**What is a computer?**

A **computer** is an electronic device that accepts data from the user, processes it, produces results, displays them to the users, and stores the results for future usage.

**Data** is a collection of unorganized facts & figures and does not provide any further information regarding patterns, context, etc. Hence data means "unstructured facts and figures".

**Information** is a structured data i.e. organized meaningful and processed data. To process the data and convert into information, a computer is used.

**Functions of Computers**

A computer performs the following functions:

**Receiving Input**

Data is fed into computer through various input devices like keyboard, mouse, digital pens, etc. Input can also be fed through devices like CD-ROM, pen drive, scanner, etc.

**Processing the information**

Operations on the input data are carried out based on the instructions provided in the programs.

**Storing the information**

After processing, the information gets stored in the primary or secondary storage area.

**Producing output**

The processed information and other details are communicated to the outside world through output devices like monitor, printer, etc.

**Generations of Computer**: With the advent of your time, the modern computer began to take shape. The development of the computer had begun in the sixteenth century. Many alterations were made to the original computer, presumably for the better. It kept improving in terms of speed, accuracy, size, and cost in order to push the boundaries of the modern, stylish computer.

1. **First Generation Computers**

The technology behind the primary generation computers was a fragile glass device, which was called a vacuum tube. These computers were very heavy and really large. These weren't very reliable and programming on them was a tedious task as they used low-level programming language and used no OS. First-generation computers were used for calculation, storage, and control purpose. They were too bulky and large that they needed a full room and consume a lot of electricity. Punch cards were used for improving the information for external storage. Magnetic card used. Machine and assembly language is developed.

**\*\*Examples of some main first-generation computers are mentioned below.**

- **ENIAC:** Electronic Numerical Integrator and Computer, built by J. Presper Eckert and John V. Mauchly was a general-purpose computer. It had been cumbersome, and large, and contained 18,000 vacuum tubes.

- **EDVAC:** Electronic Discrete Variable Automatic Computer was designed by von Neumann. It could store data also as instruction and thus the speed was enhanced.

- **UNIVAC:** Universal Automatic Computer was developed in 1952 by Eckert and Mauchly.

**\*\*Characteristics of First-Generation**

| Computers Characteristics | Components |
| --- | --- |
| Main electronic component | Vacuum tube. |
| Programming language | Machine language. |
| Main memory | Magnetic tapes and magnetic drums. |
| Input/output devices | Paper tape and punched cards. |
| Speed and size | Very slow and very large (often taking up an entire room). |
| Examples of the first generation | IBM 650, IBM 701, ENIAC, UNIVAC1, etc. |

Third Generation Computers

**2. Second Generation Computers**

The second generation of computers featured transistors, a semiconductor-based device that controlled circuits and amplified signals. Bell Laboratories invented transistors, enabling powerful performance and reducing heat, size, and cost. Other features included input/output units, memory, programming languages, and CPUs, making programming easier.

**\*\*Characteristics of Second-Generation**

| Characteristics | Components |
| --- | --- |
| Main electronic component | Transistor. |
| Programming language | Machine language and assembly language. |
| Memory | Magnetic core and magnetic tape/disk. |
| Input/output devices | Magnetic tape and punched cards. |

| | |
|---|---|
| Power and size | Smaller in size, had low power consumption, and generated less heat (in comparison with the first-generation computers). |
| Examples of the second generation | PDP-8, IBM1400 series, IBM 7090 and 7094, UNIVAC 1107, CDC 3600, etc. |

## 2. Third Generation Computers

Third-generation technology shifted from massive transistors to integrated circuits (ICs), focusing on speed and dependability. ICs, made from silicon chips, included transistors, registers, and capacitors. Memory space and efficiency improved, and value size decreased. Higher-level programming languages like BASIC were obsolete, and minicomputers began to take shape. Operating systems managed multiple tasks simultaneously.

**Characteristics of Third-Generation Computers**

| Characteristics | Components |
|---|---|
| Main electronic component | Integrated circuits (ICs). |
| Programming language | High-level language. |
| Memory | Large magnetic core, magnetic tape/disk. |
| Input/output devices | Magnetic tape, monitor, keyboard, printer, etc. |
| Examples of the third generation | IBM 360, IBM 370, PDP-11, NCR 395, B6500, UNIVAC 1108, etc. |

## 4. Fourth Generation Computers

In 1971, the first microprocessors were used, allowing for a single chip to house all necessary arithmetic, logic, and control operations. Microcomputers evolved to smaller, more compact models, eventually replacing LSI circuits with Very Large Scale Integrated (VLSI) circuits. The Intel 4004 chip, created in 1971, reduced size and introduced technologies like virtual memory, operating speed, time-sharing, multiprocessing, and multiprogramming.

**Characteristics of Fourth-Generation Computers**

| Characteristics | Components |
|---|---|
| Main electronic component | Very-large-scale integration (VLSI) and the microprocessor (VLSI has thousands of transistors on a single microchip). |
| Memory | semiconductor memory (such as RAM, ROM, etc.). |
| Input/output devices | pointing devices, optical scanning, keyboard, monitor, printer, etc. |
| Examples of the fourth generation | IBM PC, STAR 1000, APPLE II, Apple Macintosh, Alter 8800, etc. |

## 5. Fifth Generation Computers

Artificial Intelligence, the technology behind the fifth generation of computers, enables them to mimic human behaviour in various fields like voice recognition, medical, entertainment, and gaming. These computers offer faster speeds, smaller sizes, and a wider range of applications. While progress has been made in precision and speed, dimensions have not significantly changed over time.

**Characteristics of Fifth-Generation Computers**

| Characteristics | Components |
|---|---|
| Main electronic component | Based on artificial intelligence, uses the Ultra Large-Scale Integration (ULSI) technology and parallel processing method (ULSI has millions of transistors on a single microchip and the Parallel processing method use two or more microprocessors to run tasks simultaneously). |
| Language | Understand natural language (human language). |
| Size | Portable and small in size. |

| | |
|---|---|
| Input/output device | Trackpad (or touchpad), touchscreen, pen, speech input (recognize voice/speech), light scanner, printer, keyboard, monitor, mouse, etc. |
| Example of the fifth generation | Desktops, laptops, tablets, smartphones, etc. |

**\*\*Characteristics of Computer System**

The characteristics of the computer system are as follows:
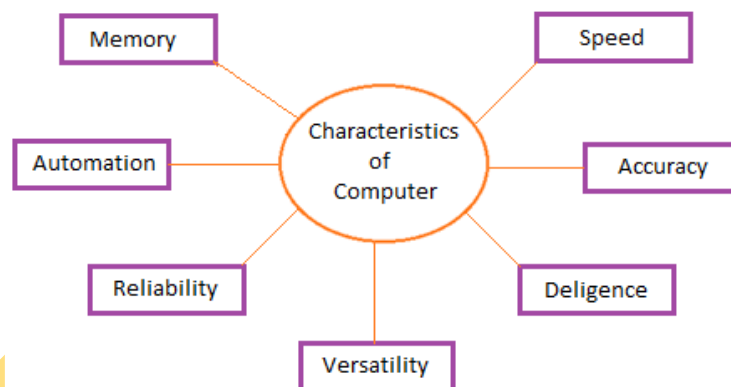


**Speed**

A computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

**Accuracy**

Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

**Diligence**

A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration. Its memory also makes it superior to that of human beings.

**Versatility**

Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

**Reliability**

A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result.

**Automation**

Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

**Memory**

A computer has built-in memory called primary memory where it stores data. Secondary storage are removable devices such as CDs, pen drives, etc., which are also used to store data.

**Basic Applications of Computer**

Computers play a role in every field of life. They are used in homes, business, educational institutions, research organizations, medical field, government offices, entertainment, etc.

**Home**

Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

**Medical Field**

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

**Entertainment**

Computers help to watch movies online, play games online; act as a virtual entertainer in playing games, listening to music, etc. MIDI instruments greatly help people in the entertainment industry in recording music with artificial instruments. Videos can be fed from computers to full screen televisions. Photo editors are available with fabulous features.

**Industry**

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

**Education**

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

**Government**

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.

**Banking**

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

**Business**

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

**Training**

Many organizations use computer-based training to train their employees, to save money and improve performance. Video conferencing through computers allows saving of time and travelling costs by being able to connect people in various locations.
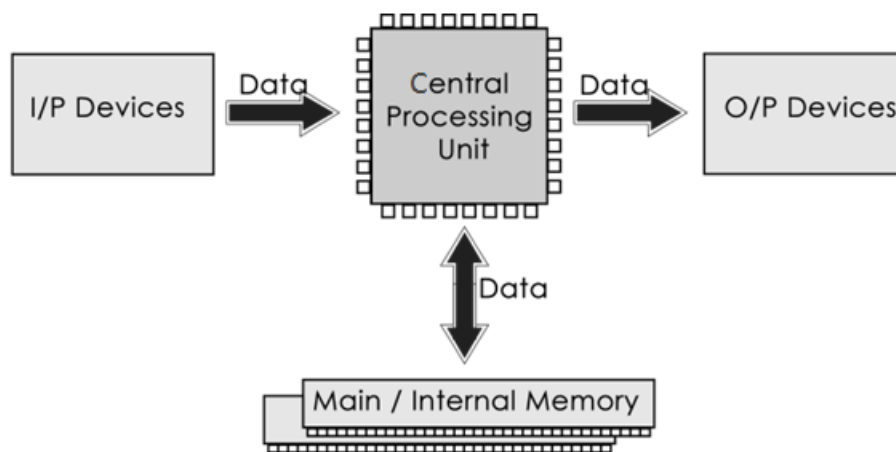
**Arts**

Computers are extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

**Science and Engineering**

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyse data to have a better understanding of earthquakes.

## Components of Computer System

Computer systems consist of three components as shown in below image: **Central Processing Unit, Input devices** and **Output devices**. Input devices provide data input to processor, which processes data and generates useful information that's displayed to the user through output devices. This is stored in computer's memory.



## Central Processing Unit

The Central Processing Unit (CPU) is called "the brain of computer" as it controls operation of all parts of computer. It consists of two components: Arithmetic Logic Unit (ALU), and Control Unit.
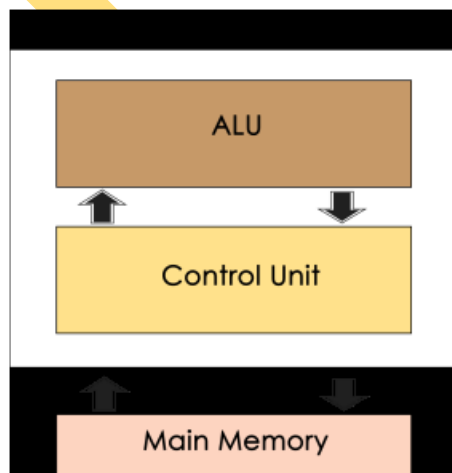


## Arithmetic Logic Unit (ALU)

Data entered into computer is sent to RAM, from where it is then sent to ALU, where rest of data processing takes place. All types of processing, such as comparisons, decision-making and processing of non-numeric information takes place here and once again data is moved to RAM.

**Control Unit**

As name indicates, this part of CPU extracts instructions, performs execution, maintains and directs operations of entire system.

**Functions of Control Unit**

Control unit performs following functions:

- ❖ It controls all activities of computer
- ❖ Supervises flow of data within CPU
- ❖ Directs flow of data within CPU
- ❖ Transfers data to Arithmetic and Logic Unit
- ❖ Transfers results to memory
- ❖ Fetches results from memory to output devices

**Memory Unit**

This is unit in which data and instructions given to computer as well as results given by computer are stored. Unit of memory is "Byte".

---

**1 Byte = 8 Bits**

---

**Input Devices –**

The devices which are used to give input to the computer system are known as input devices. Data is inputted into the computer system in raw format, which is then translated into a computer-understandable form using input devices; after that, it is processed using a central processing unit, which produces output. In another form, an input device is a type of peripheral device that allows users to interact with the computer system.

Following is some of the important input devices which are used in a computer −

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Reader

- Optical Mark Reader(OMR)

**Keyboard**

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.



Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows –

| Sr. No | Keys & Description |
|---|---|
| 1 | **Typing Keys** <br> These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters. |
| 2 | **Numeric Keypad** <br> It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators. |
| 3 | **Function Keys** <br> The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose. |
| 4 | **Control keys** |

| | |
|---|---|
| | These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc). |
| **5** | **Special Purpose Keys** Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen. |

**Mouse**

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

**Advantages**

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of the keyboard.


- **Joystick**

  Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

- **Light Pen**

  Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

  

  When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

- **Track Ball**

  Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.

- Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button, or a square.

- **Scanner**

  Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.



  Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

- **Digitizer**

  Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.

- 
- Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.
- Microphone

  Microphone is an input device to input sound that is then stored in a digital form.



  The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

- **Magnetic Ink Card Reader (MICR)**

  MICR input device is generally used in banks as there are large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

- This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

- **Optical Character Reader (OCR)**

  OCR is an input device used to read a printed text.



-

- OCR scans the text optically, character by character, converts them into a machine-readable code, and stores the text on the system memory.

- **Bar Code Readers**

  ar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

- **Optical Mark Reader (OMR)**
- OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked.



- It is specially used for checking the answer sheets of examinations having multiple choice questions.

**OUTPUT DEVICES:**

1. Monitors
2. Graphic Plotter
3. Printer

**Monitors**

Monitors, commonly called as Visual Display Unit VDU, are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

**\*\*There are two kinds of viewing screen used for monitors.**

Cathode-Ray Tube

CRT Flat- Panel

**Display Cathode-Ray Tube CRT Monitor**

the CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution. It takes more than one illuminated pixel to form whole character, such as the letter 'e' in the word help. A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

**There are some disadvantages of CRT**

- Large in Size
- High power consumption

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.



**Components of Cathode-Ray Tube (CRT) Monitor**

The key components of a CRT Monitor are as follows −

- Electron Guns − Produces beams of electrons to display images
- Phosphorescent Screen − Once electrons hit on phosphor-coated screen, it glows and makes visibility
- Circuit Board − Provides connectivity for external circuitry

- Deflection Yoke − It deflects the electron beam in precise patterns

**Advantages**

- Produces output with visual effects.

- It has good resolutions which ensure proper visibility of image-related outputs.

- No motion blur due to instant response time.

- It can display multiple resolutions without scaling artefacts.

- It has high refresh rates which reduces flicker and eye strain.

**Disadvantages**

- Large in Size

- Carries high weight

- A lot of power consumption

- Produces heat

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirements in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computers, and graphics displays.



The flat-panel display is divided into two categories −

- **Emissive Displays** − Emissive displays are devices that convert electrical energy into light. For example, plasma panels and LED (Light-Emitting Diodes).

- **Non-Emissive Displays** − Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

### Components of Flat-Panel Display Monitor

The key components of a Flat-Panel Display Monitor are as follows −

- Liquid Crystal Display (LCD) − It is positioned between two layers of glass or plastic and modulates light to create images.
- Light Emitting Diode (LED) − it emits light and improves colour and contrast.
- Plasma Display Panel (PDP) − It contains small cells with phosphor coated to emit light.
- Quantum Dot Display − It contains quantum dots to enhance colour accuracy.

### Advantages

Some of the key advantages of Flat-Panel Display Monitor are as follows −

- Smaller in size makes it easy to mount and transport.
- It consumes less power.
- It has higher resolutions which makes good picture quality.
- It makes users comfortable to get connected for a longer period and reduces eye strain.
- Available in different sizes.

### Disadvantages

- Expensive as compared to CRT monitors.
- Its resolution is not up to mark as compared to CRT.
- It is a soft covering which may damage and be difficult to clean.


### Graphic Plotter

A plotter, which is a type of printer, receives instructions from a computer to produce line drawings on paper using one or more automated pens. In contrast to a standard printer, a plotter can create uninterrupted point-to-point lines directly from vector graphic files or commands. Computer graphics and engineering applications employ graphic plotters to create high-quality, accurate, and detailed drawings or plots on paper or other media. It draws continuous lines accurately and is suited for vector drawings, unlike a standard printer. Key features of graphic plotters are as −

- Vector Graphics − Vector graphics allow graphic plotters to create lines and shapes precisely using continuous points instead of dots like raster printers.
- Pen or Pen-Like Tool − A pen or similar instrument is drawn on paper for graphic plotters. The pen may move X and Y on a moveable arm to draw complicated shapes.

- Applications − Graphic plotters are employed in engineering, architecture, cartography, and textile design. They were popular for technical drawings and diagrams before digital.



A vector graphics plotter outputs accurate and detailed drawing. They are still used in sectors and applications that need accuracy and high-quality output, even if digital printing has made them less widespread.

**Components of Graphic Plotters**

The key components of a Graphic Plotter are as follows −

- Plotter Head − A plotter head contains multiple pens of different colours to draw images.

- Plotting Surface − It is used to hold and feed paper.

- Microcontroller − Controls the plotting process and interprets commands.

- Interfaces − It provides interfaces to connect USB, Ethernet, or wireless connections.

- Memory − A device used to Store plotting instructions to process temporarily.

Types of plotters

- Pen Plotters − It uses vector graphics and line drawings.

- Drum plotters − A drum plotter is a device that uses a rotating drum to draw on paper. The drum revolves to create one direction of the plot, while the pens move to create the other direction.

- Flatbed plotters − Flatbed plotters are used to draw on paper placed on a flat surface.

- Electrostatic plotters − This printer draws on negatively charged paper with positively charged toner.

- Inkjet plotters − The printer uses vector graphic technology to control the movement of the pen plotters, which in turn drop ink beads of different colours onto the drawing surface.

**Advantages**

Some of the key advantages of Graphic Plotters are as follows −

- High Resolution − It has good resolution which opens it for CAD drawings.

- Colour Representation − It automatically sets colour matching in designs.
- Large Screen Size − It provides appropriate space to view large drawings.
- Software Compatibility − It is compatible with CAD software, graphic design, and related tools.
- Preview Functionality − A user can preview plots on the monitor to reduce errors and enhance accuracy.
- Editing Tools − Multiple editing tools are available for graphics before plotting.

**Printers**

A printer is an output device, which is used to print processed data on paper. It is one of the most popular output devices. The information that is printed is commonly referred to as hard copy because it physically exists and is a more enduring form of output than what is displayed on a VDU. Printers play a crucial role in generating hard copies of digital documents and images and are available in different types tailored to specific purposes and settings. They cater to diverse user requirements, offering features such as top-notch photo printing, speedy document output, and the ability to create three-dimensional objects, making them suitable for home, office, or industrial use.

**Types of Printers**

Different types of Printers are categorised in the following image
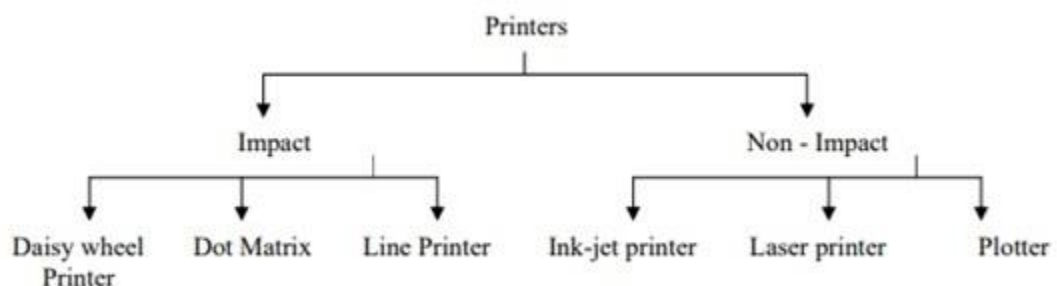


**Impact Printers**

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

**Characteristics of Impact Printers are the following −**

- Very low consumable costs
- Very noisy

- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

**Types of Impact Printers**

Generally, Impact printers are of two types −

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time. A printer that holds individual characters until it is ready to print them. Instead of printing one line at a time, a character printer prints one character at a time. Nowadays, these printers are not commonly used due to speed limitations and their ability to only print text.

Types of Character Printers

- Dot Matrix Printer (DMP)
- Daisy Wheel

**Dot Matrix Printer**

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of a pattern of dots and the head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character which is why it is called Dot Matrix Printer.



**Advantages**

- Inexpensive
- Durable
- Widely Used
- Able to print on multi-part forms
- Low Operating Costs

- Reliable
- Other language characters can be printed

**Disadvantages**

- Slow Speed
- Poor Quality

Daisy Wheel

A daisy wheel printer is an impact printer that utilizes a spinning disk, known as the "daisy wheel," which contains pre-formed characters embossed on its "petals." During printing, the printer picks the appropriate petal, impacts it against an ink ribbon, and then onto the paper to generate high-quality text.

The head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word processing in offices that require a few letters to be sent here and there with very nice quality. In the 1970s and 1980s, daisy wheel printers were commonly utilized for word processing before the introduction of laser and inkjet printers.

**Advantages**

- It produces High-Quality Text so more suitable for professional documents
- More reliable than DMP
- Better quality
- Fonts of character can be easily changed
- Durable so it has a long lifespan
- Each character is pre-formed which shows its consistent print quality

**Disadvantages**

- Slower than DMP
- Limited to Text

- Noisy
- More expensive than DMP
- Changes in fonts or styles need physical changes on the daisy wheel

**Line Printers**

Line printers are the printers which print one line at a time. Line printers are specialised impact printers which are specifically designed to get high-speed, high-volume printing, primarily for text. These are still useful in certain applications where speed and durability are critical. Their capacity to print a complete line of text at once distinguishes them from other impact printers, making them excellent for applications requiring quick and consistent document creation.



**Types of Line Printer**

- Drum Printer
- Chain Printer

**Drum Printer**

This printer is like a drum in shape hence it is called a drum printer. The surface of the drum is divided into several tracks. Total tracks are equal to the size of the paper, i.e. for a paper width of 132 characters, the drum will have 132 tracks. A character set is embossed on the track. Different character sets available in the market are 48 character sets, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast and can print 300 to 2000 lines per minute.

**Advantages**

- Very high speed
- Low cost
- Durable so they can run a long life
- Able to handle large print volumes
- Provides good printing quality

**Disadvantages**

- Very expensive
- Characters fonts cannot be changed

**Chain Printer**

A chain printer is a high-speed line printer with a revolving chain mechanism that prints characters on paper. Chain printers were widely used in large data centres and business settings where high-volume printing was required. They are well-known for their ability to handle huge print jobs quickly and efficiently. In this printer, a chain of character sets is used; hence it is called a Chain Printer. A standard character set may have 48, 64, or 96 characters.

**Advantages**

- Character fonts can easily be changed
- Able to print hundreds to thousands of lines per minute
- Durable
- Different languages can be used with the same printer
- Cost-effective for printing large quantities of text.

**Disadvantages**

- Noisy
- Limited Graphics
- Limited with fixed fonts and styles

**Non-impact Printers**

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time; thus, they are also called Page Printers.

**These printers are of two types −**

- Laser Printers
- Inkjet Printers

**Characteristics of Non-impact Printers**

- Faster than impact printers
- They are not noisy
- High quality
- Supports many fonts and different character sizes

**Laser Printers**

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

### Advantages

- Very high speed
- Very high-quality output
- Good graphics quality
- Supports many fonts and different character sizes

### Disadvantages

- Expensive
- Cannot be used to produce multiple copies of a document in a single printing

### Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high-quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Colour printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

**Advantages**

- High-quality printing
- More reliable

**Disadvantages**

- Expensive as the cost per page is high
- Slow as compared to laser printer

**Speakers**

Speakers are standard output devices that are used to hear sound clearly from a measurable distance. These are connected to the computer through sound connectors directly while others can be linked to any sound system. The primary purpose of speakers is to deliver audio output and enable users to listen to the resulting sound.



**Components of a Speakers**

Some of the key components of speakers are as follows −

- Magnet − It is an essential component fixed to speakers to create a magnetic field.
- Diaphragm (Cone) − It is made with paper, plastic and metal; it is used to create sound waves.
- Voice Coil − The diaphragm is connected to a voice coil of wire, which is placed in the magnetic field of the magnet.
- Suspension − This contains the spider and the surround. The spider keeps the voice coil centred in the magnetic gap and the surround links the diaphragm to the speaker frame and allows it to move freely.

**How does the speaker work?**

Speakers are electromagnetic waves that transform electromagnetic waves into sound waves. The computer supplies audio input to the speakers. This input may be analogue or digital. The voice coil generates an alternating magnetic field when the audio signal passes through it. This magnetic field then interacts with the stable magnetic field of the permanent magnet. Analogue speakers merely amplify electromagnetic signals to generate sound waves. Sound waves are analogue signals. Thus, digital speakers must convert the digital input to an analogue signal before producing a sound wave that can be transmitted as an output.

A speaker uses vocal commands to control a software programme. A computer speaker is hardware that connects to a computer system and produces sound. The computer's sound card contains the signal utilised to generate sound from a computer speaker.

**Types of speakers**

Some common types of speakers are as follows −

- Electrostatic speaker − An electrostatic speaker contains an electrically charged diaphragm which is positioned between two conductive plates. The electrical signal causes the diaphragm to move, which generates sound.

- Piezoelectric Speakers − These speakers use materials that change their shape when an electric field is applied and then create sound waves.

- Planar Magnetic Speakers − These speakers are similar to dynamic speakers, except they have a small, flat diaphragm and a voice coil that moves within a magnetic field.

- Subwoofers − Subwoofers produce very low-frequency sound, ranging from 20 to 200 Hz. The subwoofer is a speaker that can be oriented in any direction. These are specifically designed to produce low-frequency sounds (bass). Usually, they are used in home theatre systems and car audio systems.

- Dynamic speaker − Dynamic speakers are often equipped with one or more woofer drivers. These have one or more tweeter drivers and are known for producing low-frequency sound.

- Bluetooth speakers − It's a wireless speaker which is portable. A Bluetooth speaker produces high-quality audio.

- Horn Speakers − These speakers produce horns to amplify sound; generally used by drivers.

**Headphones**

Headphones are small-sized speakers which are specifically designed to fit into the earcups of headphones or earbuds. These speakers operate on the same principles as larger speakers but are tailored for listening at close range and for personal audio enjoyment.

**Advantages**

Some of the key advantages of headphone speakers are as follows −

- Produces better sound quality for personal use
- Users hear ambient sounds
- Relatively inexpensive
- Widely available
- Excellent for reproducing high frequencies
- Compact size
- Lower power requirements

**SECONDARY STORAGE DEVICES:**

You know that processor memory, also known as primary memory, is expensive as well as limited. The faster primary memory is also volatile. If we need to store large amount of data or programs permanently, we need a cheaper and permanent memory. Such memory is called **secondary memory**. Here we will discuss secondary memory devices that can be used to store large amount of data, audio, video and multimedia files.

Characteristics of Secondary Memory

These are some characteristics of secondary memory, which distinguish it from primary memory −

- It is non-volatile, i.e. it retains data when power is switched off
- It is large capacities to the tune of terabytes
- It is cheaper as compared to primary memory

Depending on whether secondary memory device is part of CPU or not, there are two types of secondary memory – fixed and removable.
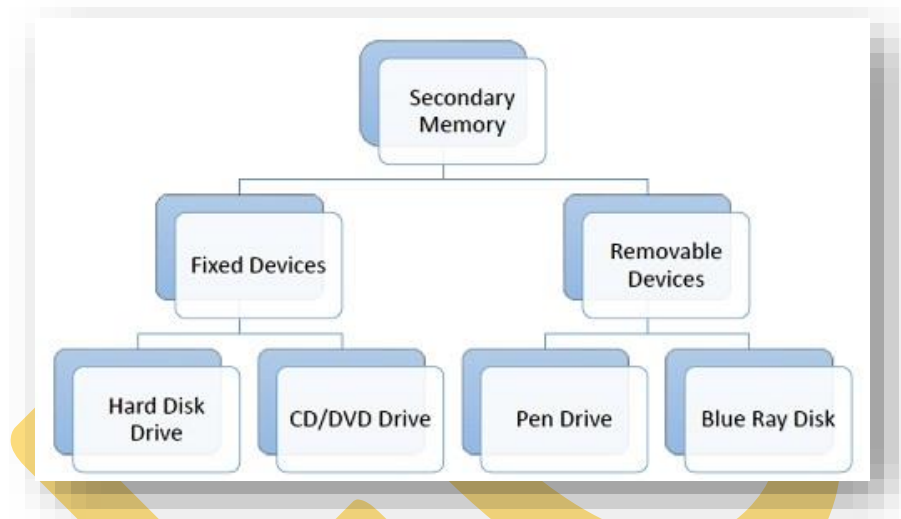


Let us look at some of the secondary memory devices available.

**Hard Disk Drive**

Hard disk drive is made up of a series of circular disks called **platters** arranged one over the other almost ½ inches apart around a **spindle**. Disks are made of non-magnetic material like aluminium alloy and coated with 10-20 nm of magnetic material.
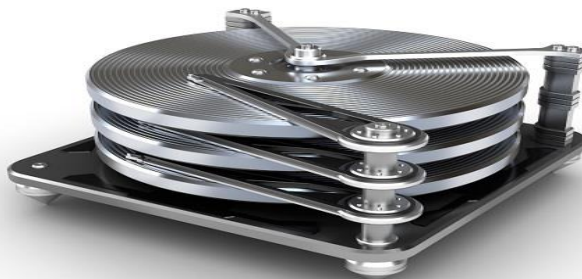


Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers. Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm

is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

**CD Drive**

CD stands for **Compact Disk**. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap as you can get 700 MB of storage space for less than a dollar. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs −

- **CD-ROM (Compact Disk – Read Only Memory)** − The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- **CD-R (Compact Disk – Recordable)** − Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- **CD-RW (Compact Disk – Rewritable)** − Data can be written and deleted on these optical disks again and again.

**DVD Drive**

DVD stands for **Digital Video Display**. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable.



**Pen Drive**

Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is non-volatile. It is also called USB drive, key drive or flash memory.



**Blu Ray Disk**

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia filed. BD uses shorter wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.

## COMPUTER MEMORY AND ITS CLASSIFICATION:

Whenever a program executes inside a computer then at first the program has to be loaded on to the computer's primary memory. And also, when a does not execute then also the program must remain loaded in computers secondary memory. This memory unit works as an extra block. In a program in memory, the entire set of performed operations is written using the keyboard as a sequence of instructions. This collection of instruction is called a program. Also, the data on which the program is to operate is entered with the help of the keyboard and can be stored in memory. Memory can also store intermediate and final results. This design of a stored program computer where program, data, and result reside in-memory is because of Von Neumann.

In a broad sense, memory can be classified as –

- **Main Memory**– Main memory has the disadvantage of high-cost and low-capacity storage. But its advantage or facility is the high speed of data transfer. The control unit can be able to directly communicate with the main memory. Main memory can be generally       classified       into random-access       memory (RAM)       and read-only

memory (ROM). It is a volatile memory. Due to the absence of power, the content of this memory will be lost.

- **Secondary Memory**– Secondary memory is also frequently known as auxiliary memory. The control unit can't directly communicate with the secondary memory. It is a non-volatile memory.

**Random Access Memory (RAM)** – RAM contains of a various number of memory locations wherein each location typically 8-bits are stored. It can be possible to read from a RAM location, as well as write to a RAM location. The drawback of RAM is that it is volatile. That means, when the power supply to the RAM is switched off, the information in the RAM will be lost. From the memory, data can be accessed in two different ways – Sequential Access and Random Access.

**Sequential Access** − Sequential access and random access are two types of accessing information. In sequential access, it is mandatory to access information strictly in order. If there are 4000 memory locations, it has to be accessed in the order of 1, 2, 3,…,4000. Thus, it takes minimum time to access information from location 0 and at most time to access information from location 4000. Magnetic Tape is an example that employs sequential access.

**Random Access** − In a random-access technique, it can be possible to access a memory location in any order. For example, one can read from the 4000locations in the order of 1500, 1210, 3060, 1640, 1352, and so on. Second, it takes a similar time to read from a memory location irrespective of its position. In a RAM, the access method is random, and its name, in fact, is derived based on the method of access.

**Read Only Memory (ROM)** – ROM consists of a number of memory locations wherein each location typically 8-bits are stored like a RAM. A ROM also uses random access method just like a RAM. The advantage of ROM is that it is non-volatile in nature. That means, though the power supply to the ROM is switched off, the information in the ROM will not be lost. However, only reading operation is possible from a ROM location. Thus, in a computer, ROM is used for storing information which is not lost when power is switched off.

Let us discuss different versions of ROM which are provided by semiconductor manufacturers for storing information –

**Mask-Programmed ROM** – It derives this name because the information is written to this type of ROM at the time of manufacture by applying a suitable mask. Once the manufacturer

writes this type of ROM, it cannot be possible to change this information even by the manufacturer. So that the information entered is permanent. It is cheap with compared to the other types of ROMs when the cost per unit quantity is considered. But the user has to place an order for a huge number at a time. Thus, ROMs are used in equipment that is produced in huge quantities. To give an analogy, mask-programmed ROMs are compared to books that are printed in huge volumes.

**Programmable Read Only Memory (PROM)** – The user writes information to this type of ROM with the help of PROM programmer equipment. Once the user writes this type of ROM, it cannot be possible to change this information anymore. Like Mask-Programmed ROM, the information entered is permanent. Though it is cheaper than the other types of ROMs but it is costlier than a mask ROM. The user can buy even a single piece of PROM from a local shop. Thus, PROMs are implemented in equipment those are produced in small quantities.

**Erasable Programmable Read Only Memory (EPROM)** – Information is written to this type of ROM by the user with the help of EPROM programmer equipment. As its content is erasable and rewritable, so the user can change this information in a number of times. Thus, although the information entered is not lost when power is switched off, it can be possible to erase it and then write new information. With the exposure of strong ultraviolet (UV) light from a very close distance on the quartz window of the EPROM chip, we can erase the content of the EPROM. Then the contents of the entire EPROM are entirely lost. The user can purchase even a single piece of EPROM from the market read and write its content for several numbers of times as well.

**Electrically erasable (or Alterable) Programmable Read Only Memory (EEPROM or EEPROM)** − Information is has written to this type of ROM by the user with the help of EPROM programmer equipment. After the user writes this type of ROM, it can be possible to change this information a number of times. Thus although the information entered is not lost at the time of power is switched off, it can be possible to erase it and then write new information. Unlike EPROM where erasing of data is to be done using ultra Violet rays, but in the case of EEPROM, erasing of its content is done with the help of electrical signals. Also, the contents of the EEPROM can be erased selectively. It is costlier than the other types of ROMs and is gaining in popularity. The user can purchase even a single piece of EEPROM or EAPROM from the market and read and write its content for several numbers of times as well.

| Types of ROM | Info. Entered by | Possible to change info? | Cost per chip | Min.order quantity | Method of erasing info. | Application area |
|---|---|---|---|---|---|---|
| Mask-programmed ROM | Manufacturer | No | Cheapest | Large | Not possible | Large-scale production |
| PROM | User | No | Costlier | One | Not possible | Medium-scale production |
| EPROM | User | Yes | Even more costly | One | Using strong UV source | R& D |
| EEPROM | User | Yes | Costliest | One | Using electrical signals | R& D |

**Secondary memory** − Whenever there is a need to have the huge amount of information that is possible to store in the main memory. In this case, it is stored in the secondary memory. This type of memory is characterized with the help of virtues of large capacity for storage and low cost per bit of storage. But its drawback is its very low speed for access. The control unit is not capable to directly access secondary storage. Hard disk, floppy disk, and magnetic tape are good examples of secondary memory.