. How will you fix this issue?

Component:

1. Screw driver set repair toolkit
2. Spare CMOS battery compatible to the system
3. ESD wrist band
4. A computer system with a faulty CMOS battery.

Prac cal

Perform the task of troubleshoo ng of 5 beep POST error.

Component:

1. Screw driver set repair toolkit
2. Spare CMOS ba ery compa ble to the system
3. ESD wrist band
4. A computer system with a faulty motherboard.

Prac cal

Perform the task of upgrading RAM in a Laptop.

Hardware:

1. DDR2, DDR3 RAM
2. Screw driver
3. ESD wrist band

UNIT 4.3: Replacing Faulty Module

Unit Objec ves

At the end of this unit, you will be able to:

1. Replace the faulty modules
2. Perform soldering
3. Iden fy and fix the errors

4.3.1. Replacing Faulty Modules

A field technician provides service and maintenance of hardware and the related so ware. This may include installa on or repair of hardware equipment or associated so ware by monitoring, troubleshoo ng and replacing faulty modules. While replacing faul ty modules, it is the responsibility of the field technician to check their warranty and also to ensure that the other hardware is undamaged. The following figure lists the steps to be followed in order to replace a faulty module:

Disassemble the system

Remove the faulty module

Replace it with the new one

Reassemble the system
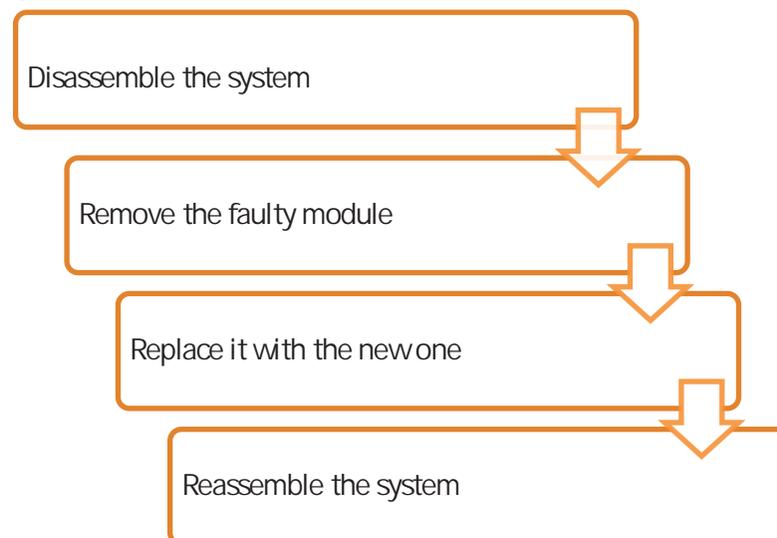
Fig. 4.3.1: Steps for replacing a faulty module

New Product Models

Since IT industry evolves at a very fast pace, the field technicians need to be updated with the latest products, their so ware ecosystem and methods to operate the technologically advanced machines. New tech savvy hardware comes with a specific set of rules and opera ng methods. Therefore, field technicians need to acquire complete kno wledge about their func oning.

A field technician should do the following when working with a new product:

- Keep in mind the constraints related to the use of the new product to avoid any hardware or so ware failure.
- Comply with the codes put in place for the use of any machine or so ware.

Soldering

Soldering is a process of joining two or more objects that are usually metals by mel ng and pouring a filler metal, called solder, into the joint. The solder component has a lower mel ng point than the other two metals that are to be joined.

While replacing the faulty parts, soldering of some components may be required. So, a field technician should have a basic knowledge of how to use manual hand soldering iron unit to solder the components or parts. The following image shows a typical soldering process:
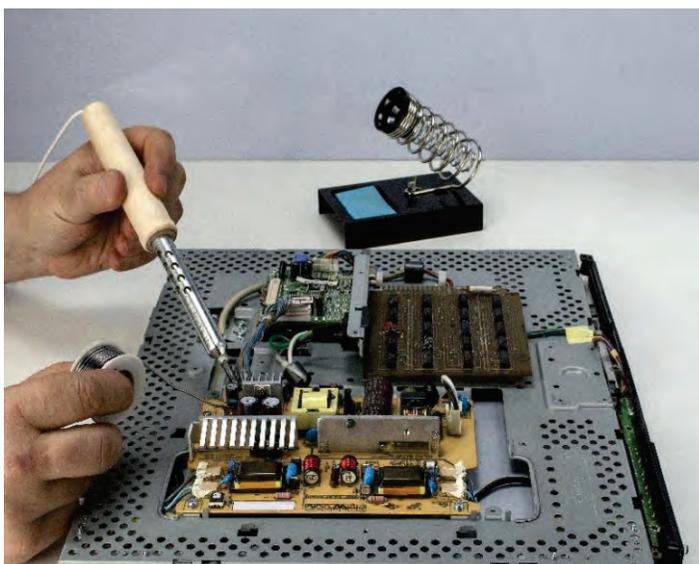
Fig. 4.3.2: Soldering process

Soldering Procedure

The steps of the soldering technique are as follows:

- Step 1: Heat up the soldering iron su ciently.
- Step 2: Clean the soldering iron with a damp sponge, if it is dirty. If a soldering sta on is used, adjust its temperature.
- Step 3: Apply suitable flux to remove any type of oxide while soldering.
- Step 4: Coat the soldering iron's p with a thin layer of solder. This process of nning helps in transferring heat between the p and the component to be soldered.
- Step 5: Use pliers for bending the lead of the component being soldered so that it can easily be embedded.

- **Step 6:** Hold the soldering iron and place the iron tip in such a way that it touches both the surface and the lead of the component on the board.
- **Step 7:** Touch the solder to the iron tip and move that around the joint by keeping the iron tip fixed. Let the solder melt and flow till the joint is covered.
- **Step 8:** Remove the iron after removing the solder and make sure the joint is kept stationary till it cools down.

Tips

When the soldering iron gets hot, it becomes dirty because of oxidization. Clean the tip with a wet sponge until it shines.

- While soldering, the iron tip should not be touched.
- The soldering iron should be placed at an angle of 45 degree.

4.3.2. Identifying and Fixing Errors/Issues

A computer functions using a combination of two important components – hardware and software. Usually, a computer hardware is reliable but it may get damaged over a period of time. It is essential to maintain the hardware system to keep the system functional. In addition, the software also needs to be maintained periodically. For example, an organized and clean hard disk helps the computer system to perform better. Deleting unused, unwanted and temporary files is the easiest way to help the system give better results.

There may be certain circumstances when a computer is not maintained properly and various hardware and software issues are faced by the operator. When a field technician is called up for the repair, then he/she should be efficient enough to find the issue and fix them accurately.

Hardware Diagnostics

Hardware diagnostics is run on most computers. It is used to check the health of the system and detect faults during normal operations of the computers. The different types of tests are listed in the following figure:

Power on Self Tests (POST)

Out of Service Tests (OST)

In-Service Monitoring
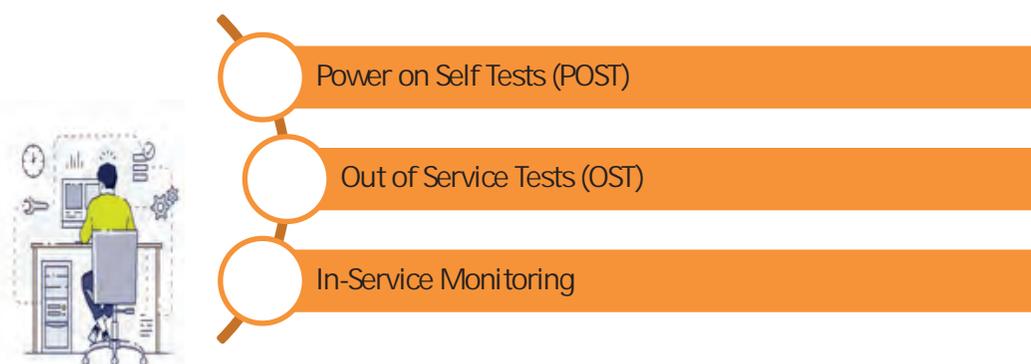
Fig. 4.3.3: Different tests

POST

POST is an in-built diagnos c tool that begins to operate as soon as the processor of a computer starts. It verifies that the various hardware components of a computer such as the keyboard, RAM and disk drives are func oning properly. If POST is successful, then the computer begins to boot; otherwise, the BIOS issues an error message.

The error message is in form of a series of beeps. These beeps may have a pa ern of long beeps or short beeps or a combina on of the two depending on the nature of the problem. The pa ern of beep conveys informa on about the type of the fault detected. For example, if the POST is unable to detect the processor, it will stop the boot process and convey the message through a par cular code of beeps.

OST

POST can only test the internal func oning of the card and not its external interface logic. There are two types of tests that can be used to test the external card interfaces. These are shown in the following figure:

Interface Tests

The card is labelled as out of service. The neighboring cards are then configured to work in the interface test mode. The card under test is instructed to run the test. The neighboring cards are then restored by bringing them out of the test mode.

Echo Back Test

The card is configured in echo back mode. The interface receives the data and echoes it back by transmi ng it to the card under test. The card under test receives back the data that it had transmi ed.

Fig. 4.3.4: OST tests

In-Service Monitoring

In this method, the health of the card is verified using any of the following two ways:

Transient error monitoring	Transient errors are caused by power fluctua ons, spikes and interference from other cards. They can occur even when the hardware is func oning normally. In case of frequent errors, complete hardware diagnos cs of the system is needed to isolate the issue.
Link monitoring	This method monitors the bit rate on the links in order to get advance warning. When a certain threshold is exceeded by the bit error rate, a diagnos cs may be triggered.

Fig. 4.3.5: In-service monitoring

Understanding Error Messages

The following table lists the common error codes faced while using Windows and its basic components. Some solu ons have been provided to solve them:

Error Code	Error Message
Code 1	Incorrect device configura on
Code 3	Corrupt device driver, or low system memory
Code 10	The device not able to start
Code 12	Not enough free resources for the device to use so disable one of the other devices on this system
Code 14	Restart the computer for the device to work
Code 16	Windows unable to iden fy resources used by the device
Code 18	Reinstall the device driver

Code 19	Incomplete or damaged configura on informa on
	Reinstall the hardware device
Code 21	Device removed
Code 22	Device disabled
Code 24	Device not present or driver not installed
Code 28	Device driver not installed
Code 29	Device disabled
Code 31	Windows unable to load the device drivers
Code 32	Device driver disabled
Code 33	Windows unable to determine the resources required by the device
Code 34	Unable to determine device se ngs
Code 35	Not enough informa on to configure and use this device
Code 36	Reconfigure the interrupt for this device
Code 37	Unable to ini alize the device driver for this hardware
Code 38	Previous device driver is s ll in memory
Code 39	Device driver corrupted or missing

Code 40	Incorrect or missing service key informa on in the registry
Code 41	Windows unable to find the hardware device
Code 42	Duplicate device running in the system
Code 43	Device stopped
Code 44	Device shut down by an applica on
Code 45	Device not connected to the computer
Code 46	Opera ng system shu ng down
Code 47	Device prepared for safe removal, but not been removed
Code 48	So ware for this device blocked
Code 49	Windows unable to start new hardware devices as the system hive is too large
Code 52	Windows unable to verify the digital signature for the device driver

Fig. 4.3.6: Error code and messages

Handling Issues Not within Scope

There may be certain circumstances when a field technician is unable to resolve the so ware or hardware problems at the customer sites. Some of the typical examples of such cases are:

- In some systems, such as ERP or data management systems, a lot of customiza on could be done for the client by the service provider or the implementa on partner. This customiza on is like a black box for an IT service engineer. This is because its code/program may not be shared. Also, there might be a separate team to support these systems.

- There are some hardware servers or systems which are under control and support of an external vendor. Thus, the service engineer may not have any role to play in this scenario.

In both the scenarios, one may take external support or escalate the issue. However, if it is not sure under whose preview the issue lies, a senior person should be consulted before approaching the problem.

Escalate Problems to the Vendor

So ware developers write a code to meet the clien t's requirement in such a way that only they can understand the system's behaviour. Hence, it is di cult to troubleshoot such a system and it can be me consuming also. It is always recommended to take external support of the developer to solve such issues.

Escalate Problems to a Senior

If the field technician is not aware of the developer of a par cular system, then it becomes di cult to contact and resolve an issue. In most of the organiza ons, there is a list of all so ware and systems that are being used. This list also contains a point of contact for each so ware or system. To refer to this list, a senior person should be consulted.

Prac cal

Perform the task of Removal and Replacement of the Wireless LAN Network Card.

Hardware:

1. Screw driver
2. Wireless Mini PCI card

Activity

Choose the correct answer for the following questions:

1. When a processor is turned on, a diagnostic tool tests if the computer hardware components are working properly or not. The tool is _____

   a. POST   b. OST   c. IST

2. Which command opens a Task Manager?

   a. Shift+Ctrl+ F1   b. Ctrl + Alt + Delete   c. Ctrl +Alt

3. 5 Beeps at the time of running POST means _____

   a. Processor Failure   b. Timer Failure   c. Memory Error

UNIT 4.4: Comple ng Repairs

Unit Objec ves

At the end of this unit, you will be able to:

1. Report percentage of call closure in mul ple visits against a benchmark
2. Ensure no sub-standard or unverified parts are used in replacement
3. Complete the func on within the agreed Turn Around Time (TAT)
4. Meet the given monthly or daily target

4.4.1. Report Percentage of Call Closure

The job of a field technician does not end at just examining or maintaining the equipment. Once an equipment, for example a computer, is worked upon, the technician is required to create a detailed report. It should include the details of the changes made; the next supposed date when the hardware or the so ware on the system may require a repair or an update; and the number of days in which the assigned task was completed.

For example, a task was to be completed in two visits but the technician took three visits to complete it. They need to report why they took more me to complete the task. In addi on, they also need to specify the reason of delay, such as appropriate tools missing, spare part unavailable at the store and so on.

4.4.2. Use Only Verified Parts

As the cost of verified parts/modules is greater than that of sub-standard and unverified ones, many people prefer the unverified parts. These parts can stop working at any me. In addi on, they can cause damage to the system's performance. So, it is the responsibility of the field technician to make use of only verified parts while replacing the faulty parts and also make the customers aware of their advantages.

4.4.3. Complete the Work in TAT

In most organiza ons, conflicts between co-workers occur due to ght schedules and deadlines. Employees working on deadlines are required to work on short turnaround mes, resul ng in frustra on and stress. Strategic planning in advance is the best way to avoid such circumstances. Irrespec ve of the team size, this can be achieved by deploying tools like Google Calendar to communicate deadlines.

The following figure shows some points which ensure that the work is always completed within the expected me period:

Complete the call closure in a single visit

Complete the task with the quality benchmark of the company
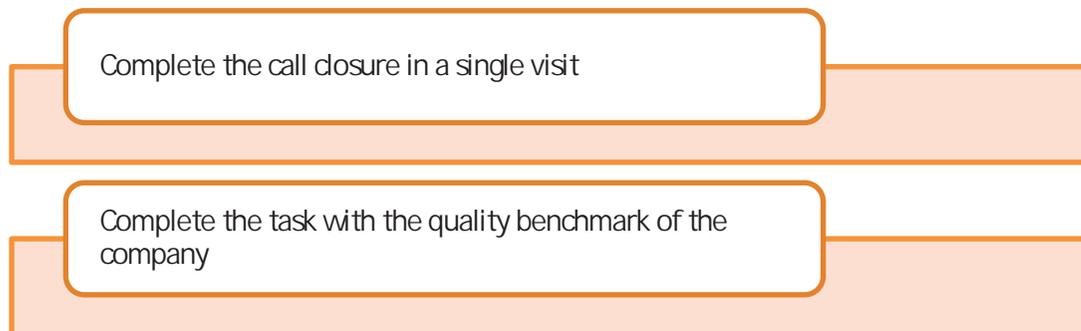
Fig. 4.4.1: Key points for mely comple on of work

4.4.4. Meet the Targets

Just like any other employee of an organiza on, mee ng the targets set by the supervisor is very important. A technician needs to be clear about the goals and visions of the organiza on to achieve all the designated targets. The following figure shows the key points which will help a field technician to meet the expected targets:

Maintain the quality of work

Ensure availability of machinery and so ware

Field Technician

Manage the team

Scru nize the procedures on site
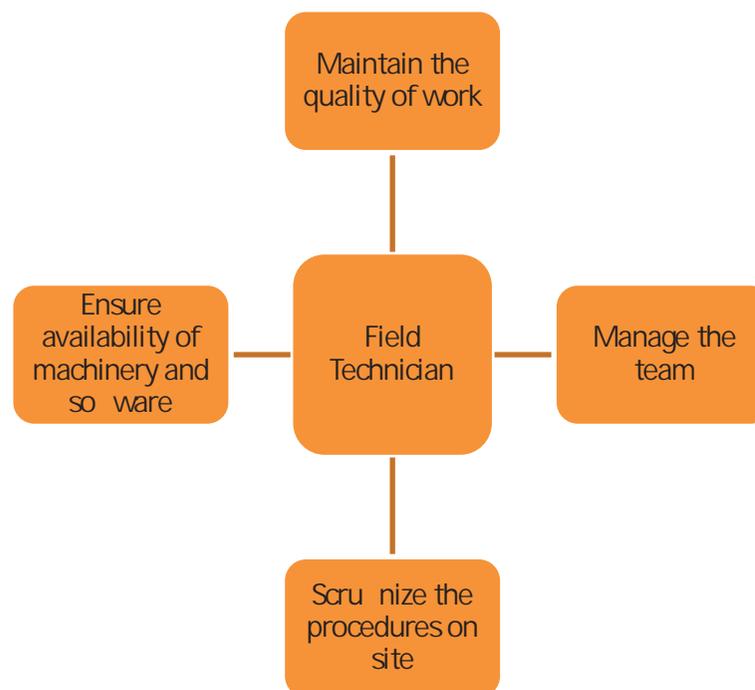
Fig. 4.4.2: Key points to remember for mee ng targets

The quality of work needs to be maintained at all mes in compliance with the referral handbook of the company. Making sure that individual roles and responsibili es are understood by the personnel is vital. Timely check of the machinery and so ware systems needs to be done to avoid any bo lenecks in achieving weekly or monthly targets.

UNIT 4.5: Reporting to Superior

Unit Objectives

At the end of this unit, you will be able to:

1. Take work order from the Supervisor
2. Report 100% on time completion
3. Submit the feedback form
4. Report work status accurately
5. Create knowledge bank

4.5.1. Understand the Work Requirement

For a person to work, it is important to understand the work requirements. The work requirements for a field technician include certain responsibilities as shown in the following figure:

Take work order from the supervisor or customer care about the complaint registered

Understand the work requirements

Follow the line of authority

Issue on time the tools and the equipment

Keep upto date with new products and developments

Plan, organize and control work for efficiency

Report on the work load and completion status

Find solutions to customer complaints and queries that are unresolved in the field or escalate issues of concern to the supervisor

Fig. 4.5.1: Meaning of work requirement

Work requirement is also a document which has the date, loca on and the details of a par cular task, which has to be done. It is the record of the task which is to be performed. The technician should be able to understand the task assigned and its requirement.

4.5.2. Quality and Timely Comple on of Work

A few simple principles, if adhered to, can ensure produc on of quality work. As a field technician, maintenance of quality and mely comple on of work can be done in the following ways:

- Ensure that work is done is as per the guidelines and standard of the company.
- Plan and organize the allocated work for the day.
- Follow the proposed plan of ac on.
- Inform the supervisor in case of any devia on or emergency.
- Work to ensure 100% customer sa sfac on.

The field technician would get a job sheet or work alloca on from the supervisor. The supervisor would also share a plan of ac on with the field technician to ensure adherence to melines and quality for the work assigned and an explana on if the target is not met. The following figure highlights the points which help a field technician in understanding the plan to achieve 100% quality and mely comple on of work:

Establish a compliance plan

Build a communica on strategy

Develop an e ec ve work schedule

Create a review plan

Test the product

Fig. 4.5.2: Achieving quality and mely comple on of work

4.5.3. Submit the Feedback Form

Once the issue/problem is solved, feedback from the customer is very important. It helps to create a reference guide for the field technician in an organiza on, if the same problem creeps up again. Having discussions with the supervisor in rela on to the problem and its solu on solves a lot of intangible problems in the organiza on.

A customer is always special for an organiza on and therefore, the customer's feedback is the most important aspect of providing service for an organiza on. A technician should take customer feedback in a feedback form provided by the company. The following figure represents a procedure to take feedback form the customer:

Take a feedback from the customer in a feedback form	Do not be defensive during the feedback	Share the feedback form with the supervisor

Fig. 4.5.3: Procedure for taking the customer's feedback

4.5.4. Documenta on

A er comple ng an installa on at a site, the technician should complete the documenta on to record the details related to the installa on. A knowledge bank should be created on the complex repairs done through documenta on. Along with comple ng the documenta on, the field technician should tell the customer about some dos and don'ts for using the computer and its peripherals. The customer should also be told about the important pages to refer from the product manual, such as the webcam switch and its func onality. The documents may include the following:

- Work status report
- Customer hand over slip
- Customer feedback form
- Servicing date or period
- Warranty documents
- Tests performed on the computer/peripherals with results, in case there is a complaint or an issue in an already installed computer/peripheral

5. Interacting with Customers

ELE/N4601

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand customer requirements
2. Learn how to interact with customers
3. Suggest resolu on to the problems of customers
4. Learn how to maintain records of customer's complaints and resolu ons
5. Describe the importance of produc vity and quality

UNIT 5.1: Understand Customers Requirements

Unit Objectives

At the end of this unit, you will be able to:

1. Identify the customer requirements
2. Educate customer about different aspects of installing and repairing hardware

5.1.1 Understand Customer Requirements

Understanding the needs of a customer is one of the foremost parts of a technician's job role. This includes the following practices:

- Call the customer as per the complaint registered to understand the issues
- Check time of visiting the location
- Greet the customer and talk politely
- Understand the customer's requirement
- Provide the best possible and cost effective solution to the customer
- Ensure that the customer is satisfied with the service
- Address the queries and issues raised by the customer about the hardware devices

5.1.2 Educating and Informing the Customer

Educating the customer about the products and their operation is an important aspect of field technician. For the satisfaction of customer, a field technician should inform the customer about the operational behaviour and other information of hardware installed by him at the customer site or premises.

The following figure shows list of informa on about hardware which is to be used by customer:
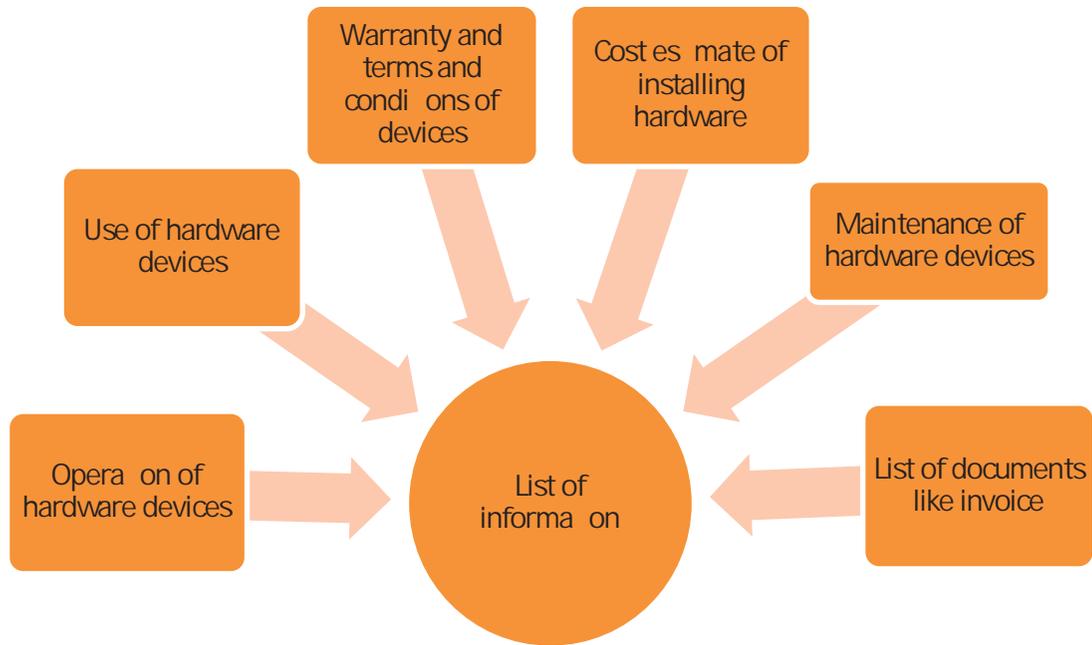
Fig 5.1.1: List of informa on about hardware

UNIT 5.2: Interacting with Customer

Unit Objectives

At the end of this unit, you will be able to:
1. Analyse location requirements for hardware devices
2. Ask customers about their issues
3. Inform customers about repair procedure and warranty coverage of devices
4. Educate customer about annual maintenance contract

5.2.1 Analyse Location Requirements

For a field technician, it is important to analyse the location before installing the hardware components and other peripherals, for proper handling of and to prevent the devices from any damage.

While analysing the location, understand the customer requirements such as where it should be installed and whether it can be installed at that location or should be taken to the service centre for any changes.

Some points that should be kept in mind while analysing the location requirements for hardware installation are as shown in the figure:

Location should be dirt free.

It should be away from wet area.

It should be spacious.

It should not be in high tempertaure and humidity zone.

Fig 5.2.1: Analysing the location requirements for hardware installation

5.2.2 Asking Ques ons

Asking Ques ons is also a skill. Ques ons may be asked to get more details or to be sure of something. A field technician should ask customer queries to analyse the problems faced and seek inputs from them to understand the symptoms.

This figure enlists the points to be asked at customer's premises:
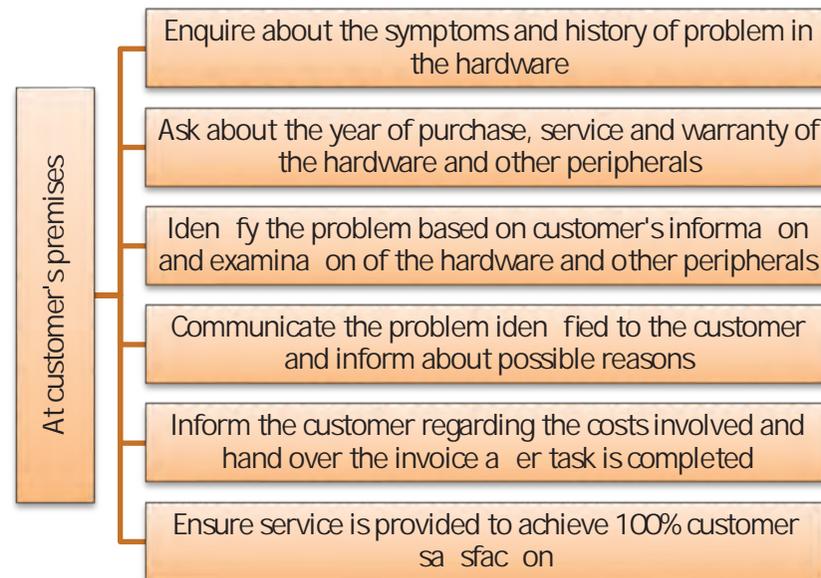
Fig 5.2.2: Points to be asked at customer's premises

Depending upon the inten on of asking a ques on, it can be:

- Close ended ques ons – are mainly yes, no answer type ques ons. The purpose of asking such ques ons is to get specific details. The following table shows close ended ques ons:

Example	Ques on Tag
Did you come yesterday?	Do, Did, Is, Can, Could, Will, Would, Shall, Should and so on
Can you finish this task in 2 hours?	
Shall I do it now?	

- Open ended ques ons – are mainly ques ons which do not demand a specific answer but are probing for details. The following table shows pa ern of open ended ques ons:

Example	
What do you think about the mee ng yesterday?	
How was your day?	
Where have you been all a ernoon?	

5.2.3 Warranty Coverage and Annual Maintenance Contract

A warranty coverage is an agreement between manufacturer and buyer which assure the customer to give free repair service ll the men oned date of warranty. A field technician should enquire about warranty coverage a er inspec ng the device which is to be replaced or repair.

If the device is out of warranty coverage, inform the customer about the ini al charges of replacing the damaged part.

The following figure shows a warranty card template:

Fig 5.2.3: Warranty card template

Informing Customer about Replacement

In this, a technician is responsible to inform customer about the replacement or repairing procedure of hardware. Tell the customer about the es mated cost of repairing or whether the repairing will take place at service centre.

Annual Maintenance Contract

It is defined as a contract between two par es about maintenance of the product owned by other party on some terms and condi ons which is nego ated in the star ng and it is maintained in the form of legal contract.

A technician should educate customer about this contract and its benefits regarding product maintenance and legal terms and condi ons, so that in future customer should be able to use this contract for repairing purpose of the damaged products.

MAINTENANCE CONTRACT FOR COMPUTER EQUIPMENT AND ACCESSORIES

Between _____represented by
        (hereinafter referred to as the COMPANY)

and _____represented by
        (hereinafter referred to as the CUSTOMER)

1.   OBJECT

2.   MAINTENANCE SERVICE

Fig 5.2.4: Template for annual maintenance contract

UNIT 5.3: Suggest Solu ons to Customer Problems

Unit Objec ves

At the end of this unit, you will be able to:
1. Provide solu on to the customer problems
2. Explain customer about the es mated cost of repairing under warranty and me required to repair the faulty equipment
3. Inform customer whether the module require replacement with reasons

5.3.1 Suggest a Solu on to the Customer

A er iden fying the issue, a field technician needs to o er solu ons. The field technician should explain all the possible solu ons along with the cost associated. The field technician should then propose the best solu on and let the customer decide whether to go ahead with the given solu on or not.

The following figure shows the steps involved in o ering solu ons to a customer:

Suggest solu ons to the customer

⬇

Explain the me for fixing the issue

⬇

Explain the service method - repair or replacement of part

⬇

Explain the costs involved

⬇

Seek the customer's approval for further ac on
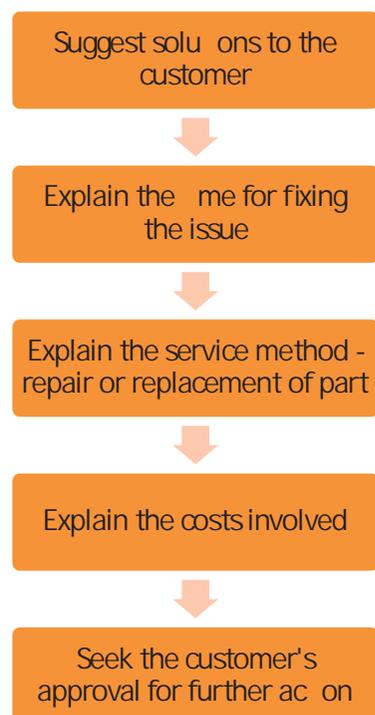
Fig 5.3.1: Sugges ng a solu on to the customer for an issue

5.3.2 Inform and Explain Customer about Modules Replacement

Under this topic, a technician required to inform customers on whether the module has to be replaced or repaired with reasons. For an instance, if the product is under warranty coverage then tell the customer about the es mated cost of repairing and me required to repair it.

The following figure shows the step required to inform the customer about modules replacement:

Visit customer's site and understand the problem.

If the product has to be replaced, take the prior approval of customer.

Tell the customer about the es mated cost and me of repairing or repalcement, whichever is required.

Analyse the problem and find out the possible solu ons.

If it is not in warranty, ask the customer whether the modules will be repaire or replace.

At last, tell the customer to maintain the copy of invoice and warranty for future purpose.

Check the device for warranty coverage and inform the customer about the same.

If the product is in warranty coverage, tell customer whether the module will replace or repair.

Fig 5.3.2: Steps required to inform the customer about modules replacement

UNIT 5.4: Maintaining Schedules and Records

Unit Objec ves

At the end of this unit, you will be able to:

1.   Explain maintenance schedules
2.   Tell customer to retain the copy of invoice and provide the same

5.4.1 Maintenance Schedule

Maintenance schedule is vital for keeping records of servicing, repairing and performing preven ve maintenance. The service engineer should maintain service records and next servicing schedules to be inform the customer about the maintenance of the components at the facility. The service engineer needs to perform hardware and so ware maintenance.

The following image shows a sample maintenance schedule report:

Fig. 5.4.1: Sample maintenance schedule report

Hardware Maintenance

The field technician should assess the condi on of hardware components and upgrade if required. He/she should be aware of the compa bility issue. He also need to maintain the warranty details of the components. If the warranty period is going to expire, he/she should communicate that with the customer and ask for any extended warranty he needs.

In this case, there are two ways:

•   The customer can ask for extending the warranty period.
•   The customer doesn't want to extend it. If there is any problem, he will buy a new one.

The field technician need to communicate about the above two ways and then tell the details of further procedure.

The following image shows a sample maintenance requirement form:

Fig. 5.4.2: Sample maintenance requirement form

The technician should maintain a checklist for scheduling the maintenance. The following figure shows a maintenance checklist:

Activity	Frequency	Auto?
Check power supply fan for ventilation and dirt build-up and clean if necessary	Quarterly	No
Back up CMOS information	Quarterly	No
Check processor temperature, inspect heat sink and fan to ensure they are working	Annually or Whenever case is open	No
Check hard disk for temperature and vibration	Annually (or whenever case is opened)	No
Clean exterior of case	Annually	No
Clean exterior of monitor	Annually	No
Check and clean interior, motherboard and expansion cards if necessary	Annually	No
Check internal connections and cables	Annually	No

Fig. 5.4.3: Maintenance checklist

5.4.2 Maintain the Copy of Invoice

Invoice is defined as a non-nego able instrument given by the seller to the customer a er purchasing of the goods and services. It acts as the bill of sale or contract of sale.

Invoice template consist of the following content:

- Trading par es (seller and customer)
- Quan ty of items sold
- Date of shipment
- Mode of transport
- Rate and discount
- Delivery and payment terms

The field technician should provide a copy of invoice to the customer and tell him to retain a copy of it for future purpose.

The following image shows sample of invoice template:

Fig 5.4.4: Sample of invoice template

UNIT 5.5: Achieving Productivity and Quality

Unit Objectives

At the end of this unit, you will be able to:

1. Deliver the service within service level agreement (SLA) time
2. Identify customer's requirement and put them at ease by providing appropriate solutions
3. Achieve customer's satisfaction
4. Maintain no repeat or second escalation from customer

5.5.1 Deliver Service within SLA time

To achieve customer's satisfaction, it is necessary to deliver the service within the time as mentioned in SLA. Managing the expectation of a customer is not easy for a field technician. The expectations can turn into a grave problem if the responsibilities and the roles of both the parties are not clearly defined on paper and agreed upon by both the customer and the service provider.

An agreement of a sort is therefore important to understand that both the parties – customer and organisation– have duties and responsibilities to each other and these must be properly detailed. This is where Service Level Agreement (SLA) comes in. An SLA is a formal contract between the service provider and the customer, defining services, responsibilities, scope and duties of both the parties. For instance, an IT hardware company may offer routine inspection and maintenance service for a certain period of time as part of one time cost at the time of purchase of equipment.

The following image shows an SLA:
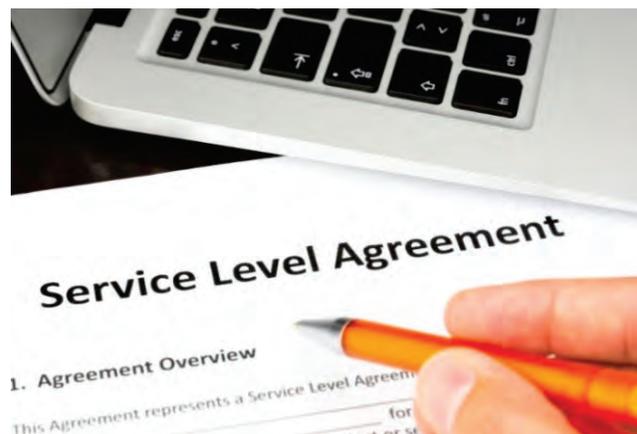
Fig. 5.5.1: Writing out an SLA

It's important for the service engineer to read and understand the SLA before visiting a customer, so that all the queries, support and service can be addressed according to the terms specified. This will minimize all the issues related to service expectations of a customer.

The following figure enlist points required to achieve customer's satisfaction:
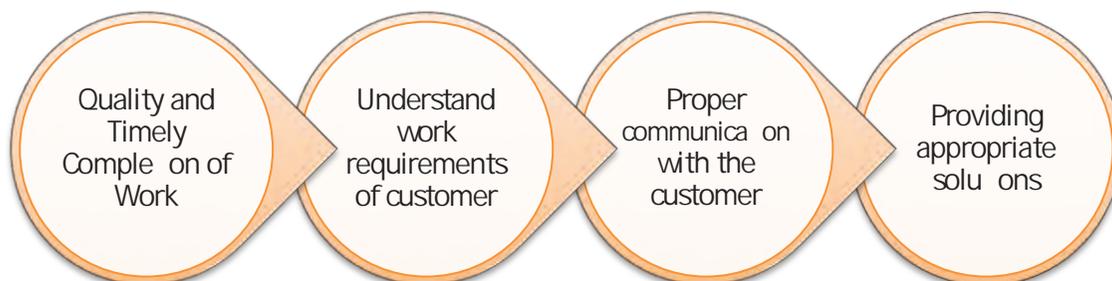
Fig 5.5.2: Points required to achieve customer's satisfaction

Maintain Records of Activity

One of the most important parts of good customer service is maintaining accurate records, containing details of dealings with the customers. Customer records can help gather information about how best to market a company's services and also help to ensure that the organisation runs smoothly. Most records are stored electronically on a database.

Objectives of Documentation

- To record all the problems reported by users.
- To record the timing of the corrective action.
- To record the issues that are escalated and to whom.
- To record what action has been taken by whom.
- To record when the outstanding requests get cleared.

5.5.2 Maintain No Repeat or Second Escala on from Customer

Zero defect in work can be achieved in the following ways:
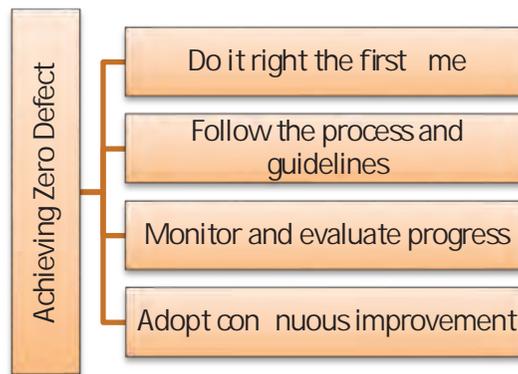
Fig. 5.5.4: Measures to achieve zero defect in work

Escala on Process

There may be cases where the customer's request is not closed within the agreed SLA me frame. In such a situa on, the technician should escalate the ma er to his superior/ back line support and the escala on manager. The supervisor is responsible for ensuring that all escalated enquiries are dealt with and resolved promptly. However, the technician should try to exhaust all the op ons at his level before escala ng any enquiry to the superviso r.

A customer enquiry should reach the supervisor only if there is a need to oversee the issue from a holis c viewpoint. The manager will evaluate the situa on, facilitate the issue resolu on and act as an advocate on behalf of the customer.

Complaints escala on process

The technician should do everything to resolve an issue in the first instance. To facilitate the fast and e cient resolu on of the issues at the first point of contact, a complaint process needs to be designed and followed.

If an issue is unresolved and needs expert guidance, the helpdesk technician should clearly explain the escala on op ons to the customer before proceeding.

The following figure illustrates the steps of a complaint resolu on process:

Step 1	• First contact
Step 2	• Escala on to supervisor or manager
Step 3	• Referred to Solu ons team
Step 4	• Further op ons
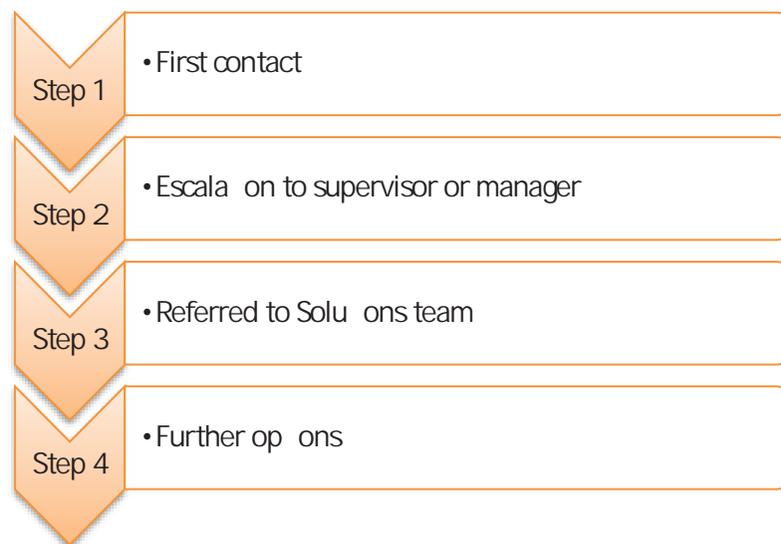
Fig. 5.5.5: A complaint resolu on process

- **Step 1:** First contact
  A helpdesk technician needs to be empowered to resolve first level complaints, complex issues and make ra onal customer service decisions.

- **Step 2:** Escala on to a supervisor or manager
  If a helpdesk technician is not able to resolve a complaint, it can be escalated to a supervisor or manager. The manager will review the problem, respond to the complainant and a empt to resolve the issue to the customer's sa sfac on.
  In circumstances where the manager is unable to resolve the complaint to the customer's sa sfac on, the complaint will be referred to the Solu ons team.

- **Step 3:** Referred to Solu ons team
  The Solu ons team will review and try to resolve the issue to the customer's sa sfac on in accordance with industry code and regula on.

- **Step 4:** Further op ons
  Most of the complaints can be handled internally by u lizing all possible avenues in resolving the complaint. However, if customer is s ll not sa sfied with the handling of the complaint, then as a last resort helpdesk technician may seek complaint media on or further assistance from the supervisor.

6. Understanding Organizational Policies and Standards Modules

Unit 6.1 – Explain Company's Policies

Unit 6.2 – Identify Company's Product/Quality Standards

Unit 6.3 – Describe Company's Safety Policies and Standards

Unit 6.4 – Interact with Supervisor

Unit 6.5 – Interact with Colleagues

ELE/N4601

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain Company's Policies
2. Iden fy Company's Product/Quality Standards
3. Describe Company's Safety Policies and Standards
4. Interact with Supervisor
5. Interact with Colleagues

UNIT 6.1: Company's Policies

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the company's customer care policies
2. Iden fy the company's code of conduct policies
3. Describe the organisa on culture and typical customer profile
4. Explain the company's repor ng structure
5. Define company's policy on product's warranty
6. Iden fy the company's line of business and product por olio and compe tors

6.1.1. Customer Care Policies

The customer care centre is designed to meet the requirements, needs and expecta ons of the users. It is done by providing mely resolu ons to queries and complaints. The goal is to minimize down me and improve the learner's overall exp erience. The team comprises of experienced so ware personnel. They help a user by answering ques ons and guiding them about using the tools. They are solely commi ed to collabora ng and communica ng with the users. The following figure lists the role of a technical:
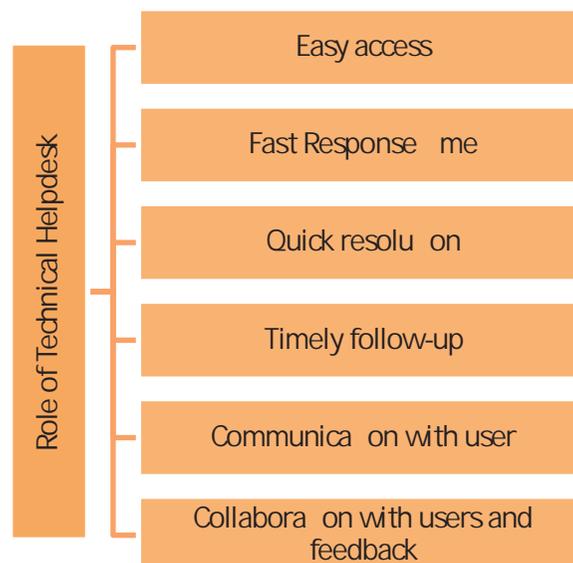
Fig. 6.1.1: Role of a technical helpdesk

6.1.2. Code of Conduct Policies

In organiza ons, the code of conduct means the core values, ethics, responsibili es, commitments and virtues that every employee of that organiza on needs to comply with. It lays down the general guidelines that the organiza ons expect from its people in specific situa ons. Thus, it is necessary to follow a proper code of conduct in terms of behaviour and work output delivered.

6.1.3. Organisa on Culture

Organiza onal culture is defined as the shared values, beliefs and norms within an organiza on and the demands of a job role. A field technician's job is a customer facing role, represen ng the face of the organiza on. The following figure represents the characteris cs of organiza onal culture which every employee should reflect:

- Be polite to the customer
- Be on me for the service
- Be well groomed and look professional
- Deliver the service as per defined quality
- Show integrity, trustworthiness and good inetrpersonal skills
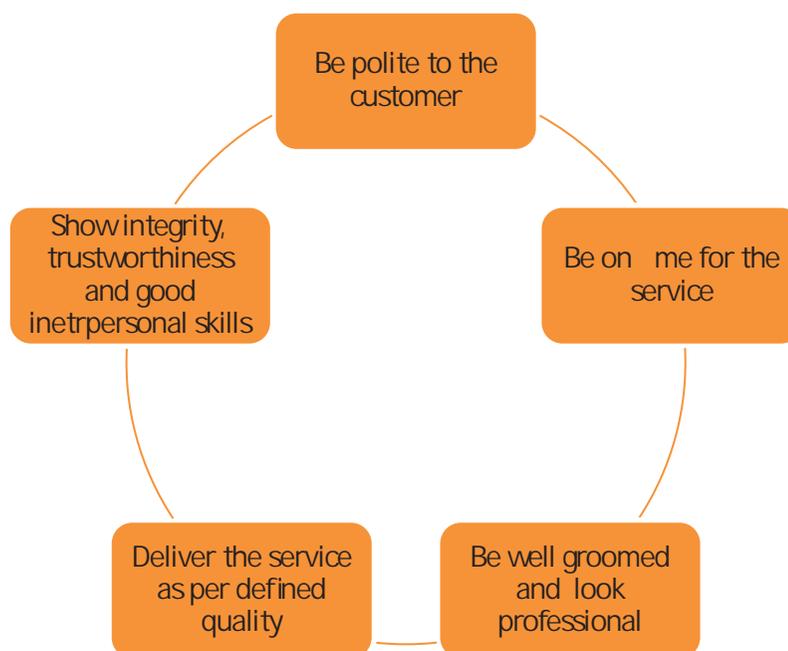
Fig 6.1.2: Characteris cs of organiza onal culture

As a field technician, you may need to cater to di erent set of customers, from di erent backgrounds.

The following figure represents the broad classifica on of customer profiles:

Domes c

- Local language
- Region/area-wise code of conduct
- Technical know-how of the product

Industry/Factory

- Scale
- Point of contact
- Layout plan/wiring diagram for the industry/factory

Small Enterprises

- Point of contact
- Layout plan/wiring diagram for the building
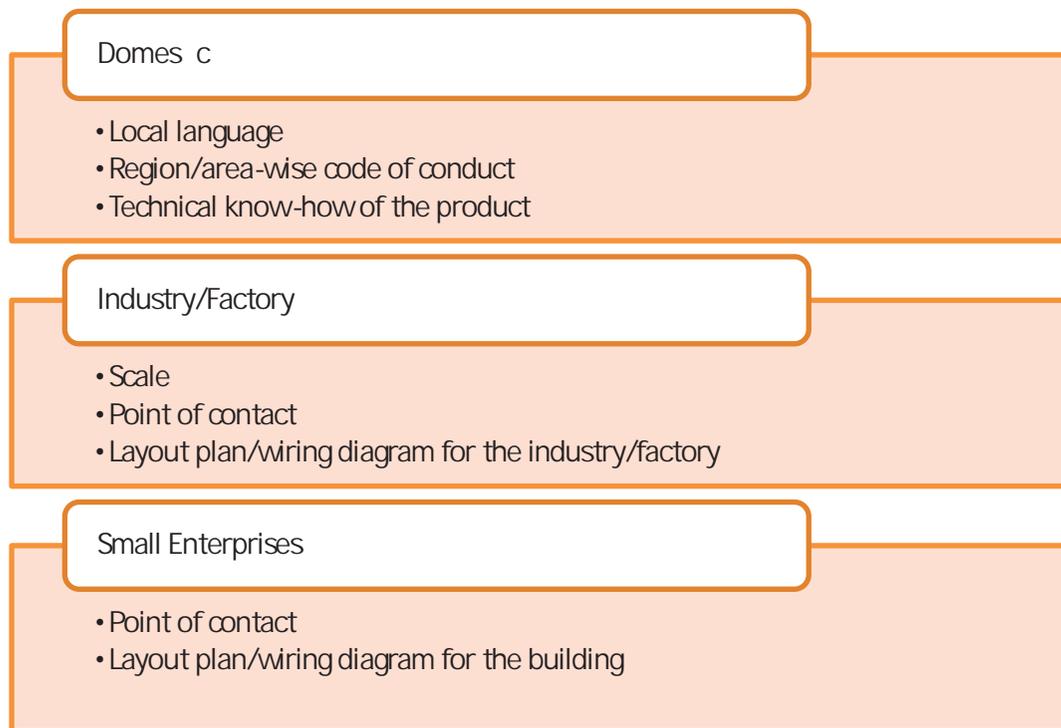
Fig 6.1.3: Classifica on of customer profiles

Company's Policies and Rules

If the company's policies and rules are not defined clearly, then the employees may not comply with the disciplinary standards wholeheartedly. The following figures are a few examples of company policies:

Conduct of an Employee

Equal rights of employees

A endance/Time o

Product's warranty and other terms and condi ons

Line of business and product por olio and compe tors
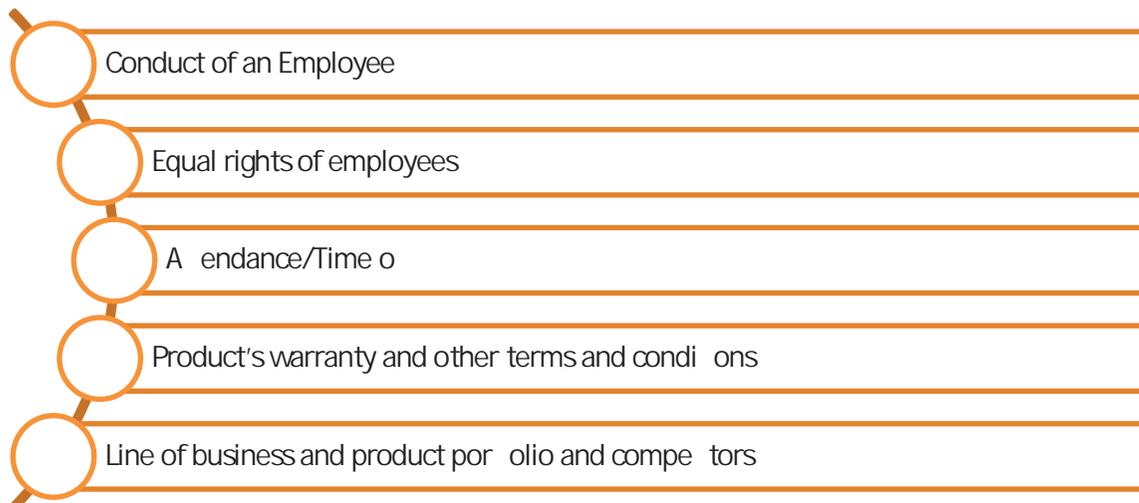
Fig. 6.1.4: Common company policies

Repor ng Structure

There are set rules and regula ons within an organiza on which an employee needs to follow. These outline responsibili es of both the employers and the employees.

The following figure explains what working in an organiza on requires a field technician to ensure:

Follow the company's policies and rules

Follow the repor ng hierarchy

Follow role as defined in the workflow

Follow the documenta on process

Follow the sales and a er sales support policy

Fig. 6.1.4: Repor ng and documenta on process

Documenta on

Right documenta on can make a lot of the di erence in ge ng quick resolu ons. To achieve this, certain steps need to be taken as shown in the following figure:

Document every complaint

Document common problems

Document cket escala on process

Make documenta on an on-going process

Fig. 6.1.5: Steps for right documenta on

Document Every Complaint

The field technicians need to document issues as they come in. In addi on to recording the symptoms described by the customers, they should probe for the right symptoms. For example, if a customer says that his computer is running slow, the help desk need s to

di eren ate whether the problem is caused by a virus or a malfunc oning hardware or an unpatched system.

The field technician should know how to ask the right ques ons to try and resolve an issue within the first call.

Document Common Problems

Majority of the issues can be reduced to a handful of common problems. If there is a good documenta on process that has resolu on paths for all common problems, then the field technician does not have to reinvent the wheel for every cket. He can use the internal help desk knowledge base and me tested processes to resolve the issues quickly.

A well organised process enables the field technician to respond to a cket quickly and resolve most of the customers' problems immediately.

Document Ticket Escala on Process

A good escala on process makes sure that when the field technician is not able to resolve a problem, he addresses cket escala on promptly. The cket gets send to the next level of customer support and the customer does not have to wait for days for it to get resolved.

Documenta on should be an on-going e ort

Documenta on is not a one me e ort; it needs to be an on-going process. The field technicians should regularly op mize the issue resolu on procedures and processes. This ensures that the customer issues are resolved promptly.

UNIT 6.2: Company's Product/ Quality Standards

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the company's products and recurring problems reported

6.2.1. Company's Products and Recurring Problems Reported

The Computer and Peripherals industry produces a wide range of products for sale to just about all businesses and consumers. It can consist of products like printer, scanner, mouse, moniter and other devices as men oned in the above modules.

The overview of company's product is as shown in the image:

Fig 6.2.1 Overview of company's product

Recurring Problems Occurred

When a field technician visit a customer's site for repairing or replacing faulty modules, he should kept a record of the visit and educate customer about the procedure of repairing, so that in future problem persists, he can tackle that.But, some mes these problems occurred frequently.

In this case a field technician should perform the following steps to troubleshoot the recurring problems in device as shown in the following figure:

Visit customer's site and understand the problem.	Document the reason for the recurring problem and consult with the superior to find out be er solu ons..	Educate the customer about the reasons behind the recurring problems, so that in future, he is able to repair it.
Analyse the reason behind the frequently occuring problem in the device.	If it is the same problem, ask customer whether to replace the device or repair.	
Check the report of the previous repairing session.	Firstly, perform the repeated procedure of finding faults as men oned in the report.	

Fig 6.2.2 Steps to troubleshoot the recurring problems in device

UNIT 6.3: Company's Safety Policies and Standards

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the safety procedures to follow
2. Iden fy the quality standards to be followed
3. Explain the ESD

6.3.1. Safety Procedures

As a field technician, there are certain guidelines that must be followed to ensure own safety, and that of the co-workers. These guidelines provide a sound, safe and flexible environment to work. The following figure represents the general safety guidelines to be followed at workplace:

Always follow the correct procedures to ensure zero accidents at work.

Always use an appropriate tool for the respec ve task.

Always read labels and instruc ons given on the components.

Always wear appropriate clothing and remove metal objects before working.

Use prescribed protec ve safety equipment only.

Always follow Electrical Safety Rules when working with electrical machinery or equipment.

Report all unsafe acts or unsafe condi ons to the supervisor.

Fig 6.3.1. Safety guidelines

The following table represents the dos and don'ts of safety measures at a customer's home:

Dos	Don'ts
Place the inverter in a well aerated place	Never place the ba ery in a closed container
Installa on should be done on a flat surface	Never keep ba eries close to water or other chemicals
Ba ery terminals should be ghtened	Never load the connec on with more than the men oned capacity
All ba ery cables should be connected in right direc on	Do not operate device with damaged cables
Keep the ba eries connected when the device is in 'ON' state	Never connect the inverter to an incoming power supply

Fig 6.3.2. Dos and don'ts of safety measures at a customer's home

6.3.2. Quality Standards

A few simple principles, if adhered to, can ensure produc on of quality work. As a field technician, maintenance of quality and mely comple on of work can be done in the following ways:

- Ensure that work is done is as per the guidelines and standard of the company.
- Plan and organize the allocated work for the day.
- Follow the proposed plan of ac on.
- Inform the supervisor in case of any devia on or emergency.
- Work to ensure 100% customer sa sfac on.

The field technician would get a job sheet or work alloca on from the supervisor. The supervisor will also share a plan of ac on with field technician to ensure adherence to melines and quality for the work assigned.

The following figure highlights the points which help a field technician in understanding the plan to achieve 100% quality and mely comple on of work:

Establish a compliance plan → Build a communica o n strategy → Develop an e ec ve work schedule → Create a review plan → Test the product
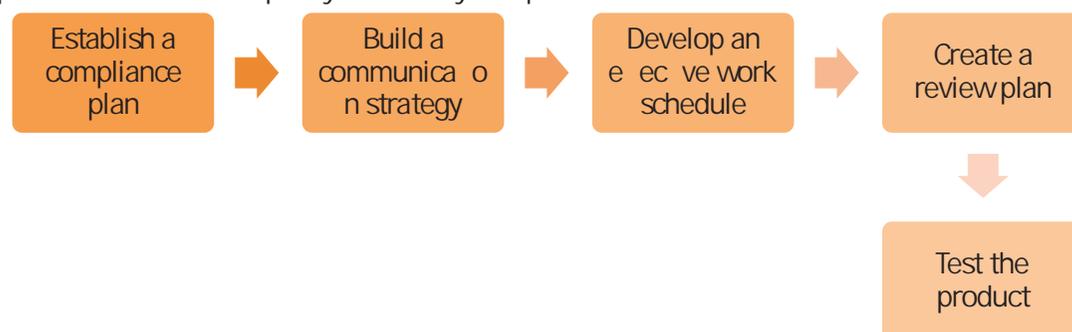
Fig 6.3.2. Achieving quality and mely comple on of work

6.3.3. ESD Protection

ESD protection is essential for sensitive components, during and after production, while shipping, during assembly of the device and in the finished device. ESD can cause severe damage to components such as microchips. Grounding is imperative for ESD prevention. An ESD Simulator having special output circuit called human body model (HBM), is generally utilized to test the vulnerability of electronic devices to ESD from human contact.

The following protective gears should be used while handling components that are prone to ESD:

Wire strap	Gloves	Safety Clothes

Fig. 6.3.3: Safety gears for prevention from ESD

UNIT 6.4: Interacting with Supervisor

Unit Objectives

At the end of this unit, you will be able to:

1. Understand and assess work requirements
2. Identify the targets and incentives
3. Documentation of work on enterprise resource planning (ERP) software
4. Resolve personnel issues
5. Communicate any potential hazards at a particular location
6. Deliver work of expected quality despite constraints

6.4.1. Work Requirement

As a field technician, one of the major roles and responsibilities is to understand the work requirements. The major roles of the field technician are as follows:

- With any issues in hardware and software, a field technician needs to come-up with solutions as soon as possible to eliminate any bottlenecks in terms of productivity. It is an integral part of maintaining a smoothly running working environment having zero tolerance for even major delays.
- Coordinating with customers, co-workers, subordinates and superiors is also defined as one of the major roles of a field technician.
- Having a clear picture about the work requirements determines the smooth functioning of an organization.

Understand Work Requirements and Targets

The targets and short-term goals set by the organization determine the targets for the personnel. The field technician needs to understand the goals set by the superiors. The goals may be set with respect to timespan as listed in the following figure:

Quarterly

Monthly

Weekly

Daily
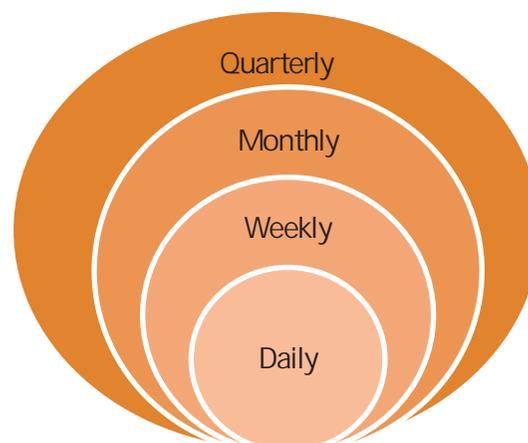
Fig. 6.4.1: Goals set by superiors

These goals then further define the targets to be assigned to the team responsible for all hardware related personnel. The incen ve policy should be clear so that the employees can understand the policy well. It will mo vate them to put maximum e ort in maintaining hardware facility of an organiza on.

Any ambiguity in understanding the work requirements defined by the supervisor results in me delays and confusions. A field technician needs to avoid such instances at all costs. For example, failing to understand the priority of jobs or tasks assigned by the supervisor for the day. Understanding the technical requirement is also equally important. So, while replacing faulty modules, a field technician should check the warranty on the faulty module while replacing it and also ensure that no damage to the other hardware is done.

6.4.2 Documenta on of Work on ERP So ware

One of the most important parts of good customer service is maintaining accurate records, containing details of dealings with the customers. Customer records can help gather informa on about how best to market a company's services and also help to ensure that the organisa on runs smoothly. Most records are stored electronically on a database.

ERP so ware is used in company to maintain the records of work performed by the field technician. It is defined as the business management so ware consist of integrated applica ons required to manage the documenta on process and control back o ce related func ons such as human resources and other technologies.

The following figure shows sample of ERP so ware used in an organisa on:

Fig 6.4.2: Sample of ERP so ware used in an organisa on

6.4.3 Work Ethics

Work ethics means di eren a ng between the right and the wrong way of doing a job and adop ng the right conduct. Work ethics involve certain principles as shown in the following figure:

| Resolve personnel issues | Delivery of work as per standards and guidelines | Inform superior about any poten al hazards |

Fig 6.4.3: Work ethics

Consider an example: Pawan finished the task assigned to him. He has done the work on me and in an e cient manner. He also informed his supervisor regarding a major safety breach which helped in preven ng an accident situa on. Pawan was awarded an incen ve for the best work done in that month. Later on, for his alertness and proac ve stance he was also awarded by the MD of the company.

Resolve Personnel Issues

Resolving personnel issues involves the followings:

- Communica ng e ec vely with the personnel ensures posi ve feedback in the organiza on. Two-way communica on within and beyond the facility is also advised for field technician in any organiza on.

- All conflicts of interest, misunderstandings and personnel grievances need to be understood and then reported to the higher authority.

- Sugges ons on resolving the problems is important as it helps the facility sta to concentrate on the job at hand.

Any personal issue or grievance also needs to be a ended to by the field technician himself before pushing the issue through to the supervisors. Managing the personnel is the most important part of team e ort towards a unified goal.

Delivery of Work of Expected Quality

Delivery of work as per expected quality should be maintained in the following ways:

- Ensure the work done is as per the guidelines and standard of the company.

- Plan and organize work for the day.
- Follow the plan.
- Inform supervisor in case of any devia on or emergency.

The following figure highlights the points which help the employers in developing a plan to achieve 100% quality and mely work comple on:

Establish a compliance plan → Build a communica on strategy → Develop an e ec ve work schedule

Create a review plan ← Test the product

Fig. 6.4.4: Achieving quality and mely work comple on

Inform Superior about Poten al Hazards

Understanding all the possible hazards that can happen in a facility are the responsibili es of a field technician. One possible cause of hazard could be the lack of clear understanding about the company's code of conduct or reference handbook which puts constraints on the use of equipment for purpose that is against the code of conduct. A field technician can handle the hazard by:

- Communica ng any such hazard to the supervisor can prevent una or dable down mes which could hamper cri cal func oning of the organiza on.
- Having clear communica on with the other sta members and ge ng in place early warning systems for poten al threats in another dimension.
- Making risk assessment is an integral part of a field technician job descrip on. Poten al hazards should be assessed with precision and supported with prac cal evidence.
- Adop ng a systema c approach is one dimension of communica ng poten al hazards.

The following figure shows a systema c approach for handling hazards:

Iden fica on of cause → Assessment of the cause → Management of hazard
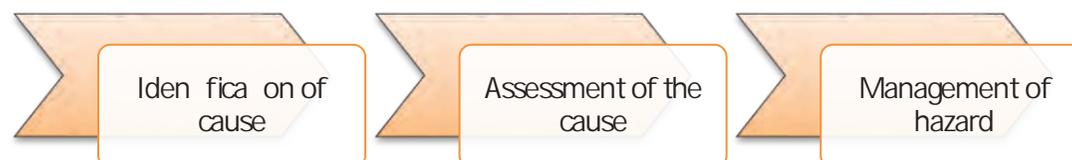
Fig. 6.4.5: Systema c approach for handling hazards

Ac vity

Tick the ac ons which can prove to be a threat to the health and safety of a field technician.

Smoking near combus ble substances ☐

Oil spill near customer interac on area ☐

Tools lying on a table of a technician ☐

Tools lying on the floor ☐

Entering a 'No Entry' zone at customer site ☐

Touching a live wire hanging out of a panel ☐

Working in dim light ☐

Walking on a wet floor ☐

UNIT 6.5: Interac ng with Colleagues

Unit Objec ves

At the end of this unit, you will be able to:

1. Receive spares from tool room or stores or deposit faulty modules and tools to stores
2. Pass on customer complaints to colleagues
3. Assist colleagues with resolving field problems
4. Resolve conflicts and achieve smooth workflow

6.5.1 Interpersonal Rela onship

Every worker works towards a common goal in an organiza on, s ll all of them are divided by certain roles and ac vi es and the way they accomplish that objec ve. Inter-personnel communica on – whether formal or informal - is the most common and important key to accomplish produc vity and perform social func ons in an organiza on.

The primary objec ve of a field technician is to understand the process and the health of the communica on taking place among the co-workers in order to improve its quality. To maintain a healthy interpersonal rela onship, it is important to adhere to the points shown in the following figure:

Interpersonal Rela onship

- Resolve interpersonal conflict and ensure smooth flow of work
- Receive Equipment/Tools from Stores
- Pass on customer complaints to colleagues in respec ve geographical loca ons
- Assist colleagues to resolve field problems
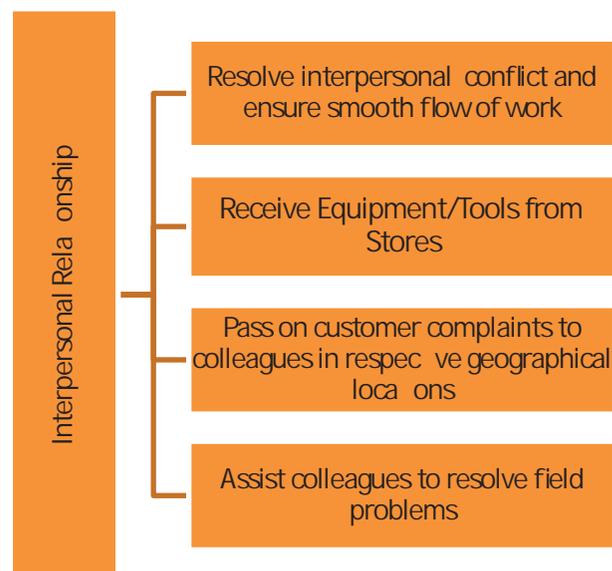
Fig 6.5.1: Managing interpersonal rela onship

Resolve Conflicts

As discussed earlier, individuals are divided by roles and responsibili es in an organiza on despite working towards a common goal. Hence possibility of conflicts is nearly unavoidable.

Here are a few tips to reinstate better communication among co-workers in such quandary.

- Clarify role and responsibilities

  Going to basics is the best way to resolve a problem. Role of a field technician is to ensure a glitch-free workflow in an organization. He and his team will participate in addressing IT issues, whether small or big. Providing a more rounded perspective of job roles and responsibilities others inculcation of a positive and resolute approach for problems among co-workers. Also, this enables people with less job experience take up things in a more constructive manner.

- Plan strategically

  In most organizations, conflicts between co-workers occur due to tight schedules and deadlines. Employees working on deadlines are required to work on short turnaround times, resulting in causing frustration and stress. Strategic planning in advance is the best way to avoid such circumstances. Irrespective of the team size, this can be achieved by deploying tools like Calendar to communicate deadlines. The following image shows planning using a calendar:

Fig. 6.5.2: Planning using a calendar

Receive Equipment/Tools from Stores

Getting the job done in a process depends on information communication. Furthermore, accuracy of the end result entirely depends on effective inter-personnel communication. For example, the IT department of an organization wants to replace old computers with the new ones, accurately and smoothly. The entire exchange process depends on how effectively the IT department communicated with the person in charge at the store, the requirement for infrastructure upgrade.

Customer Complaints in the Respective Geographical Area

Serving customers at an organization with a wide spectrum of consumer base poses additional challenges. Maintaining service quality in such cases can be a challenging task, owing to cultural and social diversity. However, such barriers can be overcome in a better way by giving the opportunity to a worker hailing from the respective geographical area. Addressing such problems in this way can improve the ability of an organization to implement strategies aimed at improving the service quality.

The following images show the segmentation of the customer base to collect their complaints accordingly:
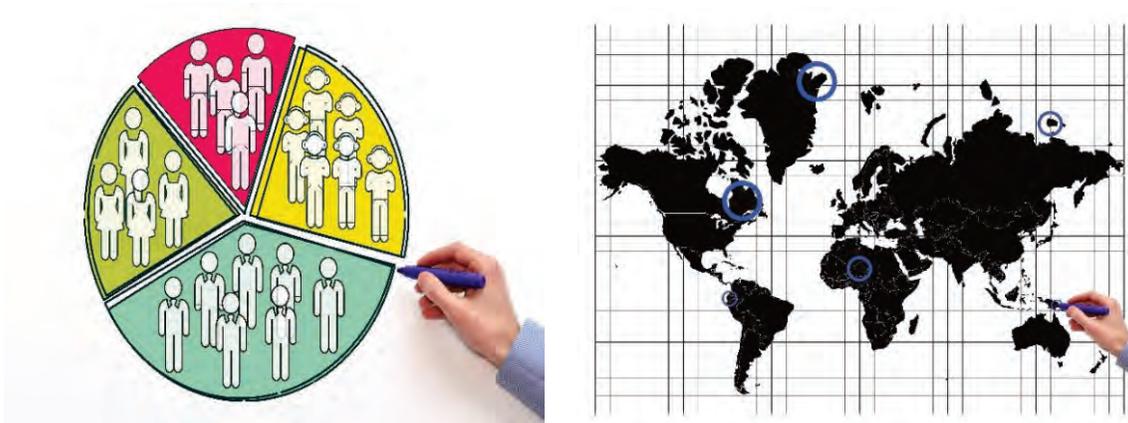
Fig. 6.5.3: Segmentation of customer base

Assist Colleagues

Be it work allocation, manpower distribution or identification of areas of high responsiveness, healthy communication is the key to improve service quality. Informal communication is what is usually seen to be dominant in most workplaces. People asking for help from the person sitting at the adjacent desk to troubleshoot a hardware issue, rather than consulting a field technician, is one of the most common examples of informal communication. The communication is spontaneous and successful in achieving the goal, paving the way to formal inter-personnel communication. Despite having established communication procedures, the informal communications occur in every organization and help in resolving problems and conflicts in real time. Hence, the role of a field technician is to understand potential of this form of communication and further it with the help of modern-day technologies.

The following image shows colleagues assisting each other:

Fig. 6.5.4: Colleagues assisting each other

Ac vity: Role Play

You are assigned the task to install a hardware at a customer's site. You reach the customer's site along with your colleague. Your colleague starts arguing and shou ng at you in front of the customer. What will you do?

Perform the role play.

Hints:

Ask one par cipant to play the role of the technician and the other will play the role of the colleague who is shou ng. Ask a third par cipant to be the customer.
A er the role play, discuss with other par cipants/viewers about what the players could have done be er or if they missed a step/process.

7. So Skills

Key Learning Outcomes

At the end of this module, you will be able to:

1. Write reports and forms as needed for the role
2. Interact with people
3. Make decisions
4. Work in a team and perform multitasking
5. Identify how to enable relative and critical thinking while performing tasks
6. Identify various aspects of personal grooming

UNIT 7.1: Writing Skills

Unit Objectives

At the end of this unit, you will be able to:

1. Write down problems on job sheet and details of work done
2. Make reports and fill forms

7.1.1. Writing Information in a Job Sheet

A job sheet is a document prepared by a senior at a workplace, typically a supervisor, for the technicians to fill each time they undertake a task (a job, such as fixing a hardware or installing a new device). Job sheets serve the purpose of storing records for later reference as well as act as a proof of the job completed along with the effectiveness and efficiency with which it was completed.

A job sheet has various fields/columns that correspond to the description of the job such as when was the job assigned, what is the customer name, address and phone number, is the product under warranty, was the job completed on time, who was assigned the job, customer signature and other such fields.

A technician needs to, therefore, possess certain writing skills to ensure that the documents are filled correctly and legitimately. The technician's handwriting needs to be clear and easily readable by the customers as well as the supervisors. Moreover, the technician should be able to read and then rightfully fill the information in the specific fields.

The following figure shows a sample of a job sheet that a field technician is required to fill for every job assigned to them:

Fig. 7.1.1: A sample job sheet

7.1.2. Filling Informa on in an Invoice

Though an invoice is generally system generated with a sale of a product, but some mes, a technician may be required to fill few fields in the invoice at customer site depending on the circumstances. For example, in case of a faulty part in a printer, a f ield technician may have to carry a new part to replace and the invoice sheet for that part. But the invoice will be filled with the details only if the faulty part is beyond repair and the customer agrees to pay for the new part.

The following figure shows a sample of an invoice that a field technician may be required to fill for a specific job assigned:

Invoice

ABC Company
XYZ city
9102993000
www.abc.domain.in

Name:
Address:
Phone:
Email:
City:
State:
Pin Code:

Product Description	Price	Quantity	Total

Authorised Signature   Customer Signature

Fig. 7.1.2: A sample invoice

7.1.3. Filling a Checklist

In addition to other forms, a technician may also need to adhere and fill a checklist for a specific job/task. In order to fill the checklist, the technician should be able to read it correctly and then fill correct responses based on the task completed. Typically, a checklist is usually a Yes or No format where a technician has to simply tick the columns/fields. But sometimes, there may be few fields for which the technician may need to write small sentences or statements.

The following figure shows a sample of a checklist that a field technician is required to fill some mes for a job, for example fixing a faulty hard drive:

Task	Daily	Weekly	Monthly	Quarterly	Half - Yearly	Yearly
Run Microsoft Update (critical update)						
Update antivirus scanner signature						
Run antivirus scan						
Run malware scanner						
Vacuum the system exterior						
Scan/clean/compact registry						
Defrag hard drive						
Run scandisk on your drives						
Full system back up						
Check for optical drive firmware updates						
Check for video adapter updates						
Refresh achieve backups						
Check for motherboard BIOS updates						
Clean system thoroughly, inside and out						

Fig. 7.1.3: A sample checklist

UNIT 7.2: Interac ng with People

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the basic communica on skills
2. Define listening, communica on, cri cal thinking and decision making
3. Iden fy cri cal thinking skills
4. Recognize factors that limit decision making skills

7.2.1 Listening

No ma er where a technician may be, whether in field or in the organiza on, one does not only want to be heard but, wants to be truly be understood. Therefore, ac ve listening plays a vital role while interac ng with people. This skill can be developed with prac ce and pa ence.

What is Listening?

In a layman's term, listening means paying a en on. It means full concentra on, engagement in and absorp on of what the other person is trying to convey. It includes expressing and giving responses by:

Shaking the head (expressing denial/no)

Nodding the head (expressing agreement/yes)

Asking ques ons to clarify

Making/maintaining eye contact

Fig. 7.2.1: Way of expressing and giving response to show ac ve listening

Why is Listening Important?

In filed, working with customer, supervisors and colleagues, there are three major reasons as to why listening is essen al.

The following figure lists these three major reasons:

Shows respect for colleagues and earn their trust

- Given the amount of pressure and stress at a workplace, people like to have understanding and suppor ve colleagues.
- A person's value increases when they show understanding and reach out.

Helps understand issues and provide solu ons

- An ac ve listener gains a be er insight to any of the colleague's concerns.
- A deeper understanding to problem results in providing be er and accurate solu ons.

Helps to di use conflict

- A workplace loaded with ideas is subject to conflict of interests.
- A person's openness to opinions and di erent percep ons revolving around a situa on help in di usion of conflicts.

Fig. 7.2.2: Importance of listening

How Does Listening Improve Workplace Performance?

One can no ce benefits if there is emphasis laid on e ec ve listening at work. It results in be er produc vity, mely achievement of goals and a be er coordina on between employees. The following figure lists factors that help in improving a workplace performance:

Reduces Conflicts	Reflects Caring A tude	Increases Working Rate	Decreases Duplica on of E orts
• People if not heard tend to look for other opportuni es because it builds resentment. • A good listener always helps his colleagues to reduce communica on gap.	• Employees react to the open door policy in a posi ve manner. • Employees are aware that they will be heard and the issues will be resolved with a best solu on.	• When employees listen e ec vely, the tasks are accomplished before me and the pace of work is much faster. • This step helps in maintaining focus and clarity towards the task.	• Good listeners tend to make less mistakes while working leading to higher produc vity. • For someone who is not an efec ve listener, the produc vity is slow due to less comprehension.

Fig. 7.2.3: Factors that help in improving a workplace performance

7.2.2 Communica on

Communica on means sending/receiving informa on by wri ng or speaking. There are a lot of technicians who o en struggle in communica ng.

When on a visit to a customer's site, to ensure good service, the customer's requirement should be understood and a solu on should be suggested.

The following figure represents the points to be taken care of while communica ng with a customer:
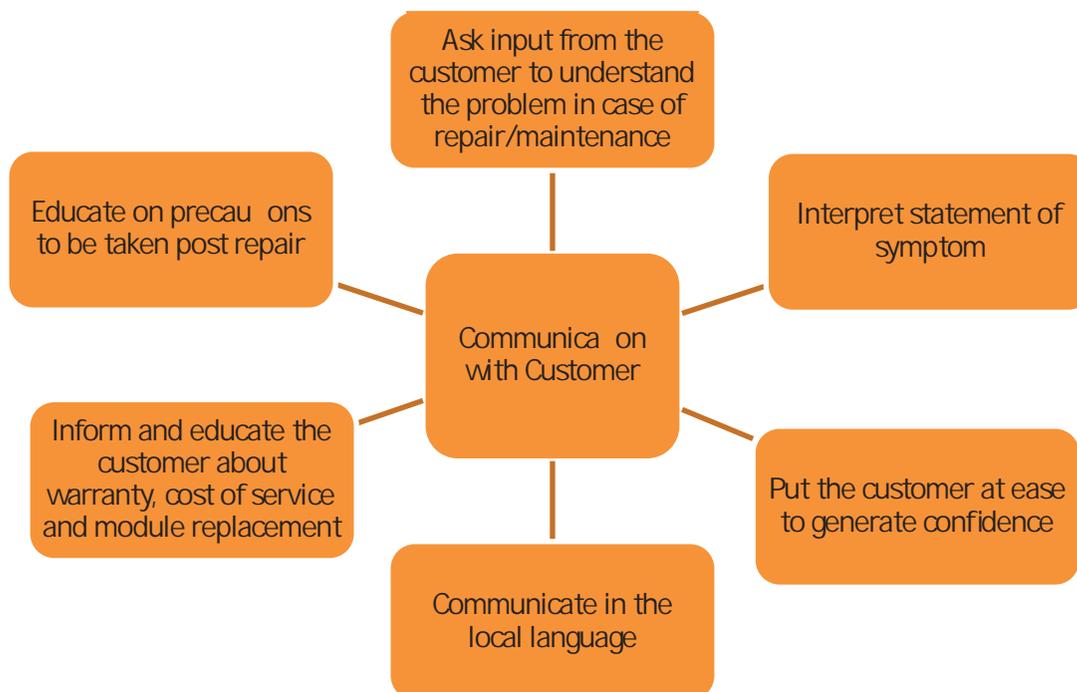
Fig 7.2 4: Communica ng with a customer

There may be instances during a conflict where people may lose their temper. It is important for a person to control anger at all mes as anger leads to mistakes. The following figure lists a few points to communicate when angry:

Fig. 7.2 5: Steps to communicate when angry

In case a person is very angry, it is advisable to 'stop' and step back to breathe. Take a few minutes to calm down. Once the anger subsides, try to 'think' and figure what the real problem was and where/how the situa on worsened? Finally, go ahead and 'talk' to the concerned person. A er talking, 'listen' carefully about what the other person say what they feel.

UNIT 7.3: Decision Making

Unit Objec ves

At the end of this unit, you will be able to:

1. Make on-spot decisions on field
2. Decide whether to call customer care

7.3.1. Making Decisions in the Field

The ability to choose the best between mul ple courses of ac on is called decision making. Decision making involves using either a person's intui on or reasoning, or both. Deciding upon something using your 'gut-feeling' is intui on.

At your workplace or in the field, intui on typically involves a person making decisions on the basis of prior work experience, values or both. Reasoning involves using factual data to interpret situa ons and take a final decision. Emo onal aspects are usually ignored while making such decisions.

Numerous issues can limit a person from taking the right decision. The following figure explains the factors responsible for this:

Not enough informa on	• It is highly unlikely, that a person can take the right decision without adequate amount of informa on.
Too much informa on	• Having too much informa on tends to confuse the person which leads to taking a wrong decision. Filtering important informa on is necessary.
Too many people	• O en, decision making in a group is di cult as it involves varied perspec ves and ideas. Some mes, taking the most suitable decison is be er than taking none.
Vested interests	• Such interests can be a hinderance to as iden fying and addressing them is di cult.
Emo onal a achment	• Many people, who are a ached to their status quo are most o en the ones who find it di cult to take a decion in case of prospect of change.

Fig. 7.3.1: Factors that limit decision making

7.3.2. Points to Consider for Decision Making

While making decisions in the field, you need to consider the points listed in the following figure:

| What decision needs to be taken | What are the choices and risks involved | Compare the choices and evaluate the op ons | Select the best possible op on | Implement the deciosn and check the results |

Fig. 7.3.2: Points to be considered for decision making

When making important decisions related to work, a field technician needs to ask the following ques ons and the answers to these ques ons would help make the correct decision at the right me:

- What decision needs to be taken? Is it a spontaneous decision, can it be made at a technician level and is it absolutely necessary to make the decision immediately?
- What are the choices and risks involved? Analyse the risks that are involved if the technician does make a decision and implements it in the field. If the risks are too high, it is best to avoid making the decision. Then, analyse all the choices and the least risk involved in the best choice.
- What is the best choice? Compare the choices and evaluate the op ons to arrive at the best choice.
- Which seems to be the best possible choice for the current situa on in the given me frame? Select the best possible op on based on the circumstances and me.
- Will the results be as expected? Implement the decision and check the results.

UNIT 7.4: Team Work and Multitasking

Unit Objectives

At the end of this unit, you will be able to:

1. Identify essential aspects of working in a team
2. Share work load as required
3. Achieve the targets given on service and sales

7.4.1. Working in a Team

A field technician needs to be able to work in a team. To work in a team, a technician should be able to get along with fellow technicians, respect others and show a cooperative behaviour always.

Working in and as a team enables some positive aspects as listed in the following figure:

A supervisors trust in the technicians to ensure that tasks are completed as expected

Technicians who are always ready to help others in time of need

Entire team sharing the same vision for their work

Using others stregth to overcome own weaknesses

Good support for each other and positive manner of working

Always lsitening to others' suggestions and requests and knowing that one will be heard

Moving in the same direction together for accomplishing a task

Fig. 7.4.1: Points to be considered for decision making

To make teamwork e ec ve at workplace, the following points need to be considered:

Collabora on

Resolving
Conflicts

Owning Roles &
Responsibili es

Varied Views

Ac ve
Par cipa on

Two-way
Communica on

Common Goal
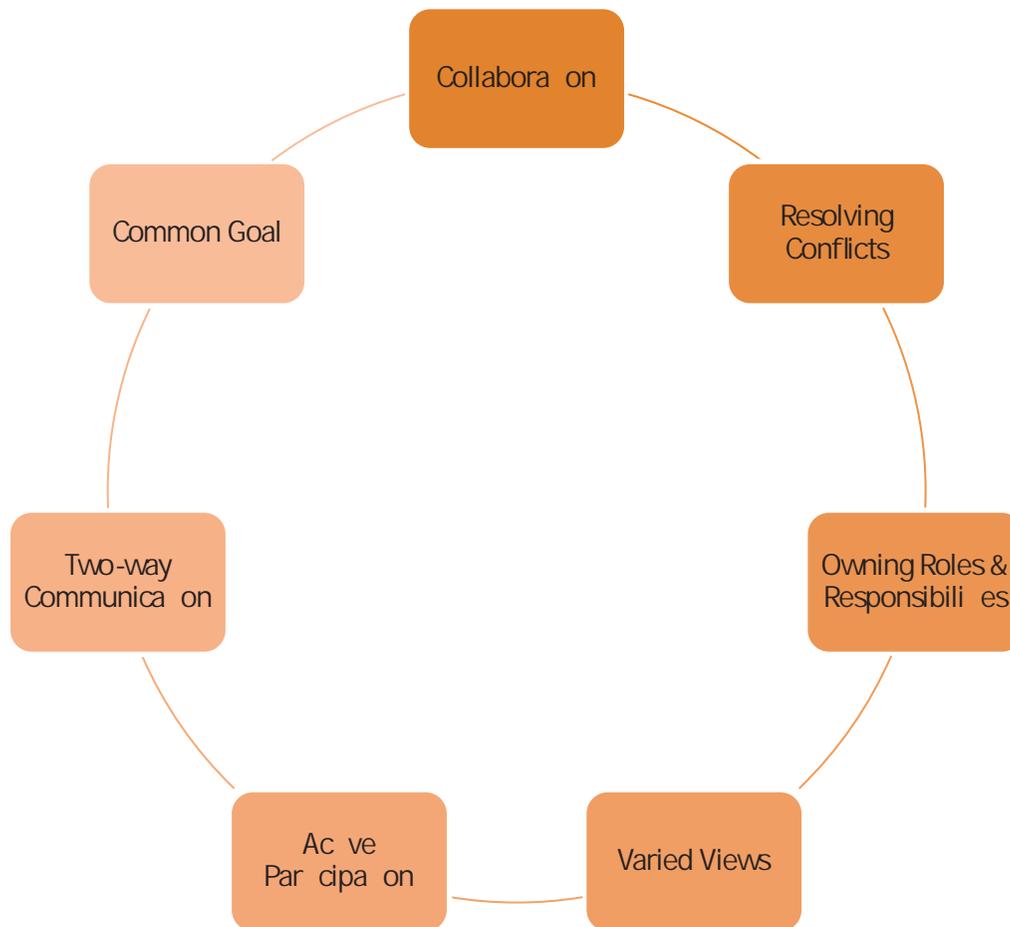
Fig. 7.4.2: Points to be considered for e ec ve teamwork

UNIT 7.5: Rela ve and Cri cal Thinking

Unit Objec ves

At the end of this unit, you will be able to:

1. Use cri cal thinking to improve work processes
2. Reduce repe on of errors
3. Spot process disrup ons and delays
4. Report on any customer concerns to superiors without delay

7.5.1. Improving Work Processes using Cri cal Thinking

Another important skill that a field technician should possess is cri cal thinking. Cri cal listening allows a person to make cri cal decisions and enables a person to judge the situa on while the speaker is talking.

Cri cal thinking is defined as a person's ability to make logical decisions in a par cular situa on, keeping all the emo ons aside. This enables a technician to:

- Collect informa on for analysis of a situa on
- Generate ample solu ons to resolve a problem
- Get feedback
- Add value to business solu ons

Rela ve thinking, on the other hand, is thinking about tasks or decisions in rela ve terms which results in realis c comparisons and achievable tasks.

As a field technician, cri cal thinking helps a person to run across many possible to solu ons to a situa on, analyse through it, and come up with the best possible solu on. The following figure lists the benefits of cri cal thinking:
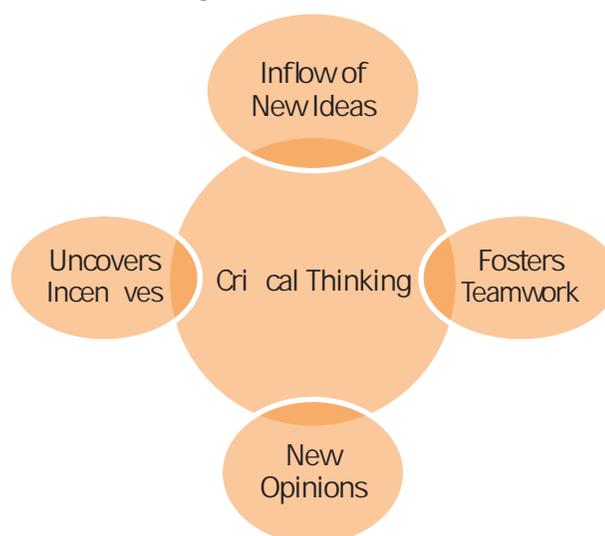
Fig. 7.5.1: Benefits of cri cal thinking

Critical thinking can be divided into three fundamental skills. The following figure lists these skills:

Critical Thinking Skills

- Curiosity
- Skepticism
- Humility
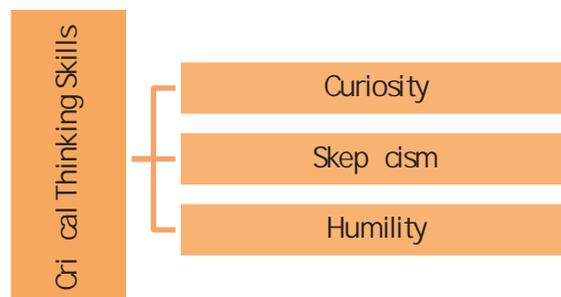
Fig. 7.5.2: Critical thinking skills

Curiosity is the hope of learning and garnering more information/knowledge as well as looking for evidence, and welcoming new ideas. Scepticism includes not believing everything that a person comes across and putting questions to get convinced fully. Humility involves acceptance if a person's idea gets rejected or is not considered suitable. At the same time, the person is willing to look up to new ideas.

The following figure lists other skills which are essential for critical thinking:

Transforming Knowledge

Predicting

Analyzing

Skills

Logical Reasoning

Applying Standards

Seeking Information

Discriminating

Fig. 7.5.3: Other critical thinking skills

UNIT 7.6: Personal Grooming

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the importance of personal grooming
2. Use proper e que e during customer interac on

7.6.1. Importance of Personal Grooming

Apart from having technical knowledge, it is important for a field technician to develop some basic personality traits and skills, such as personal grooming.

Being well groomed at workplace reflects a posi ve and professional a tude towards work. The following figure includes aspects of personal grooming:

Fig. 7.6.1: Aspects of grooming

The following figure lists few of the good prac ces classified under di erent aspects of grooming:

Dressing	Personal Hygiene	Workplace E que e
Clothes should be neat and clean.	Hair should be neatly combed and trimmed.	Smile and greet the customer.
Clothes should be ironed.	Nails and hair should be cut.	Be punctual.
If a company has a uniform, it should be worn.	Teeth should be clean.	Apologize on making a mistake.
	Bath should be taken everyday. Body odor and swea ng should be taken care of.	Be polite.
		Be careful of body language.

Fig. 7.6.2: A few of the good prac ces for grooming

A field technician needs to possess the following quality to ensure that they excel in their job:

Fig. 7.6.3: A few qualities that a field technician must possess

Ac vity: Group Discussion

Get together in groups of three or four.

List down at least three things related to grooming which you should do and which you should avoid while on a visit to a customer's site.

Use the following table to make the list.

	Dressing	Personal Hygiene	E que e
To Do			
To Avoid			

8. Employability & Entrepreneurship Skills

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain the meaning of health
2. List common health issues
3. Discuss ps to prevent common health issues
4. Explain the meaning of hygiene
5. Discuss the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss cri cal safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Discuss mo va on with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement mo va on
12. List the characteris cs of entrepreneurs with achievement mo va on
13. List the di erent factors that mo vate you
14. Discuss the role of a tude in self-analysis
15. Discuss how to maintain a posi ve a tude
16. List your strengths and weaknesses
17. Discuss the quali es of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteris cs of highly crea ve people
22. List the characteris cs of highly innova ve people
23. Discuss the benefits of me management
24. List the traits of e ec ve me managers
25. Describe e ec ve me management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss ps for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss ps for stress management
32. Iden fy the basic parts of a computer
33. Iden fy the basic parts of a keyboard
34. Recall basic computer terminology
35. Recall the func ons of basic computer keys
36. Discuss the main applica ons of MS O ce
37. Discuss the benefits of Microso Outlook
38. Discuss the di erent types of e-commerce
39. List the benefits of e-commerce for retailers and customers
40. Discuss how the Digital India campaign will help boost e-commerce in India

41.   Describe how you will sell a product or service on an e-commerce pla orm
42.   Discuss the importance of saving money
43.   Discuss the benefits of saving money
44.   Discuss the main types of bank accounts
45.   Describe the process of opening a bank account
46.   Di eren ate between fixed and variable costs
47.   Describe the main types of investment op ons
48.   Describe the di erent types of insurance products
49.   Describe the di erent types of taxes
50.   Discuss the uses of online banking
51.   Discuss the main types of electronic funds transfers
52.   Discuss the steps to prepare for an interview
53.   Discuss the steps to create an e ec ve Resume
54.   Discuss the most frequently asked interview ques ons
55.   Discuss how to answer the most frequently asked interview ques ons
56.   Discuss basic workplace terminology
57.   Discuss the concept of entrepreneurship
58.   Discuss the importance of entrepreneurship
59.   Describe the characteris cs of an entrepreneur
60.   Describe the di erent types of enterprises
61.   List the quali es of an e ec ve leader
62.   Discuss the benefits of e ec ve leadership
63.   List the traits of an e ec ve team
64.   Discuss the importance of listening e ec vely
65.   Discuss how to listen e ec vely
66.   Discuss the importance of speaking e ec vely
67.   Discuss how to speak e ec vely
68.   Discuss how to solve problems
69.   List important problem-solving traits
70.   Discuss ways to assess problem solving skills
71.   Discuss the importance of nego a on
72.   Discuss how to nego ate
73.   Discuss how to iden fy new business opportuni es
74.   Discuss how to iden fy business opportuni es within your business
75.   Explain the meaning of entrepreneur
76.   Describe the di erent types of entrepreneurs
77.   List the characteris cs of entrepreneurs
78.   Recall entrepreneur success stories
79.   Discuss the entrepreneurial process
80.   Describe the entrepreneurship ecosystem
81.   Discuss the purpose of the Make in India campaign
82.   Discuss key schemes to promote entrepreneurs

83.   Discuss the rela onship between entrepreneurship and risk appe te
84.   Discuss the rela onship between entrepreneurship and resilience
85.   Describe the characteris cs of a resilient entrepreneur
86.   Discuss how to deal with failure
87.   Discuss how market research is carried out
88.   Describe the 4 Ps of marke ng
89.   Discuss the importance of idea genera on
90.   Recall basic business terminology
91.   Discuss the need for CRM
92.   Discuss the benefits of CRM
93.   Discuss the need for networking
94.   Discuss the benefits of networking
95.   Discuss the importance of se ng goals
96.   Di eren ate between short -term, medium-term and long-term goals
97.   Discuss how to write a business plan
98.   Explain the financial planning process
99.   Discuss ways to manage your risk
100. Describe the procedure and formali es for applying for bank finance
101. Discuss how to manage your own enterprise
102. List important ques ons that every entrepreneur should ask before star ng an enterprise

UNIT 8.1: Personal Strengths & Value Systems

Unit Objectives 🎯

At the end of this unit, participant will be able to:

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Discuss the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Discuss motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss the role of attitude in self-analysis
15. Discuss how to maintain a positive attitude
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management

8.1.1 Health, Habits, Hygiene: What is Health?

As per the World Health Organiza on (WHO), health is a "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." This means being healthy does not simply mean not being unhealthy – it also means you need to be at peace emo onally and feel fit physically. For example, you cannot say you are healthy simply because you do not have any physical ailments like a cold or cough. You also need to think about whether you are feeling calm, relaxed and happy.

Common Health Issues

Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- Cough, Cold, Sore Throat
- Di culty Sleeping
- Obesity

8.1.1.1 Tips to Prevent Health Issues

Taking measures to prevent ill health is always be er than curing a disease or sickness. You can stay healthy by:

- Ea ng healthy foods like fruits, vegetables and nuts
- Cu ng back on unhealthy and sugary foods
- Drinking enough water everyday
- Not smoking or drinking alcohol
- Exercising for at least 30 minutes a day, 4 -5 mes a week
- Taking vaccina ons when required
- Prac cing yoga exercises and medita on

How many of these health standards do you follow? Tick the ones that apply to you.

1. Get minimum 7-8 hours of sleep every night. ☐

2. Avoid checking email first thing in the morning and right before you go to bed at night. ☐

3. Don't skip meals – eat regular meals at correct meal times. ☐

4. Read a little bit every single day. ☐

5. Eat more home cooked food than junk food. ☐

6. Stand more than you sit. ☐

7. Drink a glass of water first thing in the morning and have at least 8 glasses of water through the day. ☐

8. Go to the doctor and dentist for regular check-ups. ☐

9. Exercise for 30 minutes at least 5 days a week. ☐

10. Avoid consuming lots of aerated beverages. ☐

8.1.1.2 What is Hygiene?

As per the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." In other words, hygiene means ensuring that you do whatever is required to keep your surroundings clean, so that you reduce the chances of spreading germs and diseases.

For instance, think about the kitchen in your home. Good hygiene means ensuring that the kitchen is always spick and span, the food is put away, dishes are washed, and dustbins are not overflowing with garbage. Doing all this will reduce the chances of attracting pests like rats or cockroaches, and prevent the growth of fungus and other bacteria, which could spread disease.

How many of these health standards do you follow? Tick the ones that apply to you.

1. Have a bath or shower every day with soap – and wash your hair with shampoo 2-3 mes a week. ☐

2. Wear a fresh pair of clean undergarments every day. ☐

3. Brush your teeth in the morning and before going to bed. ☐

4. Cut your fingernails and toenails regularly. ☐

5. Wash your hands with soap a er going to the toilet. ☐

6. Use an an -perspirant deodorant on your underarms if you sweat a lot. ☐

7. Wash your hands with soap before cooking or ea ng. ☐

8. Stay home when you are sick, so other people don't catch what you have. ☐

9. Wash dirty clothes with laundry soap before wearing them again. ☐

10. Cover your nose with a ssue/your hand when coughing or sneezing. ☐

See how healthy and hygienic you are, by giving yourself 1 point for every cked statement! Then take a look at what your score means.

Your Score
- 0-7/20: You need to work a lot harder to stay fit and fine! Make it a point to prac ce good habits daily and see how much be er you feel!
- 7-14/20: Not bad, but there is scope for improvement! Try and add a few more good habits to your daily rou ne.
- 14-20/20: Great job! Keep up the good work! Your body and mind thank you!

8.1.1.3 Swachh Bharat Abhiyan

We have already discussed the importance of following good hygiene and health prac ces for ourselves. But, it is not enough for us to be healthy and hygienic. We must also extend this standard to our homes, our immediate surroundings and to our country as a whole.

The 'Swachh Bharat Abhiyan' (Clean India Mission) launched by Prime Minister Shri Narendra Modi on 2nd October 2014, believes in doing exactly this. The aim of this mission is to clean the streets and roads of India and raise the overall level of cleanliness. Currently this mission covers 4,041 ci es and towns across the country. Millions of our people have taken the pledge for a clean India. You should take the pledge too, and do everything possible to keep our country clean!

8.1.1.4 What are Habits?

A habit is a behaviour that is repeated frequently. All of us have good habits and bad habits. Keep in mind the phrase by John Dryden: "We first make our habits, and then our habits make us." This is why it is so important that you make good habits a way of life, and consciously avoid practicing bad habits.

Some good habits that you should make part of your daily routine are:

- Always having a positive attitude
- Making exercise a part of your daily routine
- Reading motivational and inspirational stories
- Smiling! Make it a habit to smile as often as possible
- Making time for family and friends
- Going to bed early and waking up early

Some bad habits that you should quit immediately are:

- Skipping breakfast
- Snacking frequently even when you are not hungry
- Eating too much fattening and sugary food
- Smoking, drinking alcohol and doing drugs
- Spending more money than you can afford
- Worrying about unimportant issues
- Staying up late and waking up late

Tips

- Following healthy and hygienic practices every day will make you feel good mentally and physically.
- Hygiene is two-thirds of health – so good hygiene will help you stay strong and healthy!

8.1.2: Safety: Tips to Design a Safe Workplace

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Use ergonomically designed furniture and equipment to avoid stooping and twisting
- Provide mechanical aids to avoid lifting or carrying heavy objects
- Have protective equipment on hand for hazardous jobs
- Designate emergency exits and ensure they are easily accessible
- Set down health codes and ensure they are implemented
- Follow the practice of regular safety inspections in and around the workplace
- Ensure regular building inspections are conducted
- Get expert advice on workplace safety and follow it

8.1.2.1 Nego able Employee Safety Habits

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When se ng up a business, owners must make it a point to:

- Immediately report unsafe condi ons to a supervisor
- Recognize and report safety hazards that could lead to slips, trips and falls
- Report all injuries and accidents to a supervisor
- Wear the correct protec ve equipment when required
- Learn how to correctly use equipment provided for safety purposes
- Be aware of and avoid ac ons that could endanger other people
- Take rest breaks during the day and some me o from work during the week

Tips

- Be aware of what emergency number to call at the me of a workplace emergency
- Prac ce evacua on drills regularly to avoid chao c evacua ons

8.1.3 Self Analysis – A tude, Achievement Mo va on

To truly achieve your full poten al, you need to take a deep look inside yourself and find out what kind of person you really are. This a empt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to iden fy areas within yourself that need to be further developed, changed or eliminated. You can be er understand yourself by taking a deep look at what mo vates you, what your a tude is like, and what your strengths and weaknesses are.

8.1.3.1 What is Mo va on?

Very simply put, mo va on is your reason for ac ng or behaving in a certain manner. It is important to understand that not everyone is mo vated by the same desires – people are mo vated by many, many di erent things. We can understand this be er by looking at Maslow's Hierarchy of Needs.

8.1.3.2 Maslow's Hierarchy of Needs

Famous American psychologist Abraham Maslow wanted to understand what mo vates people. He believed that people have five types of needs, ranging from very basic needs (called physiological needs) to more important needs that are required for self -growth (called self-actualiza on needs). Between the physiological and self-actualiza on needs are three other needs – safety needs, belongingness and love needs, and esteem needs.

These needs are usually shown as a pyramid with five levels and are known as Maslow's Hierarchy of Needs.
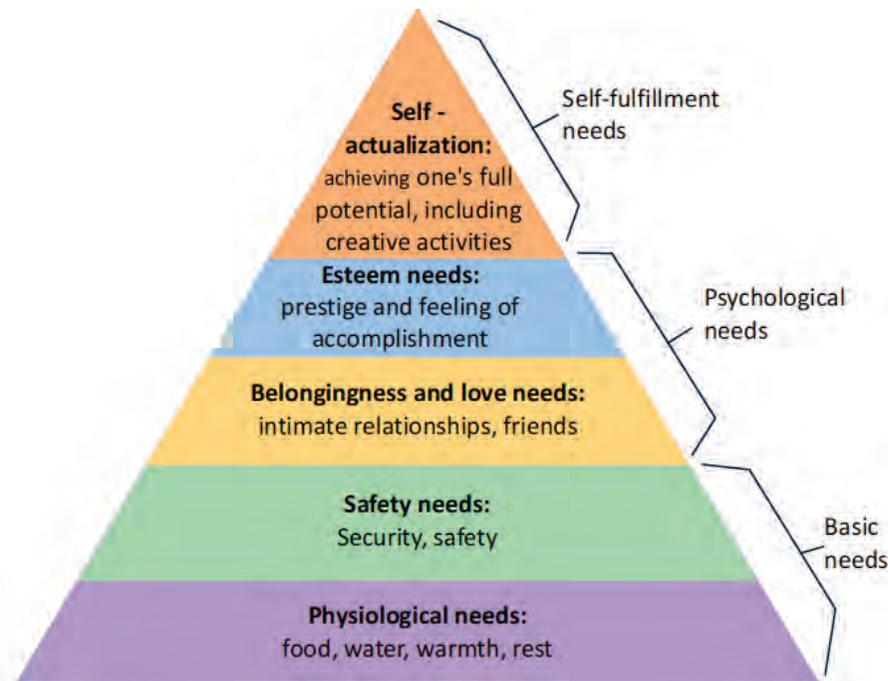
Fig. 8.1.1: Maslow's Hierarchy of Needs

The lowest level depicts the most basic needs. According to Maslow, our behaviour is driven by our basic needs, un l those needs are fulfilled. Once they are fulfilled, we move to the next level and are mo ved by the next level of needs. Let's understand this be er with an example.

Rupa comes from a very poor family. She never has enough food, water, warmth or rest. According to Maslow, un l Rupa is sure that she will get these b asic needs, she will not even think about the next level of needs – her safety needs. But, once Rupa is confident that her basic needs will be met, she will move to the next level, and her behaviour will then be mo vated by her need for security and safety. Once these new needs are met, Rupa will once again move to the next level, and be mo vated by her need for rela onships and friends. Once this need is sa sfied, Rupa will then focus on the fourth level of needs – her esteem needs, a er which she will move up to the fi h and last level of needs – the desire to achieve her full poten al.

8.1.3.3 Understanding Achievement Mo va on

We now know that people are mo vated by basic, psychological and self -fulfillment needs. However, certain people are also mo vated by the achievement of highly challenging accomplishments. This is known as Achievement Mo va on, or 'need for achievement'.

The level of mo va on achievement in a person di ers from individual to individual. It is important that entrepreneurs have a high level of achievement mo va on – a deep desire to accomplish something important and unique. It is equally important that they hire people who are also highly mo vated by challenges and success.

What Mo vates You?

What are the things that really mo vate you? List down five things that really mo vate you. Remember to answer honestly!

I am mo vated by:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Characteris cs of Entrepreneurs with Achievement Mo va on

Entrepreneurs with achievement mo va on can be described as follows:

- Unafraid to take risks for personal accomplishment
- Love being challenged Future-oriented Flexible and adap ve
- Value nega ve feedback more than posi ve feedback
- Very persistent when it comes to achieving goals
- Extremely courageous
- Highly crea ve and innova ve
- Restless - constantly looking to achieve more
- Feel personally responsible for solving problems

Think about it:

- How many of these traits do you have?
- Can you think of entrepreneurs who display these traits?

8.1.3.4 How to Cul vate a Posi ve A tude?

The good news is a tude is a choice. So, it is possible to improve, control and change our a tude, if we decide we want to!

The following ps help foster a posi ve mindset:

- Remember that you control your a tude, not the other way around
- Devote at least 15 minutes a day towards reading, watching or listening to something posi ve
- Avoid nega ve people who only complain and stop complaining yourself
- Expand your vocabulary with posi ve words and delete nega ve phrases from your mind
- Be apprecia ve and focus on what's good in yourself, in your life, and in others
- Stop thinking of yourself as a vic m and start being proac ve
- Imagine yourself succeeding and achieving your goals

8.1.3.5 What is A tude?

Now that we understand why mo va on is so important for self-analysis, let's look at the role our a tude plays in be er understanding ourselves. A tude can be described as your tendency (posi ve or nega ve), to think and feel about someone or some thing. A tude is the founda on for success in every aspect of life. Our a tude can be our best friend or our worst enemy. In other words:

" The only disability in life is a bad a tude."

When you start a business, you are sure to encounter a wide variety of emo ons, from di cult mes and failures to good mes and successes. Your a tude is what will see you through the tough mes and guide you towards success. A tude is also infec ous. It a ects everyone around you, from your customers to your employees to your investors. A posi ve a tude helps build confidence in the workplace while a nega ve a tude is likely to result in the demo va on of your people.

8.1.3.6 What Are Your Strengths and Weaknesses?

Another way to analyse yourself is by honestly iden fying your strengths and weaknesses. This will help you use your strengths to your best advantage and reduce your weaknesses. Note down all your strengths and weaknesses in the two columns below. Remember to be honest with yourself!

Strengths	Weaknesses

Tips

- Achievement motivation can be learned.
- Don't be afraid to make mistakes.
- Train yourself to finish what you start.
- Dream big.

8.1.4 Honesty & Work Ethics: What is Honesty?

Honesty is the quality of being fair and truthful. It means speaking and acting in a manner that inspires trust. A person who is described as honest is seen as truthful and sincere, and as someone who isn't deceitful or devious and doesn't steal or cheat. There are two dimensions of honesty – one is honesty in communication and the other is honesty in conduct.

Honesty is an extremely important trait because it results in peace of mind and builds relationships that are based on trust. Being dishonest, on the other hand, results in anxiety and leads to relationships full of distrust and conflict.

8.1.4.1 Qualities of Honest People

Honest individuals have certain distinct characteristics. Some common qualities among honest people are:

- They don't worry about what others think of them. They believe in being themselves – they don't bother about whether they are liked or disliked for their personalities.
- They stand up for their beliefs. They won't think twice about giving their honest opinion, even if they are aware that their point of view lies with the minority.
- They are think skinned. This means they are not affected by others judging them harshly for their honest opinions.
- They forge trusting, meaningful and healthy friendships. Honest people usually surround themselves with honest friends. They have faith that their friends will be truthful and upfront with them at all times.

They are trusted by their peers. They are seen as people who can be counted on for truthful and objective feedback and advice.

- Honesty and employees: When entrepreneurs build honest relationships with their employees, it leads to more transparency in the workplace, which results in higher work performance and better results.
- Honesty and investors: For entrepreneurs, being honest with investors means not only sharing strengths but also candidly disclosing current and potential weaknesses, problem areas and solution strategies. Keep in mind that investors have a lot of experience with startups and are aware that all new companies have problems. Claiming that everything is perfectly fine and running smoothly is a red flag for most investors.

- Honesty with oneself: The consequences of being dishonest with oneself can lead to dire results, especially in the case of entrepreneurs. For entrepreneurs to succeed, it is critical that they remain realistic about their situation at all times, and accurately judge every aspect of their enterprise for what it truly is.

8.1.4.2 Importance of Honesty in Entrepreneurs

One of the most important characteristics of entrepreneurs is honesty. When entrepreneurs are honest with their customers, employees and investors, it shows that they respect those that they work with. It is also important that entrepreneurs remain honest with themselves.

Let's look at how being honest would lead to great benefits for entrepreneurs.

- Honesty and customers: When entrepreneurs are honest with their customers it leads to stronger relationships, which in turn results in business growth and a stronger customer network.

8.1.4.3 What are Work Ethics?

Being ethical in the workplace means displaying values like honesty, integrity and respect in all your decisions and communications. It means not displaying negative qualities like lying, cheating and stealing.

Workplace ethics play a big role in the profitability of a company. It is as crucial to an enterprise as high morale and teamwork. This is why most companies lay down specific workplace ethic guidelines that must compulsorily be followed by their employees. These guidelines are typically outlined in a company's employee handbook.

8.1.4.4 Elements of a Strong Work Ethic

An entrepreneur must display strong work ethics, as well as hire only those individuals who believe in and display the same level of ethical behavior in the workplace. Some elements of a strong work ethic are:

- Professionalism: This involves everything from how you present yourself in a corporate setting to the manner in which you treat others in the workplace.
- Respectfulness: This means remaining poised and diplomatic regardless of how stressful or volatile a situation is.
- Dependability: This means always keeping your word, whether it's arriving on time for a meeting or delivering work on time.
- Dedication: This means refusing to quit until the designated work is done, and completing the work at the highest possible level of excellence.
- Determination: This means embracing obstacles as challenges rather than letting them stop you, and pushing ahead with purpose and resilience to get the desired results.

- Accountability: This means taking responsibility for your ac ons and the consequences of your ac ons, and not making excuses for your mistakes.
- Humility: This means acknowledging everyone's e orts and had work, and sharing the credit for accomplishments.

8.1.4.5 How to Foster a Good Work Ethic?

As an entrepreneur, it is important that you clearly define the kind of behaviour that you expect from each and every team member in the workplace. You should make it clear that you expect employees to display posi ve work ethics like:

- Honesty: All work assigned to a person should be done with complete honesty, without any deceit or lies.
- Good a tude: All team members should be op mis c, energe c, and posi ve.
- Reliability: Employees should show up where they are supposed to be, when they are supposed to be there.
- Good work habits: Employees should always be well groomed, never use inappropriate language, conduct themselves professionally at all mes and so on.
- Ini a ve: Doing the bare minimum is not enough. Every team member needs to be proac ve and show ini a ve.
- Trustworthiness: Trust is non-nego able. If an employee cannot be trusted, it's me to let that employee go.
- Respect: Employees need to respect the company, the law, their work, their colleagues and themselves.
- Integrity: Each and every team member should be completely ethical and must display above board behaviour at all mes.
- E ciency: E cient employees help a company grow while ine cient employees result in a waste of me and resources.

Tips

- Don't get angry when someone tells you the truth and you don't like what you hear.
- Always be willing to accept responsibility for your mistakes.

8.1.5 Crea vity & Innova on

What is Crea vity?

Crea vity means thinking outside the box. It means viewing things in new ways or from di erent perspec ves, and then conver ng these ideas into reality. Crea vity involves two parts: thinking and producing. Simply having an idea makes you imagina ve, not crea ve. However, having an idea and ac ng on it makes you crea ve.

Characteris cs of Highly Crea ve People

Some characteris cs of crea ve people are:

- They are imagina ve and playful
- They see issues from di erent angles
- They no ce small details
- They have very li le tolerance for boredom
- They detest rules and rou ne
- They love to daydream
- They are very curious

What is Innova on?

There are many di erent defini ons of innova on. In simple terms, innova on means turning an idea into a solu on that adds value. It can also mean adding value by implemen ng a new product, service or process, or significantly improving on an exis ng product, service or process.

Characteris cs of Highly Innova ve People

Some characteris cs of highly innova ve people are:

- They embrace doing things di erently
- They don't believe in taking shortcuts
- They are not afraid to be unconven onal
- They are highly proac ve and persistent
- They are organized, cau ous and risk-averse

Tips

- Take regular breaks from your crea ve work to recharge yourself and gain fresh perspec ve.
- Build prototypes frequently, test them out, get feed back, and make the required changes.

8.1.6 Time Management

Time management is the process organizing your me, and deciding how to allocate your me between di erent ac vi es. Good me management is the di erence between working smart (ge ng more done in less me) and working hard (working for more me to get more done).

E ec ve me management leads to an e cient work output, even when you are faced with ght deadlines and high pressure situa ons. On the other hand, not managing your me e ec vely results in ine cient output and increases stress and anxiety.

Benefits of Time Management

Time management can lead to huge benefits like:

- Greater produc vity
- Higher e ciency
- Be er professional reputa on
- Reduced stress
- Higher chances for career advancement
- Greater opportuni es to achieve goals

Not managing me e ec vely can result in undesirable consequences like:

- Missing deadlines
- Ine cient work output
- Substandard work quality
- Poor professional reputa on
- Stalled career
- Increase in stress and anxiety

8.1.6.1 Traits of E ec ve Time Managers

Some traits of e ec ve me managers are:
- They begin projects early
- They set daily objec ves
- They modify plans if required, to achieve be er results
- They are flexible and open-minded
- They inform people in advance if their help will be required
- They know how to say no
- They break tasks into steps with specific deadlines
- They con nually review long term goals
- They think of alternate solu ons if and when required
- They ask for help when required
- They create backup plans

8.1.6.2 Effective Time Management Techniques

You can manage your time better by putting into practice certain time management techniques. Some helpful tips are:

- Plan out your day as well as plan for interruptions. Give yourself at least 30 minutes to figure out your time plan. In your plan, schedule some time for interruptions.
- Put up a "Do Not Disturb" sign when you absolutely have to complete a certain amount of work.
- Close your mind to all distractions. Train yourself to ignore ringing phones, don't reply to chat messages and disconnect from social media sites.
- Delegate your work. This will not only help your work get done faster, but will also show you the unique skills and abilities of those around you.
- Stop procrastinating. Remind yourself that procrastination typically arises due to the fear of failure or the belief that you cannot do things as perfectly as you wish to do them.
- Prioritize. List each task to be completed in order of its urgency or importance level. Then focus on completing each task, one by one.
- Maintain a log of your work activities. Analyse the log to help you understand how efficient you are, and how much time is wasted every day.
- Create time management goals to reduce time wastage.

Tips

- Always complete the most important tasks first.
- Get at least 7 – 8 hours of sleep every day.
- Start your day early.
- Don't waste too much time on small, unimportant details.
- Set a time limit for every task that you will undertake.
- Give yourself some time to unwind between tasks.

8.1.7 Anger Management

Anger management is the process of:

1. Learning to recognize the signs that you, or someone else, is becoming angry
2. Taking the best course of action to calm down the situation in a positive way

Anger management does not mean suppressing anger.

Importance of Anger Management

Anger is a perfectly normal human emotion. In fact, when managed the right way, anger can be considered a healthy emotion. However, if it is not kept in check, anger can make us act inappropriately and can lead to us saying or doing things that we will likely later regret.

Extreme anger can:

- Hurt you physically: It leads to heart disease, diabetes, a weakened immune system, insomnia, and high blood pressure.
- Hurt you mentally: It can cloud your thinking and lead to stress, depression and mental health issues.
- Hurt your career: It can result in aliena ng your colleagues, bosses, clients and lead to the loss of respect.
- Hurt your rela onships: It makes it hard for your family and friends to trust you, be honest with you and feel comfortable around you.

This is why anger management, or managing anger appropriately, is so important.

8.1.7.1 Anger Management Strategies

Here are some strategies that can help you control your anger:

Strategy 1: Relaxa on

Something as simple as breathing deeply and looking at relaxing images works wonders in calming down angry feelings. Try this simple breathing exercise:

1. Take a deep breath from your diaphragm (don't breathe from your chest)
2. Visualize your breath coming up from your stomach
3. Keep repea ng a calming word like 'relax' or 'take it easy' (remember to keep breathing deeply while repea ng the word)
4. Picture a relaxing moment (this can be from your memory or your imagina on)

Follow this relaxa on technique daily, especially when you realize that you're star ng to feel angry.

Strategy 2: Cogni ve Restructuring

Cogni ve restructuring means changing the manner in which you think. Anger can make you curse, swear, exaggerate and act very drama cally. When this happens, force yourself to replace your angry thoughts with more logical ones. For instance, instead of thinking 'Everything is ruined' change your mindset and tell yourself 'It's not the end of the world and ge ng angry won't solve this'.

Strategy 3: Problem Solving

Ge ng angry about a problem that you cannot control is a perfectly natural response. Some mes, try as you may, there may not be a solu on to the di culty you are faced with. In such cases, stop focusing on solving the problem, and instead focus on handling and facing the problem. Remind yourself that you will do your best to deal with the situa on, but that you will not blame yourself if you don't get the solu on you desire.

Strategy 4: Better Communication

When you're angry, it is very easy to jump to inaccurate conclusions. In this case, you need to force yourself to stop reacting, and think carefully about what you want to say, before saying it. Avoid saying the first thing that enters your head. Force yourself to listen carefully to what the other person is saying. Then think about the conversation before responding.

Strategy 5: Changing Your Environment

If you find that your environment is the cause of your anger, try and give yourself a break from your surroundings. Make an active decision to schedule some personal time for yourself, especially on days that are very hectic and stressful. Having even a brief amount of quiet or alone time is sure to help calm you down.

8.1.7.2 Tips for Anger Management

The following tips will help you keep your anger in check:

- Take some time to collect your thoughts before you speak out in anger.
- Express the reason for your anger in an assertive, but non-confrontational manner once you have calmed down.
- Do some form of physical exercise like running or walking briskly when you feel yourself getting angry.
- Make short breaks part of your daily routine, especially during days that are stressful.
- Focus on how to solve a problem that's making you angry, rather than focusing on the fact that the problem is making you angry.

8.1.8 Stress Management

We say we are 'stressed' when we feel overloaded and unsure of our ability to deal with the pressures placed on us. Anything that challenges or threatens our well-being can be defined as a stress. It is important to note that stress can be good and bad. While good stress keeps us going, negative stress undermines our mental and physical health. This is why it is so important to manage negative stress effectively.

Causes of Stress

Stress can be caused by internal and external factors.

Internal causes of stress

- Constant worry
- Rigid thinking
- Unrealistic expectations
- Pessimism
- Negative self-talk
- All in or all out attitude

External causes of stress

- Major life changes
- Di cul es with rela onships
- Having too much to do
- Di cul es at work or in school
- Financial di cul es
- Worrying about one's children and/or family

8.1.8.1 Symptoms of Stress

Stress can manifest itself in numerous ways. Take a look at the cogni ve, emo onal, physical and behavioural symptoms of stress.

Cogni ve Symptoms	Emo onal Symptoms
• Memory problems • Concentra on issues • Lack of judgement • Pessimism • Anxiety • Constant worrying	• Depression • Agita on • Irritability • Loneliness • Anxiety • Anger

Physical Symptoms	Behavioural Symptoms
• Aches and pain • Diarrhoea or cons pa on • Nausea • Dizziness • Chest pain and/or rapid heartbeat • Frequent cold or flu like feelings	• Increase or decrease in appe te • Over sleeping or not sleeping enough • Withdrawing socially • Ignoring responsibili es • Consump on of alcohol or cigare es • Nervous habits like nail bi ng and pacing

8.1.8.2 Tips to Manage Stress

The following tips can help you manage your stress better:

- Note down the different ways in which you can handle the various sources of your stress.
- Remember that you cannot control everything, but you can control how you respond.
- Discuss your feelings, opinions and beliefs rather than reacting angrily, defensively or passively.
- Practice relaxation techniques like meditation, yoga or tai chi when you start feeling stressed.
- Devote a part of your day towards exercise.
- Eat healthy foods like fruits and vegetables. Avoid unhealthy foods especially those containing large amounts of sugar.
- Plan your day so that you can manage your time better, with less stress.
- Say no to people and things when required.
- Schedule time to pursue your hobbies and interests.
- Ensure you get at least 7-8 hours of sleep.
- Reduce your caffeine intake.
- Increase the time spent with family and friends.

UNIT 8.2: Digital Literacy: A Recap

Unit Objec ves

At the end of this unit, you will be able to:

1. Iden fy the basic parts of a computer
2. Iden fy the basic parts of a keyboard
3. Recall basic computer terminology
4. Recall the func ons of basic computer keys
5. Discuss the main applica ons of MS O ce
6. Discuss the benefits of Microso Outlook
7. Discuss the di erent types of e-commerce
8. List the benefits of e-commerce for retailers and customers
9. Discuss how the Digital India campaign will help boost e-commerce in India
10. Describe how you will sell a product or service on an e-commerce pla orm

8.2.1 Computer and Internet basics
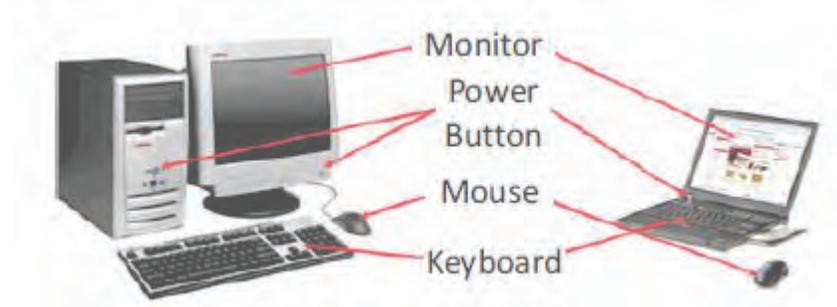
Fig. 8.2.1. Parts of a Computer

Fig. 8.2.2. Parts of a Keyboard

Basic Parts of a Computer

1. Central Processing Unit (CPU): The brain of the computer. It interprets and carries out program instruc ons.
2. Hard Drive: A device that stores large amounts of data.
3. Monitor: The device that contains the computer screen where the informa on is visually displayed.

4. Desktop: The first screen displayed after the opera ng system loads.
5. Background: The image that fills the background of the desktop.
6. Mouse: A hand-held device used to point to items on the monitor.
7. Speakers: Devices that enable you to hear sound from the computer.
8. Printer: A device that converts output from a computer into printed paper documents.
9. Icon: A small picture or image that visually represents something on your computer.
10. Cursor: An arrow which indicates where you are posi oned on the screen.
11. Program Menu: A list of programs on your computer that can be accessed from the Start menu.
12. Taskbar: The horizontal bar at the bottom of the computer screen that lists applica ons that are currently in use.
13. Recycle Bin: A temporary storage for deleted files.

Basic Internet Terms

- The Internet: A vast, interna onal collec on of computer networks that transfers informa on.
- The World Wide Web: A system that lets you access informa on on the Internet.
- Website: A loca on on the World Wide Web (and Internet) that contains informa on about a specific topic.
- Homepage: Provides informa on about a website and directs you to other pages on that website.
- Link/Hyperlink: A highlighted or underlined icon, graphic, or text that takes you to another file or object.
- Web Address/URL: The address for a website.
- Address Box: A box in the browser window where you can type in a web address.

Basic Computer Keys

- Arrow Keys: Press these keys to move your cursor.
- Space bar: Adds a space.
- Enter/Return: Moves your cursor to a new line.
- Shi : Press this key if you want to type a capital letter or the upper symbol of a key.
- Caps Lock: Press this key if you want all the letters you type to be capital letters. Press it again to revert back to typing lowercase letters.
- Backspace: Deletes everything to the le of your cursor

Tips

- When visi ng a .com address, there no need to type h p://or even www. Just type the name of the website and then press Ctrl + Enter. (Example: Type 'apple' and press Ctrl + Enter to go to www.apple.com)
- Press the Ctrl key and press the + or - to increase and decrease the size of text.
- Press F5 or Ctrl + R to refresh or reload a web page.

8.2.2 MS O ce and Email

About MS O ce

MS O ce or Microso O ce is a suite of computer programs developed by Microso . Although meant for all users, it o ers di erent versions that cater specifically to students, home users and business users. All the programs are compa ble with both, Windows and Macintosh.

Most Popular O ce Products

Some of the most popular and universally used MS O ce applica ons are:
- Microso Word: Allows users to type text and add images to a document.
- Microso Excel: Allows users to enter data into a spreadsheet and create calcula ons and graphs.
- Microso PowerPoint: Allows users to add text, pictures and media and create slideshows and presenta ons.
- Microso Outlook: Allows users to send and receive email.
- Microso OneNote: Allows users to make drawings and notes with the feel of a pen on paper.
- Microso Access: Allows users to store data over many tables.

Why Choose Microso Outlook?

A popular email management choice especially in the workplace, Microso Outlook also includes an address book, notebook, web browser and calendar. Some major benefits of this program are:
- Integrated search func on: You can use keywords to search for data across all Outlook programs.
- Enhanced security: Your email is safe from hackers, junk mail and phishing website email.
- Email syncing: Sync your mail with your calendar, contact list, notes in One Note and…your phone!
- O ine access to email: No Internet? No problem! Write emails offline and send them when you're connected again.

Tips

- Press Ctrl+R as a shortcut method to reply to email.
- Set your desktop no fica ons only for very important emails.
- Flag messages quickly by selec ng messages and hi ng the Insert key.
- Save frequently sent emails as a template to reuse again and again.
- Conveniently save important emails as files.

8.2.3 E-Commerce

What is E-Commerce?

E-commerce is the buying or selling of goods and services, or the transmi ng of money or data, electronically on the internet. E-Commerce is the short form for "electronic commerce."

Examples of E-Commerce

Some examples of e-commerce are:
- Online shopping
- Online auc ons
- Online cke ng
- Electronic payments
- Internet banking

Types of E-Commerce

E-commerce can be classified based on the types of par cipants in the transac on. The main types of e-commerce are:
- Business to Business (B2B): Both the transac ng par es are businesses.
- Business to Consumer (B2C): Businesses sell electronically to end-consumers.
- Consumer to Consumer (C2C): Consumers come together to buy, sell or trade items to other consumers.
- Consumer-to-Business (C2B): Consumers make products or services available for purchase to companies looking for exactly those services or products.
- Business-to-Administra on (B2A): Online transac ons conducted between companies and public administra on.
- Consumer-to-Administra on (C2A): Online transac ons conducted between individual and public administra on.

8.2.3.1 Benefits of E-Commerce

The e-commerce business provides some benefits for retailers and customers.

Benefits for retailers
- Establishes an online presence
- Reduces opera onal costs by removing overhead costs
- Increases brand awareness through the use of good keywords
- Increases sales by removing geographical and me constraints

Benefits for customers
- O ers a wider range of choice than any physical store
- Enables goods and services to be purchased from remote loca ons
- Enables consumers to perform price comparisons

8.2.3.2 Digital India Campaign

Prime Minister Narendra Modi launched the Digital India campaign in 2015, with the objec ve of o ering every ci zen of India access to digital services, knowledge and informa on. The campaign aims to improve the country's online infrastructure and increase internet connec vity, thus boos ng the e-commerce industry.

Currently, the majority of online transac ons come from er 2 and er 3 ci es. Once the Digital India campaign is in place, the government will deliver services through mobile connec vity, which will help deliver internet to remote corners of the country. This will help the e-commerce market to enter India's er 4 towns and rural areas.

E-Commerce Ac vity

Choose a product or service that you want to sell online. Write a brief note explaining how you will use exis ng e-commerce pla orms, or create a new e-commerce pla orm, to sell your product or service.

Tips

- Before launching your e-commerce pla orm, test everything.
- Pay close and personal a en on to your social media.

UNIT 8.3: Money Ma ers

Unit Objec ves 🎯

At the end of this unit, you will be able to:

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Di eren ate between fixed and variable costs
6. Describe the main types of investment op ons
7. Describe the di erent types of insurance products
8. Describe the di erent types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfers

8.3.1 Personal Finance – Why to Save?

Importance of Saving

We all know that the future is unpredictable. You never know what will happen tomorrow, next week or next year. That's why saving money steadily through the years is so important. Saving money will help improve your financial situa on over me. But more importantly, knowing that you have money stashed away for an emergency will give you peace of mind. Saving money also opens the door to many more op ons and possibili es.

Benefits of Saving

Inculca ng the habit of saving leads to a vast number of benefits. Saving helps you:

- Become financially independent: When you have enough money saved up to feel secure you can start making your choices, from taking a vaca on whenever you want, to switching careers or star ng your own business.

- Invest in yourself through educa on: Through saving, you can earn enough to pay up for courses that will add to your professional experience and ul mately result in higher paying jobs.

- Get out of debt: Once you have saved enough as a reserve fund, you can use your savings to pay o debts like loans or bills that have accumulated over me.

- Be prepared for surprise expenses: Having money saved enables you to pay for unforeseen expenses like sudden car or house repairs, without feeling financially stressed.

- Pay for emergencies: Saving helps you deal with emergencies like sudden health issues or emergency trips without feeling financially burdened.

- A ord large purchases and achieve major goals: Saving diligently makes it possible to place down payments towards major purchases and goals, like buying a home or a car.
- Re re: The money you have saved over the years will keep you comfortable when you no longer have the income you would get from your job.

Tips

- Break your spending habit. Try not spending on one expensive item per week, and put the money that you would have spent into your savings.
- Decide that you will not buy anything on certain days or weeks and s ck to your word.

8.3.2 Types of Bank Accounts

In India, banks o er four main types of bank accounts. These are:

1. Current Accounts
2. Savings Accounts
3. Recurring Deposit Accounts
4. Fixed Deposit Accounts

Current Accounts

Current accounts o er the most liquid deposits and thus, are best suited for businessmen and companies. As these accounts are not meant for investments and savings, there is no imposed limit on the number or amount of transac ons that can be made on any given day. Current account holders are not paid any interest on the amounts held in their accounts. They are charged for certain services o ered on such accounts.

Saving Accounts

Savings accounts are meant to promote savings, and are therefore the number one choice for salaried individuals, pensioners and students. While there is no restric on on the number and amount of deposits made, there are usually restric ons on the number and amount of withdrawals. Savings account holders are paid interest on their savings.

Recurring Deposit Accounts

Recurring Deposit accounts, also called RD accounts, are the accounts of choice for those who want to save an amount every month, but are unable to invest a large sum at one me. Such account holders deposit a small, fixed amount every month for a pre -determined period (minimum 6 months). Defaul ng on a monthly payment results in the account holder being charged a penalty amount. The total amount is repaid with interest at the end of the specified period.

Fixed Deposit Accounts

Fixed Deposit accounts, also called FD accounts, are ideal for those who wish to deposit their savings for a long term in return for a high rate of interest. The rate of interest o ered depends on the amount deposited and the me period, and also di ers from bank to bank. In the case of an FD, a certain amount of money is deposited by the account holder for a fixed period of me. The money can be withdrawn when the period expires. If necessary, the depositor can break the fixed deposit prematurely. However, this usually a racts a penalty amount which also di ers from bank to bank.

8.3.2.1 Opening a Bank Account

Opening a bank account is quite a simple process. Take a look at the steps to open an account of your own:

Step 1: Fill in the Account Opening Form

This form requires you to provide the following informa on:

- Personal details (name, address, phone number, date of birth, gender, occupa on, address)
- Method of receiving your account statement (hard copy/email)
- Details of your ini al deposit (cash/cheque)
- Manner of opera ng your account (online/mobile banking/tradi onal via cheque, slip books)
- Ensure that you sign wherever required on the form.

Step 2: A x your Photograph

S ck a recent photograph of yourself in the allo ed space on the form.

Step 3: Provide your Know Your Customer (KYC) Details

KYC is a process that helps banks verify the iden ty and address of their customers. To open an account, every individual need to submit certain approved documents with respect to photo iden ty (ID) and address proof. Some O cially Valid Documents (OVDs) are:

- Passport
- Driving License
- Voters' Iden ty Card
- PAN Card
- UIDAI (Aadhar) Card

Step 4: Submit All your Documents

Submit the completed Account Opening Form and KYC documents. Then wait un l the forms are processed and your account has been opened!

Tips

- Select the right type of account.
- Fill in complete nomina on details.
- Ask about fees.
- Understand the rules.
- Check for online banking – it's convenient!
- Keep an eye on your bank balance.

8.3.3 Costs: Fixed vs Variable

What are Fixed and Variable Costs?

Fixed costs and variable costs together make up a company's total cost. These are the two types of costs that companies have to bear when producing goods and services. A fixed cost does not change with the volume of goods or services a company produces. It always remains the same.

A variable cost, on the other hand, increases and decreases depending on the volume of goods and services produced. In other words, it varies with the amount produced.

Di erences between Fixed and Variable Costs

Let's take a look at some of the main di erences between fixed and variable costs:

Criteria	Fixed Costs	Variable Costs
Meaning	A cost that stays the same, regardless of the output produced.	A cost that changes when the
Nature	Time related.	Volume related.
Incurred	Incurred irrespec ve of units being produced.	Incurred only when units are produced
Unit cost	Inversely propor onal to the number of units produced	Remains the same, per unit.
Examples	Deprecia on, rent, salary, insurance and tax	Material consumed, wages, commission on sales and packing expenses

Tips

- When trying to determine whether a cost is fixed or variable, simply ask the following ques on: Will the par cular cost change if the company stopped its produc on ac vi es? If the answer is no, then it is a fixed cost. If the answer is yes, then it is probably a variable cost.

8.3.4 Investment, Insurance and Taxes

Investment

Investment means that money is spent today with the aim of reaping financial gains at a future me. The main types of investment op ons are as follows:

- Bonds: Bonds are instruments used by public and private companies to raise large sums of money – too large to be borrowed from a bank. These bonds are then issued in the public market and are bought by lenders.
- Stocks: Stocks or equity are shares that are issued by companies and are bought by the general public.
- Small Savings Schemes: Small Savings Schemes are tools meant to save money in small amounts. Some popular schemes are the Employees Provident Fund, Sukanya Samriddhi Scheme and Na onal Pension Scheme.
- Mutual Funds: Mutual Funds are professionally managed financial instruments that invest money in di erent securi es on behalf of investors.
- Fixed Deposits: A fixed amount of money is kept aside with a financial ins tu on for a fixed amount of me in return for interest on the money.
- Real Estate: Loans are taken from banks to purchase real estate, which is then leased or sold with the aim of making a profit on the appreciated property price.
- Hedge Funds: Hedge funds invest in both financial deriva ves and/or publicly traded securi es.
- Private Equity: Private Equity is trading in the shares of an opera ng company that is not publicly listed and whose shares are not available on the stock market.
- Venture Capital: Venture Capital involves inves ng substan al capital in a budding company in return for stocks in that company.

Insurance

There are two types of insurance, Life Insurance and General Insurance.

Life Insurance Products

The main life insurance products are:

- Term Insurance: This is the simplest and cheapest form of insurance. It o ers financial protec on for a specified tenure, say 15 to 20 years. In the case of your death, your family is paid the sum assured. In the case of your surviving the term, the insurer pays nothing.

- Endowment Policy: This o ers the dual benefit of insurance and investment. Part of the premium is allocated towards the sum assured, while the remaining premium gets invested in equity and debt. It pays a lump sum amount a er the specified dura on or on the death of the policyholder, whichever is earlier.

- Unit-Linked Insurance Plan (ULIP): Here part of the premium is spent on the life cover, while the remaining amount is invested in equity and debt. It helps develop a regular saving habit.

- Money Back Life Insurance: While the policyholder is alive, periodic payments of the par al survival benefits are made during the policy tenure. On the death of the insured, the insurance company pays the full sum assured along with survival benefits.

- Whole Life Insurance: It o ers the dual benefit of insurance and investment. It o ers insurance cover for the whole life of the person or up to 100 years whichever is earlier.

General Insurance

General Insurance deals with all insurance covering assets like animals, agricultural crops, goods, factories, cars and so on.

General Insurance Products

The main general insurance products are:

- Motor Insurance: This can be divided into Four-Wheeler Insurance and Two-Wheeler insurance.

- Health Insurance: The main types of health insurance are individual health insurance, family floater health insurance, comprehensive health insurance and cri cal illness insurance.

- Travel Insurance: This can be categorised into Individual Travel Policy, Family Travel Policy, Student Travel Insurance and Senior Ci zen Health Insurance.

- Home Insurance: This protects the house and its contents from risk.

- Marine Insurance: This insurance covers goods, freight and cargo against loss or damage during transit by rail, road, sea and/or air.

Taxes

There are two types of taxes:

1. Direct Taxes
2. Indirect Taxes.

Direct Tax

Direct taxes are levied directly on an en ty or a person and are non-transferrable. Some examples of Direct Taxes are:

- Income Tax: This tax is levied on your earning in a financial year. It is applicable to both, individuals and companies.

- Capital Gains Tax: This tax is payable whenever you receive a sizable amount of money. It is usually of two types – short term capital gains from investments held for less than 36 months and long term capital gains from investments held for longer than 36 months.

- Securities Transaction Tax: This tax is added to the price of a share. It is levied every time you buy or sell shares.
- Perquisite Tax: This tax is levied is on perks that have been acquired by a company or used by an employee.
- Corporate Tax: Corporate tax is paid by companies from the revenue they earn.

Indirect Tax

Indirect taxes are levied on goods or services. Some examples of Indirect Taxes are:

- Sales Tax: Sales Tax is levied on the sale of a product.
- Service Tax: Service Tax is added to services provided in India.
- Value Added Tax: Value Added Tax is levied at the discretion of the state government. The tax is levied on goods sold in the state. The tax amount is decided by the state.
- Customs Duty & Octroi: Customs Duty is a charge that is applied on purchases that are imported from another country. Octroi is levied on goods that cross state borders within India.
- Excise Duty: Excise Duty is levied on all goods manufactured or produced in India

Tips

- Think about how quickly you need your money back and pick an investment option accordingly.
- Ensure that you are buying the right type of insurance policy for yourself.
- Remember, not paying taxes can result in penalties ranging from fines to imprisonment.

8.3.5 Online Banking, NEFT, RTGS etc.

What is Online Banking?

Internet or online banking allows account holders to access their account from a laptop at any location. In this way, instructions can be issued. To access an account, account holders simply need to use their unique customer ID number and password.

Internet banking can be used to:

- Find out an account balance
- Transfer amounts from one account to another
- Arrange for the issuance of cheques
- Instruct payments to be made
- Request for a cheque book
- Request for a statement of accounts
- Make a fixed deposit

Electronic Funds Transfers

Electronic funds transfer is a convenient way of transferring money from the comfort of one's own home, using integrated banking tools like internet and mobile banking.

Transferring funds via an electronic gateway is extremely convenient. With the help of online banking, you can choose transferring funds:

• Into your accounts of the same bank.

• Into other people's accounts of the same bank.

• Into accounts in di erent banks through NEFT.

• Into other bank accounts though RTGS.

• Into various accounts through IMPS.

NEFT

NEFT stands for Na onal Electronic Funds Transfer. This money transfer system allows you to electronically transfer funds from your respec ve bank accounts to any other account, either in the same bank or belonging to any other bank. NEFT can be used by individuals, firms and corporate organiza ons to transfer funds between accounts.

In order to transfer funds via NEFT, two things are required:

• A transferring bank

• A des na on bank

Before you can transfer funds through NEFT, you will need to register the beneficiary who will be receiving the funds. In order to complete this registra on, you will require the following informa on:

• Recipient's name

• Recipient's account number

• Recipient's bank's name

• Recipient's bank's IFSC code

RTGS

RTGS stands for Real Time Gross Se lement. This is a real me funds transfer system which enables you to transfer funds from one bank to another, in real me or on a gross basis. The transferred amount is immediately deducted from the account of one bank, and instantly credited to the other bank's account. The RTGS payment gateway is maintained by the Reserve Bank of India. The transac ons between banks are made electronically.

RTGS can be used by individuals, companies and firms to transfer large sums of money. Before remi ng funds through RTGS, you will need to add the beneficiary and his bank account details via your online banking account.

In order to complete this registra on, you will require the following informa on:

- Name of the beneficiary
- Beneficiary's account number
- Beneficiary's bank address
- Bank's IFSC code

IMPS

IMPS stands for Immediate Payment Service. This is a real - me, inter-bank, electronic funds transfer system used to transfer money instantly within banks across India. IMPS enables users to make instant electronic transfer payments using mobile phones through both, Mobile Banking and SMS. It can also be used through ATMs and online banking. IMPS is available 24 hours a day and 7 days a week. The system features a secure transfer gateway and immediately confirms orders that have been fulfilled.

To transfer money through IMPS, you need to:

- Register for IMPS with your bank
- Receive a Mobile Money Iden fier (MMID) from the bank
- Receive a MPIN from the bank

Once you have both these, you can login or make a request through SMS to transfer a par cular amount to a beneficiary.

In order for the beneficiary to receive the transferred money, he must:

- Link his mobile number with his respec ve account
- Receive the MMID from the bank

In order to ini ate a money transfer through IMPS, you will need to enter the following informa on:

- The beneficiary's mobile number
- The beneficiary's MMID
- The transfer amount
- Your MPIN

As soon as money has been deducted from your account and credited into the beneficiary's account, you will be sent a confirma on SMS with a transac on reference number, for future reference.

8.3.5.1 Di erences between NEFT, RTGS & IMPS

Criteria	NEFT	RTGS	IMPS
Se lement	Done in batches	Real- me	Real- me
Full form	Na onal Electronic Fund Transfer	Real Time Gross Se lement	Immediate Payment Service
Timings on Monday – Friday	8:00 am – 6:30 pm	9:00 am – 4:30 pm	24x7
Timings on Saturday	8:00 am – 1:00 pm	9:00 am – 1:30 pm	24x7
Minimum amount of money transfer limit	1	2 lacs	1
Maximum amount of money transfer limit	10 lacs	10 lacs per day	2 lacs
Maximum charges as per RBI	Up to 10,000 – 2.5 above 10,000 – 1 lac - 5 above 1 – 2 lacs 15 above 2 – 5 lacs 25 above 5 – 10 lacs 25	above 2 – 5 lacs 25 above 5 – 10 lacs 50	Up to 10,000 – 5 above 10,000 – 1 lac – 5 above 1 – 2 lacs – 15

Fig. 8.3.2: Di erences Between NEFT, RTGS & IMPS

Tips

- Never click on any links in any e-mail message to access your online banking website.
- You will never be asked for your credit or debit card details while using online banking.
- Change your online banking password regularly.

UNIT 8.4: Preparing for Employment & Self-Employment

Unit Objec ves

At the end of this unit, you will be able to:

1. Discuss the steps to prepare for an interview
2. Discuss the steps to create an e ec ve Resume
3. Discuss the most frequently asked interview ques ons
4. Discuss how to answer the most frequently asked interview ques ons
5. Discuss basic workplace terminology

8.4.1 Interview Prepara on: How to Prepare for an Interview?

The success of your ge ng the job that you want depends largely on how well your interview for that job goes. Therefore, before you go in for your interview, it is important that you prepare for it with a fair amount of research and planning. Take a look at the steps to follow in order to be well prepared for an interview:

1. Research the organiza on that you are having the interview with.

   • Studying the company beforehand will help you be more prepared at the me of the interview. Your knowledge of the organiza on will help you answer ques ons at the me of the interview, and will leave you looking and feeling more confident. This is sure to make you stand out from other, not as well informed, candidates.

   • Look for background informa on on the company. Ty and find an overview of the company and its industry profile.

   • Visit the company website to get a good idea of what the company does. A company website o ers a wealth of important informa on. Read and understand the company's mission statement. Pay a en on to the company's products/services and client list. Read through any press releases to get an idea of the company's projected growth and stability.

   • Note down any ques ons that you have a er your research has been completed.

2. Think about whether your skills and qualifica ons match the job requirements.

   • Carefully read through and analyse the job descrip on.

   • Make a note of the knowledge, skills and abili es required to fulfil the job requirements.

   • Take a look at the organiza on hierarchy. Figure out where the posi on you are applying for fits into this hierarchy.

3. Go through the most typical interview questions asked, and prepare your responses.
   - Remember, in most interviews a mix of resume-based, behavioural and case study questions are asked.
   - Think about the kind of answers you would like to provide to typical questions asked in these three areas.
   - Practice these answers until you can express them confidently and clearly.
4. Plan your attire for the interview.
   - It is always safest to opt for formal business attire, unless expressly informed to dress in business casual (in which case you should use your best judgement).
   - Ensure that your clothes are clean and well-ironed. Pick neutral colours – nothing too bright or flashy.
   - The shoes you wear should match your clothes, and should be clean and suitable for an interview.
   - Remember, your aim is to leave everyone you meet with the impression that you are a professional and highly efficient person.
5. Ensure that you have packed everything that you may require during the interview.
   - Carry a few copies of your resume. Use a good quality paper for your resume print outs.
   - Always take along a notepad and a pen.
   - Take along any information you may need to refer to, in order to fill out an application form.
   - Carry a few samples of your work, if relevant.
6. Remember the importance of non-verbal communication.
   - Practice projecting confidence. Remind yourself to smile and make eye contact. Practice giving a firm handshake.
   - Keep in mind the importance of posture. Practice sitting up straight. Train yourself to stop nervous gestures like fidgeting and foot-tapping.
   - Practice keeping your reactions in check. Remember, your facial expressions provide a good insight into your true feelings. Practice projecting a positive image.
7. Make a list of questions to end the interview with.
   - Most interviews will end with the interviewer(s) asking if you have any questions. This is your chance to show that you have done your research and are interested in learning more about the company.
   - If the interviewer does not ask you this question, you can inform him/her that you have some queries that you would like to discuss. This is the time for you to refer to the notes you made while studying the company.
   - Some good questions to ask at this point are:
     o What do you consider the most important criteria for success in this job?
     o How will my performance be evaluated?
     o What are the opportunities for advancement?
     o What are the next steps in the hiring process?
   - Remember, never ask for information that is easily available on the company website.

Tips 🔍

- Ask insigh ul and probing ques ons.
- When communica ng, use e ec ve forms of body language like smiling, making eye contact, and ac vely listening and nodding. Don't slouch, play with nearby items, fidget, chew gum, or mumble.

8.4.2 Preparing an E ec ve Resume

A resume is a formal document that lists a candidate's work experience, educa on and skills. A good resume gives a poten al employer enough informa on to believe the applicant is worth interviewing. That's why it is so important to create a résumé that is e ec ve. Take a look at the steps to create an e ec ve resume:

Step 1: Write the Address Sec on

The Address sec on occupies the top of your resume. It includes informa on like your name, address, phone number and e-mail address. Insert a bold line under the sec on to separate it from rest of your resume.

Example:

Jasmine Watts
Breach Candy, Mumbai – India
Contact No: +91 2223678270
Email: jasmine.watts@gmail.com

Step 2: Add the Profile Summary Sec on

This part of your resume should list your overall experiences, achievements, awards, cer fica ons and strengths. You can make your summary as short as 2-3 bullet points or as long as 8-10 bullet points.

Example:

Profile Summary

- A Content Writer graduated from University of Strathclyde having 6 years of experience in writing website copy.
- Core expertise lies in content creation for e-learning courses, specifically for the K-12 segment.

Step 3: Include Your Educa onal Qualifica ons

When lis ng your academic records, first list your highest degree. Then add the second highest qualifica on under the highest one and so on. To provide a clear and accurate picture of your educa onal background, it is cri cal that include informa on on your posi on, rank, percentage or CPI for every degree or cer fica on that you have listed.

If you have done any cer fica ons and trainings, you can add a Trainings & Cer fica ons sec on under your Educa onal Qualifica ons sec on.

Example:

Educational Qualifications
- Masters in International Management (2007) from Columbia University with 8.8 CPI.
- Bachelor of Management Studies (2004) from Mumbai University with 87% marks.
- 10+2 with Math, Stats (2001) from Maharashtra Board with 91% marks.
- High School (1999) from Maharashtra Board with 93% marks.

Step 4: List Your Technical Skills

When lis ng your technical skills, start with the skills that you are most confident about. Then add the skills that you do not have as good a command over. It is perfectly acceptable to include just one skill, if you feel that par cular skill adds tremendous value to your résumé. If you do not have any technical skills, you can omit this step.

Example:

Technical Skills
- Flash
- Photoshop

Step 5: Insert Your Academic Project Experience

List down all the important projects that you have worked on. Include the following informa on in this sec on:

• Project title	• Organization	• Platform used
• Contribution	• Description	

Example:

Academic Projects
Project Title: Different Communication Skills
Organization: True Blue Solutions
Platform used: Articulate
Contribution: Content writing and graphic visualization
Description: Development of storyboards for corporate induction & training programs

Step 6: List Your Strengths

This is where you list all your major strengths. This sec on should be in the form of a bulleted list.

Example:

Strengths
- Excellent oral, written and presentation skills
- Action-oriented and result-focused
- Great time management skills

Step 7: List Your Extracurricular Ac vi es

It is very important to show that you have diverse interests and that your life consists of more than academics. Including your extracurricular ac vi es can give you an added edge over other candidates who have similar academic scores and project experiences. This sec on should be in the form of a bulleted list.

Example:

Extracurricular Activities
- Member of the Debate Club
- Played tennis at a national level
- Won first prize in the All India Camel Contest, 2010

Step 8: Write Your Personal Details

The last sec on of your résumé must include the following personal informa on:

- Date of birth
- Na onality
- Gender & marital status
- Languages known

Example:

Personal Details
- Date of birth: 25th May, 1981
- Gender & marital status: Female, Single
- Nationality: Indian
- Languages known: English, Hindi, Tamil, French

Tips

- Keep your resume file name short, simple and informa onal.
- Make sure the resume is neat and free from typing errors.
- Always create your resume on plain white paper.

8.4.3 Interview FAQs

Take a look at some of the most frequently asked interview ques ons, and some helpful ps on how to answer them.

Q1. Can you tell me a li le about yourself?

Tips to answer:
- Don't provide your full employment or personal history.
- O er 2-3 specific experiences that you feel are most valuable and relevant.
- Conclude with how those experiences have made you perfect for this specific role.

Q2. How did you hear about the posi on?

Tips to answer:

- Tell the interviewer how you heard about the job – whether it was through a friend (name the friend), event or ar cle (name them) or a job portal (say which one).
- Explain what excites you about the posi on and what in par cular caught your eye about this role.

Q3. What do you know about the company?

Tips to answer:
- Don't recite the company's About Us page.
- Show that you understand and care about the company's goals.
- Explain why you believe in the company's mission and values.

Q4. Why do you want this job?

Tips to answer:

- Show that you are passionate about the job.
- Iden fy why the role is a great fit for you.
- Explain why you love the company.

Q5. Why should we hire you?

Tips to answer:
- Prove through your words that you can not only do the work, but can definitely deliver excellent results.
- Explain why you would be a great fit with the team and work culture.
- Explain why you should be chosen over any other candidate.

Q6. What are your greatest professional strengths?

Tips to answer:
- Be honest – share some of your real strengths, rather than give answers that you think sound good.
- O er examples of specific strengths that are relevant to the posi on you are applying for.
- Provide examples of how you've demonstrated these strengths.

Q7. What do you consider to be your weaknesses?

Tips to answer:

- The purpose of this ques on is to gauge your self-awareness and honesty.
- Give an example of a trait that you struggle with, but that you're working on to improve.

Q8. What are your salary requirements?

Tips to answer:

- Do your research beforehand and find out the typical sala ry range for the job you are applying for.
- Figure out where you lie on the pay scale based on your experience, educa on, and skills.
- Be flexible. Tell the interviewer that you know your skills are valuable, but that you want the job and are willing to nego ate.

Q9. What do you like to do outside of work?

Tips to answer:

- The purpose of this ques on is to see if you will fit in with the company culture.
- Be honest – open up and share ac vi es and hobbies that interest and excite you.

Q10. If you were an animal, which one would you want to be?

Tips to answer:

- The purpose of this ques on is to see if you are able to think on your feet.
- There's no wrong answer – but to make a great impression try to bring out your strengths or personality traits through your answer.

Q11: What do you think we could do be er or di erently?

Tips to answer:

- The purpose of this ques on is to see if you have done your research on the company, and to test whether you can think cri cally and come up with new ideas.
- Suggest new ideas. Show how your interests and exper se would help you execute these ideas.

Q12: Do you have any ques ons for us?

Tips to answer:

- Do not ask ques ons to which the answers can be easily found on the company website or through a quick online search.
- Ask intelligent ques ons that show your ability to think cri cally.

Tips

- Be honest and confident while answering.
- Use examples of your past experiences wherever possible to make your answers more impac ul.

8.4.4 Work Readiness – Terms & Terminologies

Every employee should be well versed in the following terms:

- Annual leave: Paid vaca on leave given by employers to employees.
- Background Check: A method used by employers to verify the accuracy of the informa on provided by poten al candidates.
- Benefits: A part of an employee's compensa on package.
- Breaks: Short periods of rest taken by employees during working hours.
- Compensa on Package: The combina on of salary and benefits that an employer provides to his/her employees.
- Compensatory Time (Comp Time): Time o in lieu of pay.
- Contract Employee: An employee who works for one organiza on that sells said employee's service to another company, either on a project or me basis.
- Contract of Employment: When an employee is o ered work in exchange for wages or salary, and accepts the o er made by the employer, a contract of employment exists.
- Corporate Culture: The beliefs and values shared by all the members of a company, and imparted from one genera on of employees to another.
- Counter O er/Counter Proposal: A nego a on technique used by poten al candidates to increase the amount of salary o ered by a company.
- Cover Le er: A le er that accompanies a candidate's resume. It emphasizes the important points in the candidate's resume and provides real examples that prove the candidate's ability to perform the expected job role.
- Curriculum Vitae (CV)/Resume: A summary of a candidate's achievements, educa onal work experience, skills and strengths.
- Declining Le er: A le er sent by an employee to an employer, turning down the job o er employer to the employee.
- Deduc ons: Amounts subtracted from an employee's pay and listed on the employee's pay slip.
- Discrimina on: The act of trea ng one person not as favourably as another person.
- Employee: A person who works for another person in exchange for payment.
- Employee Training: A workshop or in-house training that an employee is asked to a end by his or her superior, for the benefit of the employer.
- Employment Gaps: Periods of unemployed me between jobs.
- Fixed-Term Contract: A contract of employment which gets terminated on an agreed-upon date.
- Follow-Up: The act of contac ng a poten al employer a er a candidate has submi ed his or her resume.
- Freelancer/Consultant/Independent Contractor: A person who works for him or herself for temporary jobs and projects with di erent employers.
- Holiday: Paid me-o from work.
- Hourly Rate: The amount of salary or wages paid for 60 minutes of work.

- Internship: A job opportunity o ered by an employer to a poten al employee, called an at the employer's company for a fixed, limited me period.

- Interview: A conversa on between a poten al employee and a representa ve of an order to determine if the poten al employee should be hired.

- Job Applica on: A form which asks for a candidate's informa on like the candidate's name, details and work experience. The purpose of a candidate submi ng a job applica on, is to show that candidate's interest in working for a par cular company.

- Job O er: An o er of employment made by an employer to a poten al employee.

- Job Search Agent: A program that enables candidates to search for employment opportuni es by selec ng criteria listed in the program, for job vacancies. background, made by the and pitches intern, to work employer, in address, contact

- Lay O : A lay o occurs when an employee is temporarily let go from his or her job, due to the employer not having any work for that employee.

- Leave: Formal permission given to an employee, by his or her employer, to take a leave of absence from work.

- Le er of Acceptance: A le er given by an employer to an employee, confirming the o er of employment made by the employer, as well as the condi ons of the o er.

- Le er of Agreement: A le er that outlines the terms of employment.

- Le er of Recommenda on: A le er wri en for the purpose of valida ng the work skills o f a person.

- Maternity Leave: Leave taken from work by women who are pregnant, or who have just given birth.

- Mentor: A person who is employed at a higher level than you, who o ers you advice and guides you in your career.

- Minimum wage: The minimum wage amount paid on an hourly basis.

- No ce: An announcement made by an employee or an employer, sta ng that the employment contract will end on a par cular date.

- O er of Employment: An o er made by an employer to a prospec ve employee that contains important informa on pertaining to the job being o ered, like the star ng date, salary, working condi ons etc.

- Open-Ended Contract: A contract of employment that con nues ll the employer or terminates it.

- Overqualified: A person who is not suited for a par cular job because he or she has too m any years of work experience, or a level of educa on that is much higher than required f or the job, or is currently or was previously too highly paid.

- Part-Time Worker: An employee who works for fewer hours than the standard number of hours normally worked.

- Paternity Leave: Leave granted to a man who has recently become a father.

- Recruiters/Head-hunters/Execu ve Search Firms: Professionals who are paid by employers to search for people to fill par cular posi ons.

- Resigning/Resigna ons: When an employee formally informs his or her employer that he or she is qui ng his or her job.

- Self-Employed: A person who has his or her own business and does not work in the capacity of an employee.
- Time Sheet: A form that is submi ed to an employer, by an employee, that contains the number of hours worked every day by the employee.

UNIT 8.5: Understanding Entrepreneurship

Unit Objec ves

At the end of this unit, you will be able to:

1. Discuss the concept of entrepreneurship
2. Discuss the importance of entrepreneurship
3. Describe the characteris cs of an entrepreneur
4. Describe the di erent types of enterprises
5. List the quali es of an e ec ve leader
6. Discuss the benefits of e ec ve leadership
7. List the traits of an e ec ve team
8. Discuss the importance of listening e ec vely
9. Discuss how to listen e ec vely
10. Discuss the importance of speaking e ec vely
11. Discuss how to speak e ec vely
12. Discuss how to solve problems
13. List important problem solving traits
14. Discuss ways to assess problem solving skills
15. Discuss the importance of nego a on
16. Discuss how to nego ate
17. Discuss how to iden fy new business opportuni es
18. Discuss how to iden fy business opportuni es within your business
19. Understand the meaning of entrepreneur
20. Describe the di erent types of entrepreneurs
21. List the characteris cs of entrepreneurs
22. Recall entrepreneur success stories
23. Discuss the entrepreneurial process
24. Describe the entrepreneurship ecosystem
25. Discuss the government's role in the entrepreneurship ecosystem
26. Discuss the current entrepreneurship ecosystem in India
27. Understand the purpose of the Make in India campaign
28. Discuss the rela onship between entrepreneurship and risk appe te
29. Discuss the rela onship between entrepreneurship and resilience
30. Describe the characteris cs of a resilient entrepreneur
31. Discuss how to deal with failure

8.5.1 Concept Introduc on

Anyone who is determined to start a business, no ma er what the risk, is an entrepreneur. Entrepreneurs run their own start-up, take responsibility for the financial risks and use crea vity, innova on and vast reserves of self-mo va on to achieve success. They dream big and are determined to do whatever it takes to turn their idea into a viable o ering. The aim of an entrepreneur is to create an enterprise. The process of crea ng this enterprise is known as entrepreneurship.

8.5.1.1 Importance of Entrepreneurship

Entrepreneurship is very important for the following reasons:
1. It results in the crea on of new organiza ons
2. It brings crea vity into the marketplace
3. It leads to improved standards of living
4. It helps develop the economy of a country

8.5.1.2 Characteris cs of Entrepreneurs

All successful entrepreneurs have certain characteris cs in common.

They are all:
- Extremely passionate about their work
- Confident in themselves
- Disciplined and dedicated
- Mo vated and driven
- Highly crea ve
- Visionaries
- Open-minded
- Decisive

Entrepreneurs also have a tendency to:
- Have a high-risk tolerance
- Thoroughly plan everything
- Manage their money wisely
- Make their customers their priority
- Understand their o ering and their market in detail
- Ask for advice from experts when required
- Know when to cut their losses

8.5.1.3 Examples of Famous Entrepreneurs

Some famous entrepreneurs are:
- Bill Gates (Founder of Microso)
- Steve Jobs (Co-founder of Apple)
- Mark Zuckerberg (Founder of Facebook)
- Pierre Omidyar (Founder of eBay)

8.5.1.4 Types of Enterprises

As an entrepreneur in India, you can own and run any of the following types of enterprises:

Sole Proprietorship

In a sole proprietorship, a single individual owns, manages and controls the enterprise. This type of business is the easiest to form with respect to legal formali es. The business and the owner have no separate legal existence. All profit belongs to the proprietor, as do all the losses the liability of the entrepreneur is unlimited.

Partnership

A partnership firm is formed by two or more people. The owners of the enterprise are called partners. A partnership deed must be signed by all the partners. The firm and its partners have no separate legal existence. The profits are shared by the partners. With respect to losses, the liability of the partners is unlimited. A firm has a limited life span and must be dissolved when any one of the partners dies, re res, claims bankruptcy or goes insane.

Limited Liability Partnership (LLP)

In a Limited Liability Partnership or LLP, the partners of the firm enjoy perpetual existence as well as the advantage of limited liability. Each partner's liability is limited to their agreed contribu on to the LLP. The partnership and its partners have a separate legal exis tence.

Tips

- Learn from others' failures.
- Be certain that this is what you want.
- Search for a problem to solve, rather than look for a problem to a ach to your idea.

8.5.2 Leadership & Teamwork: Leadership and Leaders

Leadership means se ng an example for others to follow. Se ng a good example means not asking someone to do something that you wouldn't willingly want to do yourself. Leadership is about figuring out what to do in order to win as a team, and as a company.

Leaders believe in doing the right things. They also believe in helping others to do the right things. An e ec ve leader is someone who:

- Creates an inspiring vision of the future.
- Mo vates and inspires his team to pursue that vision.

8.5.2.1 Leadership Quali es That All Entrepreneurs Need

Building a successful enterprise is only possible if the entrepreneur in charge possesses excellent leadership quali es. Some cri cal leadership skills that every entrepreneur must have are:

1. Pragma sm: This means having the ability to highlight all obstacles and challenges, in order to resolve issues and reduce risks.
2. Humility: This means admi ng to mistakes o en and early, and being quick to take responsibility for your ac ons. Mistakes should be viewed as challenges to overcome, not opportuni es to point blame.
3. Flexibility: It is cri cal for a good leader to be very flexible and quickly adapt to change. It is equally cri cal to know when to adapt and when not to.
4. Authen city: This means showing both, your strengths and your weaknesses. It means being human and showing others that you are human.
5. Reinven on: This means refreshing or changing your leadership style when necessary. To do this, it's important to learn where your leadership gaps lie and find out what resources are required to close them.
6. Awareness: This means taking the me to recognize how others view you. It means understanding how your presence a ects those around you.

8.5.2.2 Benefits of E ec ve Leadership

E ec ve leadership results in numerous benefits. Great leadership leads to the leader successfully:

- Gaining the loyalty and commitment of the team members
- Mo va ng the team to work towards achieving the company's goals and objec ves
- Building morale and ins lling confidence in the team members
- Fostering mutual understanding and team-spirit among team members
- Convincing team members about the need to change when a situa on requires adaptability

8.5.2.3 Teamwork and Teams

Teamwork occurs when the people in a workplace combine their individual skills to pursue a common goal. E ec ve teams are made up of individuals who work together to achieve this common goal. A great team is one who holds themselves accountable for the end result.

8.5.2.4 Importance of Teamwork in Entrepreneurial Success

For an entrepreneurial leader, building an effec ve team is cri cal to the success of a venture. An entrepreneur must ensure that the team he builds possesses certain crucial quali es, traits and characteris cs. An effec ve team is one which has:

1. Unity of purpose: All the team members should clearly understand and be equally commi ed to the purpose, vision and goals of the team.

2. Great communica on skills: Team members should have the ability to express their concerns, ask ques ons and use diagrams, and charts to convey complex informa on.

3. The ability to collaborate: Every member should feel en tled to provide regular feedback on new ideas.

4. Ini a ve: The team should consist of proac ve individuals. The members should have the enthusiasm to come up with new ideas, improve exis ng ideas, and conduct their own research.

5. Visionary members: The team should have the ability to an cipate problems and act on these poten al problems before they turn into real problems.

6. Great adaptability skills: The team must believe that change is a posi ve force. Change should be seen as the chance to improve and try new things.

7. Excellent organiza onal skills: The team should have the ability to develop standard work processes, balance responsibili es, properly plan projects, and set in place methods to measure progress and ROI.

Tips

- Don't get too a ached to your original idea. Allow it to evolve and change.

- Be aware of your weaknesses and build a team that will complement your shor alls.

- Hiring the right people is not enough. You need to promote or incen vize your most talented people to keep them mo vated.

- Earn your team's respect.

8.5.3 Communica on Skills

Listening is the ability to correctly receive and understand messages during the process of communica on. Listening is cri cal for e ec ve communica on. Without e ec ve listening skills, messages can easily be misunderstood. This results in a communica on breakdown and can lead to the sender and the receiver of the message becoming frustrated or irritated.

It's very important to note that listening is not the same as hearing. Hearing just refers to sounds that you hear. Listening is a whole lot more than that. To listen, one requires focus. It means not only paying a en on to the story, but also focusing on how the story is relayed, the way language and voice is used, and even how the speaker uses their body language. The ability to listen depends on how e ec vely one can perceive and understand both, verbal and non-verbal cues.

8.5.3.1 How to Listen E ec vely?

To listen e ec vely you should:
- Stop talking
- Stop interrup ng
- Focus completely on what is being said
- Nod and use encouraging words and gestures
- Be open-minded
- Think about the speaker's perspec ve
- Be very, very pa ent
- Pay a en on to the tone that is being used
- Pay a en on to the speaker's gestures, facial expressions and eye movements
- Not try and rush the person
- Not let the speaker's mannerisms or habits irritate or distract you

8.5.3.2 The Importance of Speaking E ec vely

How successfully a message gets conveyed depends en rely on how e ec vely you are able to get it through. An e ec ve speaker is one who enunciates properly, pronoun ces words correctly, chooses the right words and speaks at a pace that is easily understandable. Besides this, the words spoken out loud need to match the gestures, tone and body language used.

What you say, and the tone in which you say it, results in numerous percep ons being formed. A person who speaks hesitantly may be perceived as having low self-esteem or lacking in knowledge of the discussed topic. Those with a quiet voice may very well be labelled as shy. And those who speak in commanding tones with high levels of clarity, are usually considered to be extremely confident. This makes speaking a very cri cal communica on skill.

8.5.3.3 How to Speak E ec vely?

To speak e ec vely you should:
- Incorporate body language in your speech like eye contact, smiling, nodding, gesturing etc.
- Build a dra of your speech before actually making your speech.
- Ensure that all your emo ons and feelings are under control.
- Pronounce your words dis nctly with the correct pitch and intensity. Your speech should be crystal clear at all mes. Use a pleasant and natural tone when speaking. Your audience should not feel like you are pu ng on an accent or being unnatural in any way.
- Use precise and specific words to drive your message home. Ambiguity should be avoided at all costs.
- Ensure that your speech has a logical flow.
- Be brief. Don't add any unnecessary informa on.
- Make a conscious e ort to avoid irrita ng mannerisms like fidge ng, twitching etc.

- Choose your words carefully and use simple words that the majority of the audience will have no difficulty understanding.
- Use visual aids like slides or a whiteboard.
- Speak slowly so that your audience can easily understand what you're saying. However, be careful not to speak too slowly because this can come across as stiff, unprepared or even condescending.
- Remember to pause at the right moments.

Tips

- If you're finding it difficult to focus on what someone is saying, try repeating their words in your head.
- Always maintain eye contact with the person that you are communicating with, when speaking as well as listening. This conveys and also encourages interest in the conversation.

8.5.4 Problem Solving & Negotiation Skills

As per The Concise Oxford Dictionary (1995), a problem is, "A doubtful or difficult matter requiring a solution"

All problems contain two elements:
1. Goals
2. Obstacles

The aim of problem solving is to recognize the obstacles and remove them in order to achieve the goals.

8.5.4.1 How to Solve Problems?

Solving a problem requires a level of rational thinking. Here are some logical steps to follow when faced with an issue:

- **Step 1:** Identify the problem
- **Step 2:** Study the problem in detail
- **Step 3:** List all possible solutions
- **Step 4:** Select the best solution
- **Step 5:** Implement the chosen solution
- **Step 6:** Check that the problem has really been solved

8.5.4.2 Important Traits for Problem Solving

Highly developed problem-solving skills are cri cal for both, business owners and their employees. The following personality traits play a big role in how e ec vely problems are solved:

- Being open minded
- Asking the right questions
- Being proac ve
- Not panicking
- Having a posi ve a tude
- Focusing on the right problem

8.5.4.3 How to Assess for Problem Solving Skills?

As an entrepreneur, it would be a good idea to assess the level of problem solving skills of poten al candidates before hiring them. Some ways to assess this skill are through:

1. Applica on forms: Ask for proof of the candidate's problem solving skills in the applica on form.
2. Psychometric tests: Give poten al candidates logical reasoning and cri cal thinking tests and see how they fare.
3. Interviews: Create hypothe cal problema c situa ons or raise ethical ques ons and see how the candidates respond.
4. Technical ques ons: Give candidates examples of real life problems and evaluate their thought process.

8.5.4.4 What is Nego a on?

Nego a on is a method used to se le di erences. The aim of nego a on is to resolve di erences through a compromise or agreement while avoiding disputes. With out nego a on, conflicts are likely to lead to resentment between people. Good nego a on skills help sa sfy both par es and go a long way towards developing strong rela onships.

Why Nego ate?

Star ng a business requires many, many nego a ons. Some nego a ons are small while others are cri cal enough to make or break a start -up. Nego a on also plays a big role inside the workplace. As an entrepreneur, you need to know not only know how to nego ate yourself, but also how to train employees in the art of nego a on.

How to Negotiate?

Take a look at some steps to help you negotiate:

- **Step 1:** Pre-Negotiation Preparation: Agree on where to meet to discuss the problem, decide who all will be present and set a time limit for the discussion.
- **Step 2:** Discuss the problem: This involves asking questions, listening to the other side, putting your views forward and clarifying doubts.
- **Step 3:** Clarify the Objective: Ensure that both parties want to solve the same problem and reach the same goal.
- **Step 4:** Aim for a Win-Win Outcome: Try your best to be open minded when negotiating. Compromise and offer substitute solutions to arrive at an outcome where both win.
- **Step 5:** Clearly Define the Agreement: When an agreement has been reached, the details of the agreement should be crystal clear to both sides, with no scope for misunderstandings.
- **Step 6:** Implement the Agreed Upon Solution: Agree on a course of action to set the solution in motion.

Tips

- Know exactly what you want before you work towards getting it
- Give more importance to listening and thinking, than speaking
- Focus on building a relationship rather than winning
- Remember that your people skills will affect the outcome
- Know when to walk away – sometimes reaching an agreement may not be possible

8.5.5 Business Opportunities Identification

"The entrepreneur always searches for change, responds to it and exploits it as an opportunity."

Peter Drucker

The ability to find good business opportunities is an important characteristic of an entrepreneur.

What is an Opportunity?

The word opportunity suggests a good chance or a favourable situation to do something offered by circumstances.

A business opportunity is typically a good/favourable change that can be used to run a business in a given environment, at a given point of time.

Common Ques ons Faced by Entrepreneurs

A cri cal ques on that all entrepreneurs face is how to go about finding the business opportunity that is right for them.

Some common ques ons that entrepreneurs constantly think about are:

- Should the new enterprise introduce a new product or service based on an unmet need?
- Should the new enterprise select an exis ng product or service from one market and o er it in another where it may not be available?
- Should the enterprise be based on a tried and tested formula that has worked elsewhere?

It is therefore extremely important that entrepreneurs must learn how to iden fy new and exis ng business opportuni es and evaluate their chances of success.

When is an Idea an Opportunity?

An idea is an opportunity when:

- It creates or adds value to a customer
- It solves a significant problem, removes a pain point or meets a demand
- Has a robust market and profit margin
- Is a good fit with the founder and management team at the right me and place

Factors to Consider When Looking for Opportuni es

Consider the following when looking for business opportuni es:

- Economic trends
- Changes in funding
- Changing rela onships between vendors, partners and suppliers
- Market trends
- Changes in poli cal support
- Shi in target audience

Ways to Iden fy New Business Opportuni es

- Iden fy Market Ine ciencies: When looking at a market, consider what ine ciencies are present in the market. Think about ways to correct these ine ciencies.
- Remove Key Hassles: Rather than create a new product or service, you can innova vely improve a product, service or process.
- Create Something New: Think about how you can create a new experience for customers, based on exis ng business models.
- Pick a Growing Sector/Industry: Research and find out which sectors or industries are growing and think about what opportuni es you can tap in the same.
- Think About Product Di eren a on: If you already have a product in mind, think about ways to set it apart from the exis ng ones.

Ways to Identify Business Opportunities within Your Business

1. SWOT Analysis

An excellent way to identify opportunities inside your business is by creating a SWOT analysis. The acronym SWOT stands for strengths, weaknesses, opportunities, and threats. SWOT analysis framework:
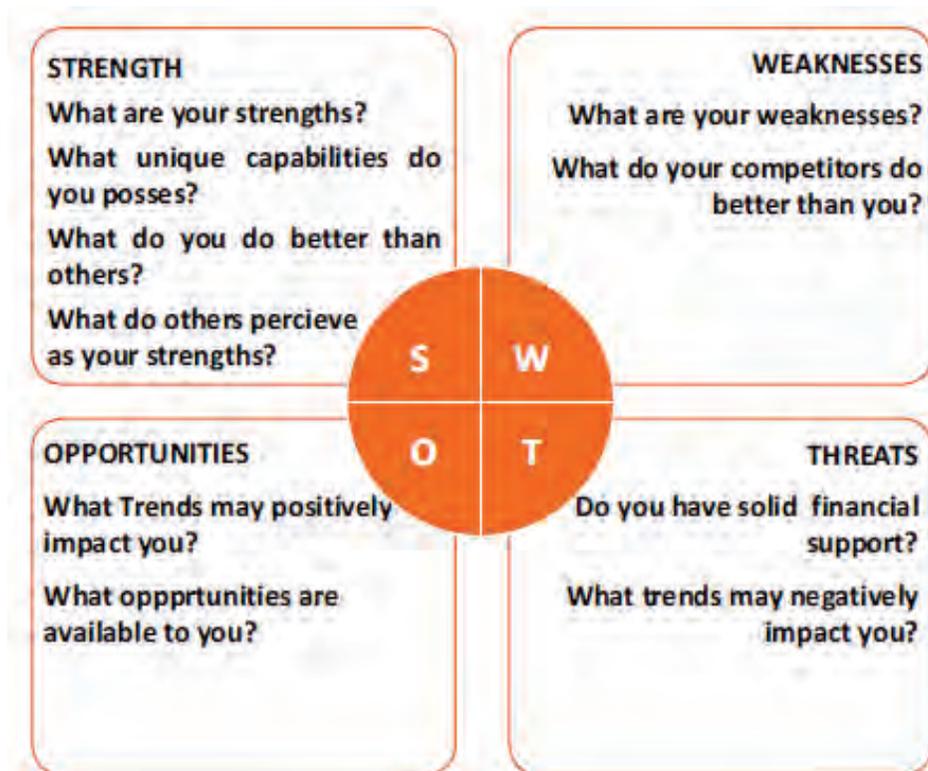
Fig. 8.5.1. SWOT Analysis

Consider the following when looking for business opportunities:

By looking at yourself and your competitors using the SWOT framework, you can uncover opportunities that you can exploit, as well as manage and eliminate threats that could derail your success.

2. Establishing Your USP

Establish your USP in such a way that positions you differently from your competitors. Identify the uniqueness about your product that will motivate customers to buy from you and then promote that reason.

Opportunity Analysis

Once you have identified an opportunity, you need to analyse it. To analyse an opportunity, you must:

- Focus on the idea
- Focus on the market of the idea
- Talk to industry leaders in the same space as the idea
- Talk to players in the same space as the idea

Tips

- Remember, opportuni es are situa onal.
- Look for a proven track record.
- Avoid the latest craze.
- Love your idea.

8.5.6 Entrepreneurship Support Eco-System

An entrepreneur is a person who:
- Does not work for an employee
- Runs a small enterprise
- Assumes all the risks and rewards of the enterprise, idea, good or service

Types of Entrepreneurs

There are four main types of entrepreneurs:
1. The Tradi onal Entrepreneur: This type of entrepreneur usually has some kind of skill – they can be a carpenter, mechanic, cook etc. They have businesses that have been around for numerous years like restaurants, shops and carpenters. Typically, they gain plenty of experience in a par cular industry before they begin their own business in a similar field.
2. The Growth Poten al Entrepreneur: The desire of this type of entrepreneur is to start an enterprise that will grow, win many customers and make lots of money. Their ul mate aim is to eventually sell their enterprise for a nice profit. Such entrepreneurs usually have a science or technical background.
3. The Project-Oriented Entrepreneur: This type of entrepreneur generally has a background in the Arts or psychology. Their enterprises tend to be focus on something that they are very passionate about.
4. The Lifestyle Entrepreneur: This type of entrepreneur has usually worked as a teacher or a secretary. They are more interested in selling something that people will enjoy, rather than making lots of money.

Characteris cs of an Entrepreneur

Successful entrepreneurs have the following characteris cs:
- They are highly mo vated
- They are crea ve and persuasive
- They are mentally prepared to handle each and every task
- They have excellent business skills – they know how to evaluate their cash flow, sales and revenue

- They are willing to take great risks
- They are very proac ve – this means they are willing to do the work themselves, rather than wait for someone else to do it
- They have a vision – they are able to see the big picture
- They are flexible and open-minded
- They are good at making decisions

8.5.6.1 Entrepreneur Success Stories

Dhiru Bhai Ambani

Dhirubhai Ambani began his entrepreneurial career by selling "bhajias" to pilgrims in Mount Girnar on weekends. At 16, he moved to Yemen where he worked as a gas -sta on a endant, and as a clerk in an oil company. He returned to India with Rs. 50,000 and started a tex le trading company. Reliance went on to become the first Indian company to raise mo ney in global markets and the first Indian company to feature in Forbes 500 list.

Dr. Karsanbhai Patel

Karsanbhai Patel made detergent powder in the backyard of his house. He sold his product door-to door and o ered a money back guarantee with every pack that was sold. He charged Rs. 3 per kg when the cheapest detergent at that me was Rs. 13 per kg. Dr. Patel eventually started Nirma which became a whole new segment in the Indian domes c detergent market.

8.5.6.2 The Entrepreneurial Process

Let's take a look at the stages of the entrepreneurial process.

- Stage 1: Idea Genera on. The entrepreneurial process begins with an idea that has been thought of by the entrepreneur. The idea is a problem that has the poten al to be solved.
- Stage 2: Germina on or Recogni on. In this stage a possible solu on to the iden fied problem is thought of.
- Stage 3: Prepara on or Ra onaliza on. The problem is studied further and research is done to find out how others have tried to solve the same problem.
- Stage 4: Incuba on or Fantasizing. This stage involves crea ve thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.
- Stage 5: Feasibility Study: The next step is the crea on of a feasibility study to determine if the idea will make a profit and if it should be seen through.
- Stage 6: Illumina on or Realiza on. This is when all uncertain areas suddenly become clear. The entrepreneur feels confident that his idea has merit.
- Stage 7: Verifica on or Valida on. In this final stage, the idea is verified to see if it works and if it is useful.

Take a look at the diagram below to get a be er idea of this process.
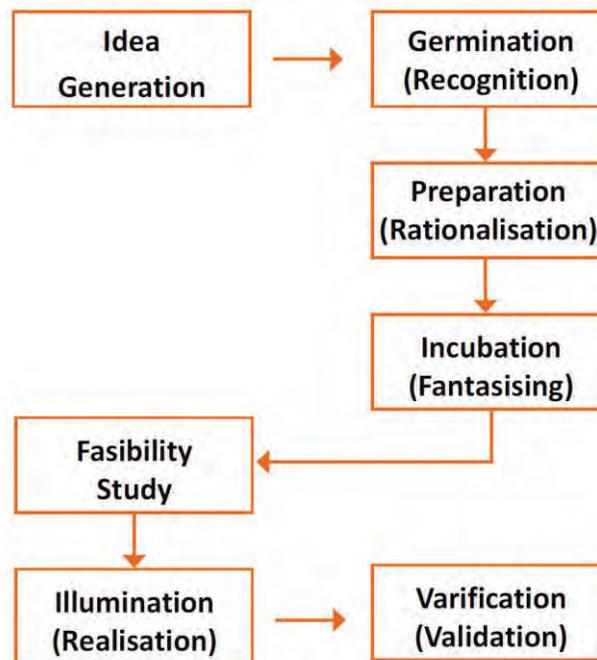
Fig.8.5.2: Stages of the entrepreneurial process

8.5.6.3 What is an Entrepreneur?

The entrepreneurship support ecosystem signifies the collec ve and complete nature of entrepreneurship. New companies emerge and flourish not only because of the courageous, visionary entrepreneurs who launch them, but they thrive as they are set in an environment or 'ecosystem' made of private and public par cipants. These players nurture and sustain the new ventures, facilita ng the entrepreneurs' e orts. An entrepreneurship ecosystem comprises of the following six domains:

1. Favourable Culture: This includes elements such as tolerance of risk and errors, valuable networking and posi ve social standing of the entrepreneur.

2. Facilita ng Policies & Leadership: This includes regulatory framework incen ves and existence of public research ins tutes.

3. Financing Op ons: Angel financing, venture capitalists and micro loans would be good examples of this.

4. Human Capital: This refers to trained and untrained labour, entrepreneurs and entrepreneurship training programmes, etc.

5. Conducive Markets for Products & Services: This refers to an existence or scope of existence of a market for the product/service.

6. Ins tu onal & Infrastructural Support: This includes legal and financing advisers, telecommunica ons, digital and transporta on infrastructure, and entrepreneurship networking programmes.

These domains indicate whether there is a strong entrepreneurship support ecosystem and what ac ons should the government put in place to further encourage this ecosystem.

The six domains and their various elements have been graphically depicted.
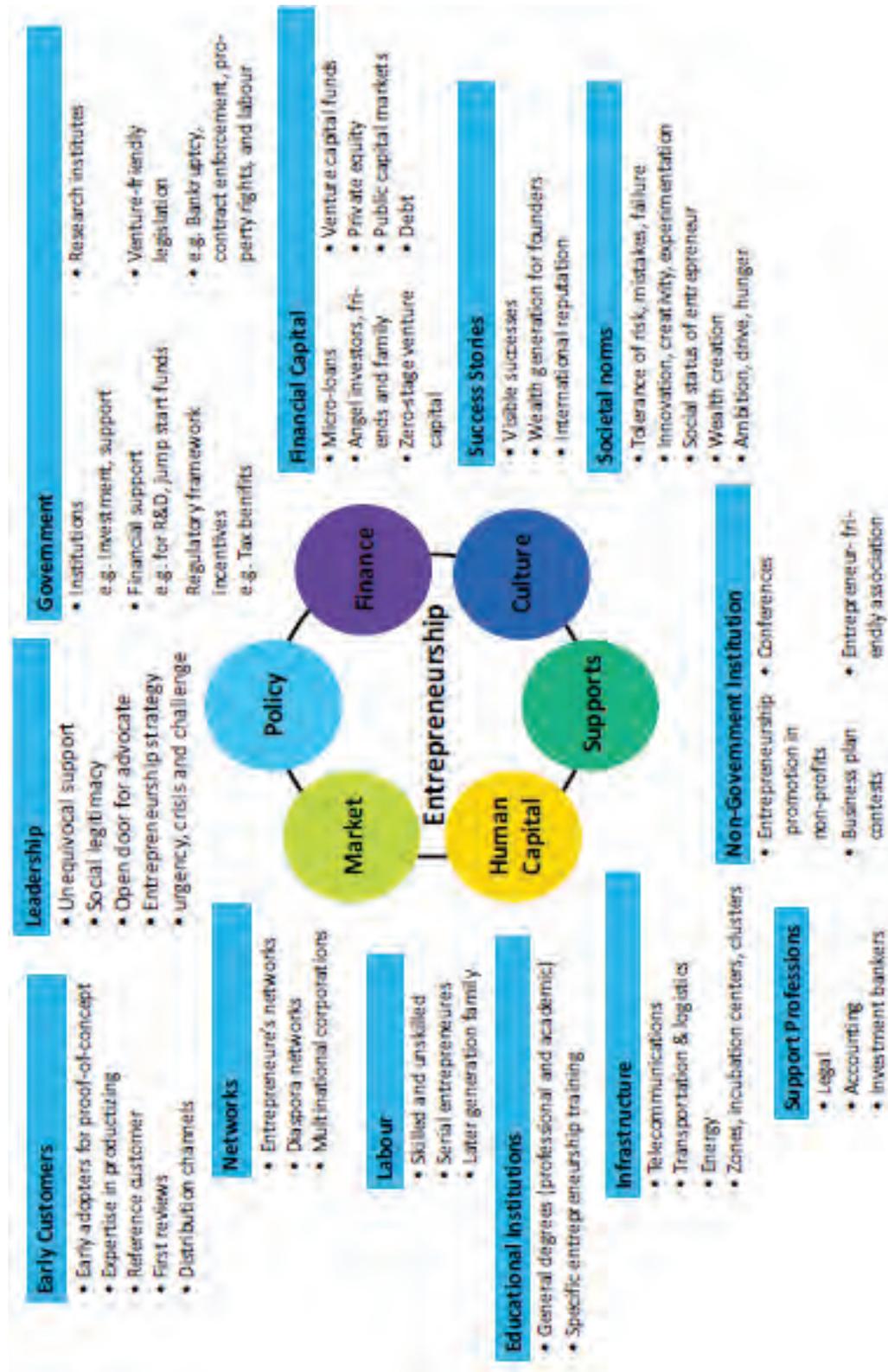
Fig. 8.5.3. Entrepreneurship at a Glance

Every entrepreneurship support ecosystem is unique and all the elements of the ecosystem are interdependent. Although every region's entrepreneurship ecosystem can be broadly described by the above features, each ecosystem is the result of the hundred elements interac ng in highly complex and par cular ways.

Entrepreneurship ecosystems eventually become (largely) self-sustaining. When the six domains are resilient enough, they are mutually beneficial. At this point, government involvement can and should be significantly minimized. Public leaders do not n eed to invest a lot to sustain the ecosystem. It is impera ve that the entrepreneurship ecosystem incen ves are formulated to be self-liquida ng, hence focusing on sustain ability of the environment.

8.5.6.4 Government's Role in the Entrepreneurship Ecosystem

Encouraging new ventures is a major focus for policymakers. Governments across the world are recognizing that new businesses flourish in dis nc ve types of suppor ve environments. Policymakers should study the scenario and take into account the following points whilst they formulate policies and regula ons that enable successful entrepreneurship support ecosystems.

- Policymakers should avoid regula ons that discourage new entrants and work towards building e cient methods for business startups. Policies and regula ons which help exis ng, leading firms over entrepreneurial ventures, limit compe on and obstruct growth/forma on of new companies.

- Therefore, in place of developing policies that are intended to improve market failures, policymakers should interact with entrepreneurs and understand the challenges faced by them. The feedback is used to develop policies which encourage exploring ideas, developing new products and increase the rates of deal flow.

- Entrepreneurial supporters ideally need to create a database that enables iden fying who the members in the ecosystem are and how they are connected. The ecosystem database are useful tools in developing engagement strategies.

- Disrup ons are inevitable in economic as well as social life. However, it's important to note that economic disrup on gives rise to entrepreneurial opportuni es. Architects of the entrepreneurship ecosystems (entrepreneurs, mentors, policymakers and consumers,) should an cipate these dips, thus capitalizing on the opportuni es they create.

8.5.6.5 Snapshot of the Entrepreneurship Ecosystem in India

Entrepreneurship has earned a newfound respect in India. Many Indians, with exposure to the world of business, who tradi onally would have opted for a job, are se ng up their own ventures. Many elements of the entrepreneurship ecosystem are beginning to come together. For example, increase in venture capitalists, government schemes and incubators, academia industry linkages, and emerging clusters and support to rural economy.

All these ini a ves are effec ve but there is a need to scale up and enrich the ecosystem further in the following ways:

1. We need to review our a tude towards failures and accept them as learning experiences.
2. We must encourage the educated to become entrepreneurs and provide students in schools and colleges with entrepreneurship skills.
3. Universi es, research labs and the government need to play the role of enablers in the entrepreneurship support ecosystem.
4. Policymakers need to focus on reducing the obstacles such as corrup on, red tape and bureaucracy.
5. We need to improve our legal systems and court interna onal venture capital firms and bring them to India.
6. We must devise policies and methods to reach the secondary and ter ary towns in India, where people do not have access to the same resources available in the ci es.

Today, there is a huge opportunity in this country to introduce innova ve solu ons that are capable of scaling up, and collabora ng within the ecosystem as well as enriching it.

8.5.6.6 Make in India Campaign

Every entrepreneur has certain needs. Some of their important needs are:

- To easily get loans
- To easily find investors
- To get tax exemp ons
- To easily access resources and good infrastructure
- To enjoy a procedure that is free of hassles and is quick
- To be able to easily partner with other firms

The Make in India campaign, launched by Prime Minister Modi aims to sa sfy all these needs of young, aspiring entrepreneurs. Its objec ve is to:

- Make investment easy
- Support new ideas
- Enhance skill development
- Safeguard the ideas of entrepreneurs
- Create state-of-the-art facili es for manufacturing goods

Tips

- Research the exis ng market, network with other entrepreneurs, venture capitalists, angel investors, and thoroughly review the policies in place to enable your entrepreneurship.
- Failure is a stepping stone and not the end of the road. Review yours and your peers' errors and correct them in your future venture.
- Be proac ve in your ecosystem. Iden fy the key features of your ecosystem and enrich them to ensure self-sustainability of your entrepreneurship support ecosystem.

8.5.7 Risk Appe te & Resilience

Entrepreneurship and Risk

Entrepreneurs are inherently risk takers. They are path-makers not path-takers. Unlike a normal, cau ous person, an entrepreneur would not think twice about qui ng his job (his sole income) and taking a risk on himself and his idea.

An entrepreneur is aware that while pursuing his dreams, assump ons can be proven wrong and unforeseen events may arise. He knows that a er dealing with numerous problems, success is s ll not guaranteed. Entrepreneurship is synonymous with the ability to take risks. This ability, called risk-appe te, is an entrepreneurial trait that is partly gene c and partly acquired.

What is Risk Appe te?

Risk appe te is defined as the extent to which a company is equipped to take risk, in order to achieve its objec ves. Essen ally, it refers to the balance, struck by the company, between possible profits and the hazards caused by changes in the environment (economic ecosystem, policies, etc.). Taking on more risk may lead to higher rewards but have a high probability of losses as well. However, being too conserva ve may go against the company as it can miss out on good opportuni es to grow and reach their objec ves.

The levels of risk appe te can be broadly categorized as "low", "medium" and "high." The company's entrepreneur(s) need to assess all possible alterna ves and choose the op on most likely to succeed. Companies have varying levels of risk appe tes for di erent objec ves. The levels depend on:

• The type of industry
• Market pressures
• Company objec ves

For example, a start-up with a revolu onary concept will have a very high risk appe te. The start-up can a ord short term failures before it achieves longer term success. This type of appe te will not remain constant and will be adjusted to account for the present circumstances of the company.

Risk Appe te Statement

Companies have to define and ar culate their risk appe te in sync with decisions made about their objec ves and opportuni es. The point of having a risk appe te statement is to have a framework that clearly states the acceptance and management of risk in business. It sets risk taking limits within the company. The risk appe te statement should convey the following:

• The nature of risks the business faces.
• Which risks the company is comfortable taking on and which risks are unacceptable.
• How much risk to accept in all the risk categories.
• The desired trade-o between risk and reward.
• Measures of risk and methods of examining and regula ng risk exposures.

Entrepreneurship and Resilience

Entrepreneurs are characterized by a set of quali es known as resilience. These quali es play an especially large role in the early stages of developing an enterprise. Risk resilience is an extremely valuable characteris c as it is believed to protect entrepreneurs against the threat of challenges and changes in the business environment.

What is Entrepreneurial Resilience?

Resilience is used to describe individuals who have the ability to overcome setbacks related to their life and career aspira ons. A resilient person is someone who is capable of easily and quickly recovering from setbacks. For the entrepreneur, resilience is a cri cal trait. Entrepreneurial resilience can be enhanced in the following ways:

- By developing a professional network of coaches and mentors
- By accep ng that change is a part of life
- By viewing obstacles as something that can be overcome

Characteris cs of a Resilient Entrepreneur

The characteris cs required to make an entrepreneur resilient enough to go the whole way in their business enterprise are:

- A strong internal sense of control
- Ability to diversify and expand
- Strong social connec ons
- Survivor a tude
- Skill to learn from setbacks
- Cash-flow conscious habits
- Ability to look at the bigger picture
- A en on to detail

Tips

- Cul vate a great network of clients, suppliers, peers, friends and family. This will not only help you promote your business, but will also help you learn, iden fy new opportuni es and stay tuned to changes in the market.
- Don't dwell on setbacks. Focus on what you need to do next to get moving again.
- While you should try, and curtail expenses, ensure that it is not at the cost of your growth.

8.5.8 Success & Failures

Understanding Successes and Failures in Entrepreneurship

Shyam is a famous entrepreneur, known for his success story. But what most people don't know, is that Shyam failed numerous mes before his enterprise became a success. Read his interview to get an idea of what entrepreneurship is really about, straight from an entrepreneur who has both, failed and succeeded.

Interviewer: Shyam, I have heard that entrepreneurs are great risk-takers who are never afraid of failing. Is this true?

Shyam: Ha ha, no of course it's not true! Most people believe that entrepreneurs need to be fearlessly enthusias c. But the truth is, fear is a very normal and valid human reac on, especially when you are planning to start your own business! In fact, my biggest fear was the fear of failing. The reality is, entrepreneurs fail as much as they succeed. The trick is to not allow the fear of failing to stop you from going ahead with your plans. Remember, failures are lessons for future success!

Interviewer: What, according to you, is the reason that entrepreneurs fail?

Shyam: Well, there is no one single reason why entrepreneurs fail. An entrepreneur can fail due to numerous reasons. You could fail because you have allowed your fear of failure to defeat you. You could fail because you are unwilling to delegate (distribute) work. As the saying goes, "You can do anything, but not everything!" You could fail because you gave up too easily – maybe you were not persistent enough. You could fail because you were focusing your energy on small, insignificant tasks and ignoring the tasks that were most important. Other reasons for failing are partnering with the wrong people, not being able to sell your product to the right customers at the right me at the right price…and many more reasons!

Interviewer: As an entrepreneur, how do you feel failure should be looked at?

Shyam: I believe we should all look at failure as an asset, rather than as some thing nega ve. The way I see it, if you have an idea, you should try to make it work, even if there is a chance that you will fail. That's because not trying is failure right there, anyway! And failure is not the worst thing that can happen. I think having regrets because of not trying, and wondering 'what if' is far worse than trying and actually failing.

Interviewer: How did you feel when you failed for the first me?

Shyam: I was completely heartbroken! It was a very painful experience. But the good news is, you do recover from the failure. And with every subsequent failure, the recovery process gets a lot easier. That's because you start to see each failure more as a lesson that will eventually help you succeed, rather than as an obstacle that you cannot overcome. You will start to realize that failure has many benefits.

Interviewer: Can you tell us about some of the benefits of failing?

Shyam: One of the benefits that I have experienced personally from failing is that the failure made me see things in a new light. It gave me answers that I didn't have before. Failure can make you a lot stronger. It also helps keep your ego in control.

Interviewer: What advice would you give entrepreneurs who are about to start their own enterprises?

Shyam: I would tell them to do their research and ensure that their product is something that is actually wanted by customers. I'd tell them to pick their partners and employees very wisely and cauᵗously. I'd tell them that it's very important to be aggressive – push and market your product as aggressively as possible. I would warn them that starᵗng an enterprise is very expensive and that they should be prepared for a situaᵗon where they run out of money. I would tell them to create long term goals and put a plan in acᵗon to achieve that goal. I would tell them to build a product that is truly unique. Be very careful and ensure that you are not copying another start-up. Lastly, I'd tell them that it's very important that they find the right investors.

Interviewer: That's some really helpful advice, Shyam! I'm sure this will help all entrepreneurs to be more prepared before they begin their journey! Thank you for all your insight!

Tips

- Remember that nothing is impossible.
- Idenᵗfy your mission and your purpose before you start.
- Plan your next steps – don't make decisions hasᵗly.

UNIT 8.6: Preparing to be an Entrepreneur

Unit Objec ves

At the end of this unit, you will be able to:

1. Discuss how market research is carried out
2. Describe the 4 Ps of marke ng
3. Discuss the importance of idea genera on
4. Recall basic business terminology
5. Discuss the need for CRM
6. Discuss the benefits of CRM
7. Discuss the need for networking
8. Discuss the benefits of networking
9. Discuss the importance of se ng goals
10. Di eren ate between short-term, medium-term and long-term goals
11. Discuss how to write a business plan
12. Explain the financial planning process
13. Discuss ways to manage your risk
14. Describe the procedure and formali es for applying for bank finance
15. Discuss how to manage your own enterprise
16. List important ques ons that every entrepreneur should ask before star ng an enterprise

8.6.1 Market Study/The 4 Ps of Marke ng/Importance of an IDEA

Understanding Market Research

Market research is the process of gathering, analysing and interpre ng market informa on on a product or service that is being sold in that market. It also includes informa on on:

- Past, present and prospec ve customers
- Customer characteris cs and spending habits
- The loca on and needs of the target market
- The overall industry
- Relevant compe tors

Market research involves two types of data:

- Primary informa on. This is research collected by yourself or by someone hired by you.
- Secondary informa on. This is research that already exists and is out there for you to find and use.

Primary research

Primary research can be of two types:

- Exploratory: This is open-ended and usually involves detailed, unstructured interviews.
- Specific: This is precise and involves structured, formal interviews. Conduc ng specific

Secondary research

Secondary research uses outside informa on. Some common secondary sources are:

- Public sources: These are usually free and have a lot of good informa on. Examples are government departments, business departments of public libraries etc.
- Commercial sources: These o er valuable informa on but usually require a fee to be paid. Examples are research and trade associa ons, banks and other financial ins tu ons etc.
- Educa onal ins tu ons: These o er a wealth of informa on. Examples are colleges, universi es, technical ins tutes etc.

8.6.1.1 The 4 Ps of Marke ng

The 4 Ps of marke ng are Product, Price, Promo on and Place.

Let's look at each of these 4 Ps in detail.

Product

A product can be tangible, like a good or intangible, like a service.

Whatever your product is, it is cri cal that you have a clear understanding of what you are o ering, and what its unique characteris cs are, before you begin with the marke ng process.

Some ques ons to ask yourself are:
- What need does the customer have for the product/service?
- What needs does it sa sfy?
- Are there any more features that can be added?
- Does it have any expensive and unnecessary features?
- How will customers use it?
- What should it be called?
- How is it di erent from similar products?
- How much will it cost to produce?
- Can it be sold at a profit?

Price

Once all the elements of Product have been established, the Price factor needs to be considered. The Price of a Product will depend on several factors such as profit margins, supply, demand and the marke ng strategy.

Some typical ques ons to ask yourself include:

- What is the value of the product/service to customers?
- Do local products/services have established price points?
- Is the customer price sensi ve?
- Should discounts be o ered?
- How is your price compared to that of your compe tors?

Promo on

Once you are certain about your Product and your Price, the next step is to look at ways to promote it. Some key elements of promo on are adver sing, public rela ons, social media marke ng, email marke ng, search engine marke ng, video marke ng and more.

Some ques ons to ask yourself are:

- Where should you promote your product or service?
- What is the best medium to use to reach your target audience
- When would be the best me to promote your product?
- How are your compe tors promo ng their products?

Place

According to most marketers, the basis of marke ng is about o ering the right product, at the right price, at the right place, at the right me. For this reason, selec ng the best possible loca on is cri cal for conver ng prospec ve clients into actual clients.

Some ques ons to ask yourself are:

- Will your product or service be looked for in a physical store, online or both?
- What should you do to access the most appropriate distribu on channels?
- Will you require a sales force?
- Where are your compe tors o ering their products or services?
- Should you follow in your compe tors' footsteps?
- Should you do something di erent from your compe tors?

Importance of an IDEA

Ideas are the founda on of progress. An idea can be small or ground-breaking, easy to accomplish or extremely complicated to implement. Whatever the case, the fact that it is an idea gives it merit. Without ideas, nothing is possible. Most people are afraid to speak out their ideas, out for fear of being ridiculed. However, if are an entrepreneur and want to remain compe ve and innova ve, you need to bring your ideas out into the light.

Some ways to do this are by:

- Establishing a culture of brainstorming where you invite all interested par es to contribute
- Discussing ideas out loud so that people can add their ideas, views, opinions to them

- Being open minded and not limi ng your ideas, even if the idea who have seems ridiculous
- Not discarding ideas that you don't work on immediately, but instead making a note of them and shelving them so they can be revisited at a later date.

Tips

- Keep in mind that good ideas do not always have to be unique.
- Remember that ming plays a huge role in determining the success of your idea.
- Situa ons and circumstances will always change, so be flexible and adapt your idea accordingly.

8.6.2 Business En ty Concepts: Basic Business Terminology

If your aim is to start and run a business, it is crucial that you have a good understanding of basic business terms. Every entrepreneur should be well versed in the following terms:

- Accoun ng: A systema c method of recording and repor ng financial transac ons.
- Accounts payable: Money owed by a company to its creditors.
- Accounts Receivable: The amount a company is owed by its clients.
- Assets: The value of everything a company owns and uses to conduct its business.
- Balance Sheet: A snapshot of a company's assets, liabili es and owner's equity at a given moment.
- Bo om Line: The total amount a business has earned or lost at the end of a month.
- Business: An organiza on that operates with the aim of making a profit.
- Business to Business (B2B): A business that sells goods or services to another business.
- Business to Consumer (B2C): A business that sells goods or services directly to the end user.
- Capital: The money a business has in its accounts, assets and investments. The two main types of capital are debt and equity.
- Cash Flow: The overall movement of funds through a business each month, including income and expenses.
- Cash Flow Statement: A statement showing the money that entered and exited a business during a specific period of me.
- Contract: A formal agreement to do work for pay.
- Deprecia on: The degrading value of an asset over me.
- Expense: The costs that a business incurs through its opera ons.
- Finance: The management and alloca on of money and other assets.
- Financial Report: A comprehensive account of a business' transac ons and expenses.
- Fixed Cost: A one- me expense.

- Income Statement (Profit and Loss Statement): Shows the profitability of a business during a period of me.
- Liabili es: The value of what a business owes to someone else.
- Marke ng: The process of promo ng, selling and distribu ng a product or service.
- Net Income/Profit: Revenues minus expenses.
- Net Worth: The total value of a business.
- Payback Period: The amount of me it takes to recover the ini al investment of a business.
- Profit Margin: The ra o of profit, divided by revenue, displayed as a percentage.
- Return on Investment (ROI): The amount of money a business gets as return from an investment.
- Revenue: The total amount of income before expenses are subtracted.
- Sales Prospect: A poten al customer.
- Supplier: A provider of supplies to a business.
- Target Market: A specific group of customers at which a company's products and services are aimed.
- Valua on: An es mate of the overall worth of the business.
- Variable Cost: Expenses that change in propor on to the ac vity of a business.
- Working Capital: Calculated as current assets minus current liabili es.

8.6.3 CRM & Networking

What is CRM?

CRM stands for Customer Rela onship Management. Originally the expression Customer Rela onship Management meant managing one's rela onship with customers. However, today it refers to IT systems and so ware designed to help companies manage their rela onships.

The Need for CRM

The be er a company can manage its rela onships with its customers, the higher the chances of the company's success. For any entrepreneur, the ability to successfully retain exis ng customers and expand the enterprise is paramount. This is why IT systems that focus on addressing the problems of dealing with customers on a daily basis are becoming more and more in demand.

Customer needs change over me, and technology can make it easier to understand what customers really want. This insight helps companies to be more responsive to the needs of their customers. It enables them to modify their business opera ons when required, so that their customers are always served in the best manner possible. Simply put, CRM helps companies recognize the value of their clients and enables them to capitalize on improved customer rela ons.

Benefits of CRM

CRM has a number of important benefits:
- It helps improve rela ons with exis ng customers which can lead to:
    o Increased sales
    o Iden fica on of customer needs
    o Cross-selling of products
- It results in be er marke ng of one's products or services
- It results in be er marke ng of one's products or service s
- It enhances customer sa sfac on and reten on
- It improves profitability by iden fying and focusing on the most profitable customers

8.6.3.1 What is Networking?

In business, networking means leveraging your business and personal connec ons in order to bring in a regular supply of new business. This marke ng method is e ec ve as well as low cost. It is a great way to develop sales opportuni es and contacts. Networking can be based on referrals and introduc ons, or can take place via phone, email, and social and business networking websites.

The Need for Networking

Networking is an essen al personal skill for business people, but it is even more important for entrepreneurs. The process of networking has its roots in rela onship building. Networking results in greater communica on and a stronger presence in the entrepreneurial ecosystem. This helps build strong rela onships with other entrepreneurs.

Business networking events held across the globe play a huge role in connec ng like -minded entrepreneurs who share the same fundamental beliefs in communica on, exchanging ideas and conver ng ideas into reali es. Such networking events also play a crucial role in connec ng entrepreneurs with poten al investors. Entrepreneurs may have vast ly di erent experiences and backgrounds but they all have a common goal in mind – they all seek connec on, inspira on, advice, opportuni es and mentors. Networking o ers them a pla orm to do just that.

Benefits of Networking

Networking o ers numerous benefits for entrepreneurs. Some of the major benefits are:
- Ge ng high quality leads
- Increased business opportuni es
- Good source of relevant connec ons
- Advice from like-minded entrepreneurs
- Gaining visibility and raising your profile
- Mee ng posi ve and enthusias c people

- Increased self-confidence
- Sa sfac on from helping others
- Building strong and las ng friendships

Tips ⚲

- Use social media interac ons to iden fy needs and gather feedback.
- When networking, ask open-ended ques ons rather than yes/no type ques ons.

8.6.4 Business Plan: Why Set Goals?

Se ng goals is important because it gives you long-term vision and short-term mo va on. Goals can be short term, medium term and long term.

Short-Term Goals

- These are specific goals for the immediate future.

Example: Repairing a machine that has failed.

Medium-Term Goals

- These goals are built on your short-term goals.
- They do not need to be as specific as your short-term goals.

Example: Arranging for a service contract to ensure that your machines don't fail again.

Long-Term Goals

These goals require me and planning.

They usually take a year or more to achieve.

Example: Planning your expenses so you can buy new machinery

Why Create a Business Plan?

A business plan is a tool for understanding how your business is put together. It can be used to monitor progress, foster accountable and control the fate of the business. It usually o ers a 3-5year projec on and outlines the plan that the company intends to follow to grow its revenues. A business plan is also a very important tool for ge ng the interest of key employees or future investors.

A business plan typically comprises of eight elements.

8.6.4.1 Elements of a Business Plan

Execu ve Summary

The execu ve summary follows the tle page. The summary should clearly state your desires as the business owner in a short and business like way. It is an overview of your business and your plans. Ideally this should not be more than 1-2 pages.

Your Execu ve Summary should include:

*   The Mission Statement: Explain what your business is all about.

    Example: Nike's Mission Statement

    Nike's mission statement is "To bring inspira on and innova on to every athlete in the world."

*   Company Informa on: Provide informa on like when your business was formed, the names and roles of the founders, the number of employees, your business loca on(s) etc.

*   Growth Highlights: Men on examples of company growth. Use graphs and charts where possible.

*   Your Products/Services: Describe the products or services provided.

*   Financial Informa on: Provide details on current bank and investors.

*   Summarize future plans: Describe where you see your business in the future.

Business Descrip on

The second sec on of your business plan needs to provide a detailed review of the di erent elements of your business. This will help poten al investors to correctly understand your business goal and the uniqueness of your o ering.

Your Business Descrip on should include:

*   A descrip on of the nature of your business

*   The market needs that you are aiming to sa sfy

*   The ways in which your products and services meet these needs

*   The specific consumers and organiza ons that you intend to serve

*   Your specific compe ve advantages

Market Analysis

The market analysis sec on usually follows the business descrip on. The aim of this sec on is to showcase your industry and market knowledge. This is also the sec on where you should lay down your research findings and conclusions.

Your Market Analysis should include:

*   Your industry descrip on and outlook

*   Informa on on your target market

*   The needs and demographics of your target audience

*   The size of your target market

- The amount of market share you want to capture
- Your pricing structure
- Your compe ve analysis
- Any regulatory requirements

Organiza on & Management

This sec on should come immediately a er the Market Analysis. Your Organiza on & Management sec on should include:

- Your company's organiza onal structure
- Details of your company's ownership
- Details of your management team
- Qualifica ons of your board of directors
- Detailed descrip ons of each division/department and its func on
- The salary and benefits package that you o er your people

Service or Product Line

The next sec on is the service or product line sec on. This is where you describe your service or product, and stress on their benefits to poten al and current customers. Explain in detail why your product of choice will fulfil the needs of your target audience.

Your Service or Product Line sec on should include:

- A descrip on of your product/service
- A descrip on of your product or service's life cycle
- A list of any copyright or patent filings
- A descrip on of any R&D ac vi es that you are involved in or planning

Marke ng & Sales

Once the Service or Product Line sec on of your plan has been completed, you should start on the descrip on of the marke ng and sales management strategy for your business.

Your Marke ng sec on should include the following strategies:

- Market penetra on strategy: This strategy focuses on selling your exis ng products or services in exis ng markets, in order to increase your market share.
- Growth strategy: This strategy focuses on increasing the amount of market share, even if it reduces earnings in the short-term.
- Channels of distribu on strategy: These can be wholesalers, retailers, distributers and even the internet.
- Communica on strategy: These can be wri en strategies (e-mail, text, chat), oral strategies (phone calls, video chats, face-to-face conversa ons), non-verbal strategies (body language, facial expressions, tone of voice) and visual strategies (signs, webpages, illustra ons).

Your Sales sec on should include the following informa on:

- A salesforce strategy: This strategy focuses on increasing the revenue of the enterprise.
- A breakdown of your sales ac vi es: This means detailing out how you intend to sell your products or services – will you sell it o ine or online, how many units do you intend to sell, what price do you plan to sell each unit at, etc.

Funding Request

This sec on is specifically for those who require funding for their venture. The Funding Request sec on should include the following informa on:

- How much funding you currently require.
- How much funding you will require over the next five years. This will depend on your long-term goals.
- The type of funding you want and how you plan to use it. Do you want funding that can be used only for a specific purpose, or funding that can be used for any kind of requirement?
- Strategic plans for the future. This will involve detailing out your long-term plans – what these plans are and how much money you will require to put these plans in mo ons.
- Historical and prospec ve financial informa on. This can be done by crea ng and maintaining all your financial records, right from the moment your enterprise started, to the present day. Documents required for this are your balance sheet which contains details of your company's assets and liabili es, your income statement which lists your company's revenues, expenses and net income for the year, your tax returns (usually for the last three years) and your cash flow budget which lists the cash that came in, the cash that went out and states whether you had a cash deficit (nega ve balance) or surplus (posi ve balance) at the end of each month.

Financial Planning

Before you begin building your enterprise, you need to plan your finances. Take a look at the steps for financial planning:

- **Step 1:** Create a financial plan. This should include your goals, strategies and melines for accomplishing these goals.
- **Step 2:** Organize all your important financial documents. Maintain a file to hold your investment details, bank statements, tax papers, credit card bills, insurance papers and any other financial records.
- **Step 3:** Calculate your net worth. This means figure out what you own (assets like your house, bank accounts, investments etc.), and then subtract what you owe (liabili es like loans, pending credit card amounts etc.) the amount you are le with is your net worth.
- **Step 4:** Make a spending plan. This means write down in detail where your money will come from, and where it will go.
- **Step 5:** Build an emergency fund. A good emergency fund contains enough money to cover at least 6 months' worth of expenses.
- **Step 6:** Set up your insurance. Insurance provides long term financial security and protects you against risk.

Risk Management

As an entrepreneur, it is cri cal that you evaluate the risks involved with the type of enterprise that you want to start, before you begin se ng up your company. Once you have iden fied poten al risks, you can take steps to reduce them. Some ways to manage risks are:

- Research similar business and find out about their risks and how they were minimized.
- Evaluate current market trends and find out if similar products or services that launched a while ago are s ll being well received by the public.
- Think about whether you really have the required exper se to launch your product or service.
- Examine your finances and see if you have enough income to start your enterprise.
- Be aware of the current state of the economy, consider how the economy may change over me, and think about how your enterprise will be a ected by any of those changes.
- Create a detailed business plan.

Tips

- Ensure all the important elements are covered in your plan.
- Scru nize the numbers thoroughly.
- Be concise and realis c.
- Be conserva ve in your approach and your projec ons.
- Use visuals like charts, graphs and images wherever possible.

8.6.5 Procedure and Formali es for Bank Finance

The Need for Bank Finance

For entrepreneurs, one of the most di cult challenges faced involves securing funds for start - ups. With numerous funding op ons available, entrepreneurs need to take a close look at which funding methodology works best for them. In India, banks are one of the largest funders of start-ups, o ering funding to thousands of start-ups every year.

8.6.5.1 What Informa on Should Entrepreneurs O er Banks for Funding?

When approaching a bank, entrepreneurs must have a clear idea of the di erent criteria that banks use to screen, rate and process loan applica ons. Entrepreneurs must also be aware of the importance of providing banks with accurate and correct informa on. It is now easier than ever for financial ins tu ons to track any default behaviour of loan applicants. Entrepreneurs looking for funding from banks must provide banks with informa on rela ng to their general creden als, financial situa on and guarantees or collaterals that can be o ered.

General Creden als

This is where you, as an entrepreneur, provide the bank with background informa on on yourself. Such informa on includes:

- Le er(s) of Introduc on: This le er should be wri en by a respected business person who knows you well enough to introduce you. The aim of this le er is set across your achievements and vouch for your character and integrity.

- Your Profile: This is basically your resume. You need to give the bank a good idea of your educa onal achievements, professional training, qualifica ons, employment record and achievements.

- Business Brochure: A business brochure typically provides informa on on company products, clients, how long the business has been running for etc.

- Bank and Other References: If you have an account with another bank, providing those bank references is a good idea.

- Proof of Company Ownership or Registra on: In some cases, you may need to provide the bank with proof of company ownership and registra on. A list of assets and liabili es may also be required.

Financial Situa on

Banks will expect current financial informa on on your enterprise. The standard financial reports you should be prepared with are:

- Balance Sheet
- Cash-Flow Statement
- Business Plan
- Profit-and-Loss Account
- Projected Sales and Revenues
- Feasibility Study

Guarantees or Collaterals

Usually banks will refuse to grant you a loan without security. You can o er assets w hich the bank can seize and sell o   if you do not repay the loan. Fixed assets like machinery, equipment, vehicles etc. are also considered to be security for loans.

8.6.5.2 The Lending Criteria of Banks

Your request for funding will have a higher chance of success if you can sa sfy the following lending criteria:

- Good cash flow
- Adequate shareholders' funds
- Adequate security
- Experience in business
- Good reputa on

The Procedure

To apply for funding the following procedure will need to be followed.

- Submit your applica on form and all other required documents to the bank.

- The bank will carefully assess your credit worthiness and assign ra ngs by analysing your business informa on with respect to parameters like management, financial, opera onal and industry informa on as well as past loan performance.

- The bank will make a decision as to whether or not you should be given funding.

Tips

- Get advice on funding op ons from experienced bankers.

- Be cau ous and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

8.6.6 Enterprise Management - An Overview

To manage your enterprise e ec vely you need to look at many di erent aspects, right from managing the day-to-day ac vi es to figuring out how to handle a large-scale event. Let's take a look at some simple steps to manage your company e ec vely.

Step 1: Use your leadership skills and ask for advice when required.

Let's take the example of Ramu, an entrepreneur who has recently started his own enterprise. Ramu has good leadership skills – he is honest, communicates well, knows how to delegate work etc. These leadership skills definitely help Ramu in the management of his enterprise. However, some mes Ramu comes across situa ons that he is unsure how to handle. What should Ramu do in this case? One solu on is for him to find a more experienced manager who is willing to mentor him. Another solu on is for Ramu to use his networking skills so that he can connect with managers from other organiza ons, who can give him advice on how to handle such situa ons.

Step 2: Divide your work amongst others – realize that you cannot handle everything yourself.

Even the most skilled manager in the world will not be able to manage every single task that an enterprise will demand of him. A smart manager needs to realize that the key to managing his enterprise lies in his dividing all his work between those around him. This is known as delega on. However, delega ng is not enough. A manager must delegate e ec vely if he wants to see results. This is important because delega ng, when done incorrectly, can result in you crea ng even more work for yourself. To delegate e ec vely, you can start by making two lists. One list should contain the things that you know you need to handle yourself. The second list should contain the things that you are confident can be given to others to manage and handle.

Besides incorrect delega on, another issue that may arise is over-delega on. This means giving away too many of your tasks to others. The problem with this is, the more tasks you delegate, the more me you will spend tracking and monitoring the work progress of those you have handed the tasks to. This will leave you with very li le me to finish your own work.

Step 3: Hire the right people for the job.

Hiring the right people goes a long way towards e ec vely m anaging your enterprise. To hire the best people suited for the job, you need to be very careful with your interview process. You should ask poten al candidates the right ques ons and evaluate their answers carefully. Carrying out background checks is always a good prac ce. Running a credit check is also a good idea, especially if the people you are planning to hire will be handling your money. Create a detailed job descrip on for each role that you want filled and ensure that all candidates have a clear and correct understanding of the job descrip on. You should also have an employee manual in place, where you put down every expecta on that you have from your employees. All these ac ons will help ensure that the right people are approached for running your enterprise.

Step 4: Mo vate your employees and train them well.

Your enterprise can only be managed e ec vely if your employees are mo vated to work hard for your enterprise. Part of being mo vated involves your employees believing in the vision and mission of your enterprise and genuinely wan ng to make e orts towards pursuing the same. You can mo vate your employees with recogni on, bonuses and rewards for achievements. You can also mo vate them by telling them about how their e orts hav e led to the company's success. This will help them feel pride and give them a sense of responsibility that will increase their mo va on. Besides mo va ng your people, your employees should be constantly trained in new prac ces and technologies. Remember, training is not a one- me e ort. It is a consistent e ort that needs to be carried out regularly.

Step 5: Train your people to handle your customers well.

Your employees need to be well-versed in the art of customer management. This means they should be able to understand what their customers want, and also know how to sa sfy their needs. For them to truly understand this, they need to see how you deal e ec vely with customers.

This is called leading by example. Show them how you sincerely listen to your clients and the e orts that you put into understand their requirements. Let them listen to the type of ques ons that you ask your clients so they understand which ques ons are appropriate.

Step 6: Market your enterprise e ec vely.

Also, hire a marke ng agency if you feel you need help in this area. Now that you know what is required to run your enterprise e ec vely, put these steps into play, and see how much easier managing your enterprise becomes!

Tips

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

8.6.7 Considering Entrepreneurship

Questions to ask yourself before considering entrepreneurship.

1. Why am I starting a business?
2. What problem am I solving?
3. Have others attempted to solve this problem before? Did they succeed or fail?
4. Do I have a mentor1 or industry expert that I can call on?
5. Who is my ideal customer2?
6. Who are my competitors3?
7. What makes my business idea different from other business ideas?
8. What are the key features of my product or service?
9. Have I done a SWOT4 analysis?
10. What is the size of the market that will buy my product or service?
11. What would it take to build a minimum viable product5 to test the market?
12. How much money do I need to get started?
13. Will I need to get a loan?
14. How soon will my products or services be available?
15. When will I break even6 or make a profit?
16. How will those who invest in my idea make a profit?
17. How should I set up the legal structure7 of my business?
18. What taxes8 will I need to pay?
19. What kind of insurance9 will I need?
20. Have I reached out to potential customers for feedback

Tips

- It is very important to validate your business ideas before you invest significant time, money and resources into it.
- The more questions you ask yourself, the more prepared you will be to handle to highs and lows of starting an enterprise.

Footnotes:

1. A mentor is a trusted and experienced person who is willing to coach and guide you.

2. A customer is someone who buys goods and/or services.

3. A compe tor is a person or company that sells products and/or services similar to your products and/or services.

4. SWOT stands for Strengths, Weaknesses, Opportuni es and Threats. To cond uct a SWOT analysis of your company, you need to list down all the strengths and weaknesses of your company, the opportuni es that are present for your company and the threats faced by your company.

5. A minimum viable product is a product that has the fewest possible features, that can be sold to customers, for the purpose of ge ng feedback from customers on the product.

6. A company is said to break even when the profits of the company are equal to the costs.

7. The legal structure could be a sole proprietorshi p, partnership or limited liability partnership.

8. There are two types of taxes – direct taxes payable by a person or a company, or indirect taxes charged on goods and/or services.

9. There are two types of insurance – life insurance and general insurance. Life insurance overs human life while general insurance covers assets like animals, goods, cars etc.

Notes

Skill India
कौशल भारत - कुशल भारत

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP
सत्यमेव जयते

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI
Skilling India in Electronics

Address : 602-608, 6th Floor, Ansal Chambers-II. Bhikaji Cama Place,
New Delhi-110066

Email : info@essc-india.org

Website : www.essc-india.org

Phone : +91-11-46035050

Price: ₹