Computer Science

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XI

CHAPTER - 1

# Fundamental of Computer

1.1 INTRODUCTION

A computer is a programmable machine designed to perform arithmetic and logical operations automatically and sequentially on the input given by the user and gives the desired output after processing. Computer components are divided into two major categories namely hardware and software. Hardware is the machine itself and its connected devices such as monitor, keyboard, mouse etc. Software are the set of programs that make use of hardware for performing various functions.
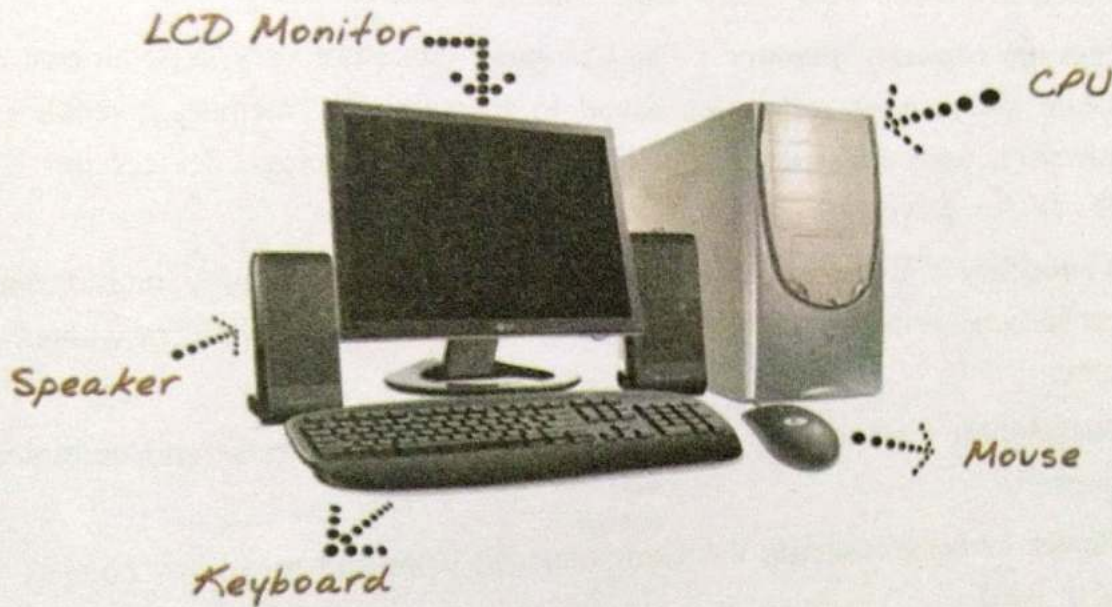
Definition :-

"Computer is an electronic device that takes input/data from user, processes it according to given instructions and gives the output to the user".

System — Input, Process, Output
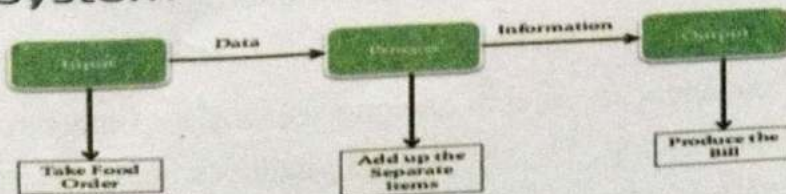
- *Data* : Data is a raw material of information.

- *Information* : Proper collection of the data is called information.

1.2 Characteristics of Computer :

The main characteristics of computer are given below :-

1. **SPEED** : Computer is a very high speed electronic device. It can process millions of instruction in seconds as compared to human being.

2. **Accuracy** : Computer is an accurate device. The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. It can do all the calculation without making any mistake.

3. **Diligence** : Diligence means the capability to perform continuously with same efficiency. It can work many hours without any tiredness.

4. **Storage capacity/memory** : The Computer can store very large amount of data. Once the data or instruction saved to the computer memory it remains in the memory, until any user deletes. There is another storage devices just like CD, DVD, Pen drive etc.

5. **Versatility** : It has capable of multitasking. You can enjoy multimedia, word processing, printing, and communicating jobs from one platform without closing other.

6. **Reliability:** Computer is a reliable electronic multipurpose and multiprocessing machine.

7. **Power of remembering** : A Computer can store and recall any amount of data/ information.

8. **No Feeling** : The computer has no feeling.

1.3 Applications of computer :

1. **Education** : Computers are used in education field. The computer helps in providing a lot of facilities in the education system.

2. **Business** : Computers are used in business organizations. They are used in keeping records of daily sales and profit.

3. **Banking** : Computers are used in banking sector also. Banks provide the facilities like online accounting facility, which includes current balances, deposits, overdrafts, interest charges, shares, and trustee records.

4. **Healthcare :** Computers are used in hospitals. It is also used in scanning and diagnosing different diseases. ECG, EEG, ultrasounds and CT scans, etc. are also done by computerized machines.

5. **Science :** Computers are used in science field to simulate experiment, which are dangerous to perform in real life.

6. **Government :** Computers play an important role in government services. Computer is useful to govt. sector in maintaining census record, vehicle registration record, voter list, driving license, land record etc.

7. **Communication :** Computers are most efficient and the cheapest communication way for long distance. Some main areas in this category are –

    *   E-mail
    *   Chatting
    *   Usenet
    *   FTP
    *   Telnet
    *   Video-conferencing

1.4   **Block diagram of computer :**
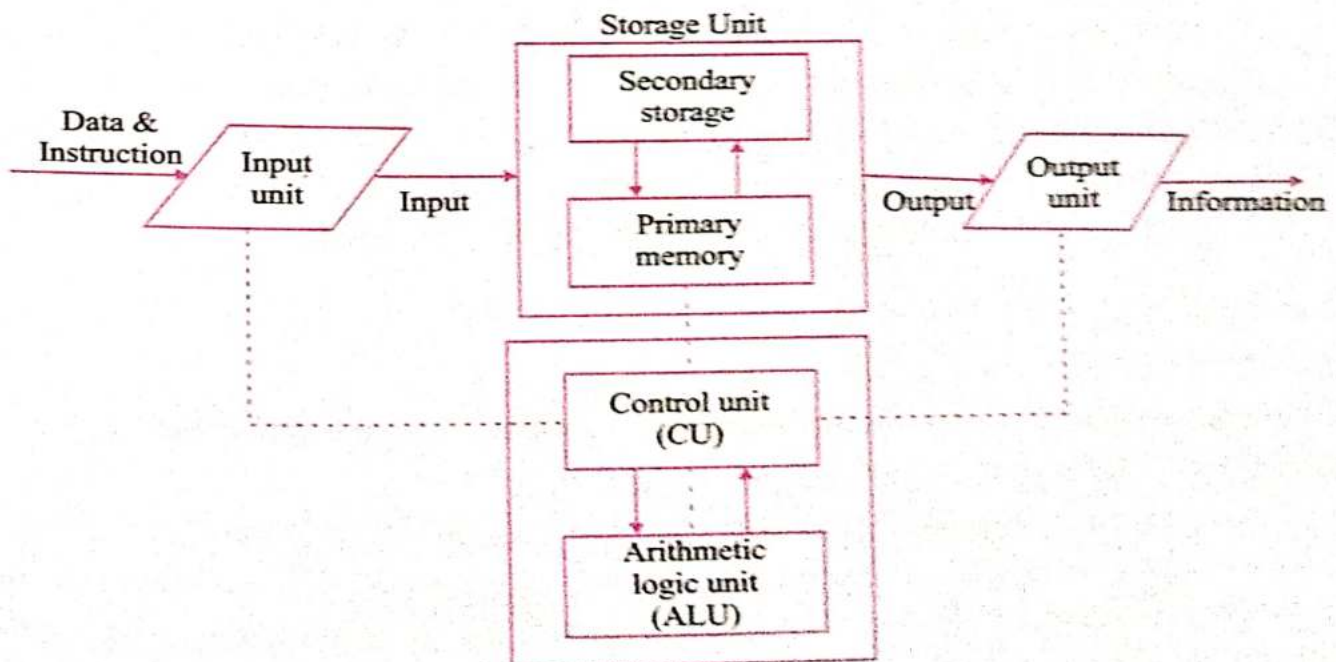
1. **Input Unit :** Input unit or device is a device through which we enter data and instructions to computer. In addition it convert the entered data in computer acceptable form. The input unit consists of one or more input devices. Keyboard is the one of the most commonly used input device.

2. **Central Processing Unit (CPU) :** CPU is the brain of computer. The control unit and ALU of the computer are together known as the Central Processing Unit (CPU).

   CPU has three parts :

   1. Arithmetic Logic Unit (ALU)

   2. Control Unit (CU)

   3. Memory Unit (MU)

   - **Arithmetic Logic Unit (ALU) :** ALU performs all the arithmetic and logical functions i.e. addition, subtraction, multiplication, division (+, - , * , /) and certain comparisons. These comparisons include greater than, less than, equals to etc.

   - **Control Unit (CU) :** It controls and coordinates all operations of computer and is known as heart of computer. It tells other parts of the computer system what to do.

   - **Memory Unit (MU) :** Memory is used to store data and instructions before and after processing. Memory is also called Primary memory or internal memory. It is used to store data temporary or permanently.

3. **Output Unit :** Output unit or device is a device through which results are displayed to user. An output device is used to show the result of processing. Some commonly used output devices are Monitor(VDU),Printer etc.

1.5 Generations of Computers

Introduction :

Computer is an electronic device that manipulates information or data. It has the ability to store, retrieve, and process data.

Nowadays, a computer can be used for type documents, send email, play games, and browse the Web. It can also be used to edit or create spreadsheets, presentations, and even videos. But the evolution of this complex system started around 1946 with the first Generation of Computer and evolving ever since.

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There are five generations of computers :–

1. **First generation (1940 – 1956) :** The first generation of computers used vacuum tubes as a major piece of technology. Vacuum tubes were widely used in computers from 1940 through 1956. Vacuum tubes were larger components and resulted in first generation computers being quite large in size, taking up a lot of space in a room. Some of the first generation computers took up an entire room.

Vacuum Tubes
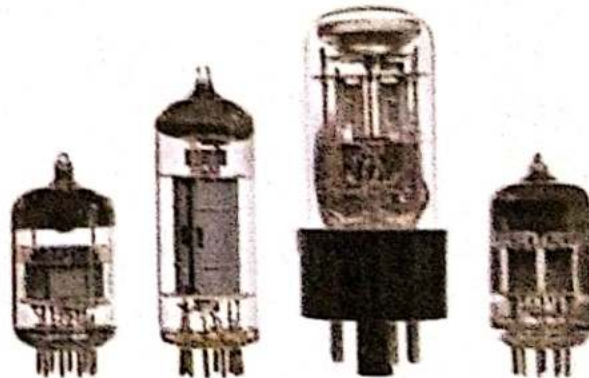
The ENIAC is a great example of a first generation computer. It consisted of nearly 20,000 vacuum tubes, as well as 10,000 capacitors and 70,000 resistors. It weighed over 30 tons and took up a lot of space, requiring a large room to house it. Other examples of first generation computers include the EDSAC, IBM 701, and Manchester Mark 1.

2. **Second generation (1956 – 1963) :** The second generation of computers saw the use of transistors instead of vacuum tubes. Transistors were widely used in computers from 1956 to 1963. Transistors were smaller than vacuum tubes and allowed computers to be smaller in size, faster in speed, and cheaper to build.

Transistors

The first computer to use transistors was the TX-0 and was introduced in 1956. Other computers that used transistors include the IBM 7070, Philco Transac S-1000, and RCA 501.

3. **Third generation (1964 - 1971)** : The third generation of computers introduced the use of IC(integrated circuits) in computers. Using IC's in computers helped reduce the size of computers even more compared to second-generation computers, as well as make them faster.

Integrated Circuit

Nearly all computers since the mid to late 1960s have utilized IC's. While the third generation is considered by many people to have spanned from 1964 to 1971, IC's are still used in computers today. Over 45 years later, today's computers have deep roots going back to the third generation.

4. **Fourth generation (1972 - 2010)** : The fourth generation of computers took advantage of the invention of the microprocessor, more commonly known as a CPU. Microprocessors, along with integrated circuits, helped make it possible for computers to fit easily on a desk and for the introduction of the laptop.
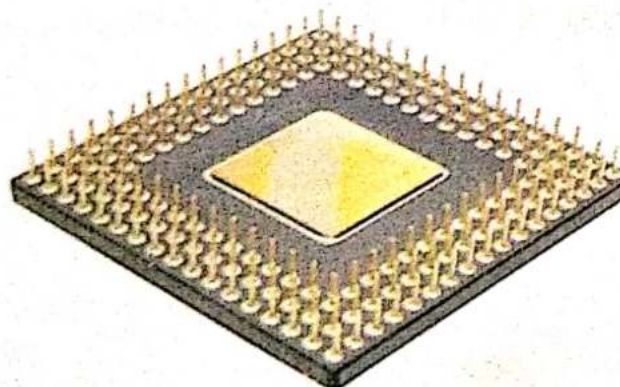
Some of the earliest computers to use a microprocessor include the Altair 8800, IBM 5100, and Micral. Today's computers still use a microprocessor, despite the fourth generation being considered to have ended in 2010.

5. **Fifth generation (2010 to present)** : The fifth generation of computers is beginning to use AI (artificial intelligence), an exciting technology that has many potential applications around the world. Leaps have been made in AI technology and computers, but there is still much room for improvement.
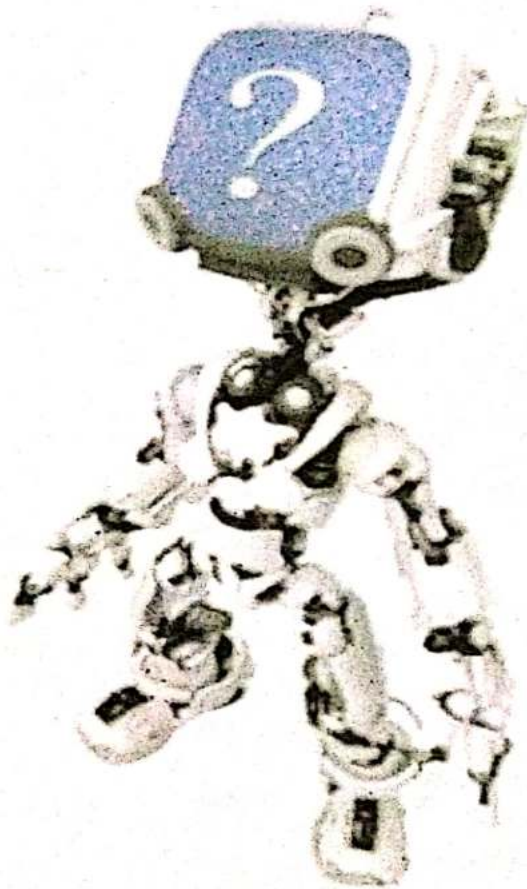
One of the more well-known examples of AI in computers is IBM's Watson, which has been featured on the TV show Jeopardy as a contestant. Other better-known examples include Apple's Siri on the iPhone and Microsoft's Cortana on Windows 8 and Windows 10 computers. The Google search engine also utilizes AI to process user searches.

1.6 Advantages and Disadvantages of computer generation :

Advantages

1st Generation	2nd Generation	3rd Generation	4rth Generation	5th Generation
• That was the only electronic during those old days. • Those computers were very fast to calculate. • Vacuum tube technology made possible the advent of electronic digital computers. • Color-coded for easier and faster identification of readings.	• Smaller in size compared to the first generation of computer • The second generations computers were more reliable. • Used less energy and were not heated as much as the first one. • Wider commercial use. • Better portability as compared to the first generation.	• Less energy • Easily portable • Maintenance cost is low because hardware failures are rare.	• Air conditioning is not required in most cases. • Faster in computation than the last generations • Totally general purpose. • Smallest in size it's because of the high component density.	• It is more reliable and works faster. • Available in different sizes with unique features.

Disadvantages

1st Generation	2nd Generation	3rd Generation	4rth Generation	5th Generation
• It is not really a reliable device. • No portable • It is required to be air conditioned.	• Cooling system was required. • Constant maintenance was require. • Costly and not versatile. • Commercial production was difficult. • Punch cards were used for input.	• There are a lot of cases required for air conditioning. • Highly sophisticated production was easier and cheaper.	• Highly sophisticated technology required for the manufacture of LSI chips.	• They need very low-level languages. • They may make the human brains dull and doomed.

1.7 Concept of Computer Memory

Introduction

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.

Computer **memory** is any physical device capable of storing information temporarily like RAM (random access memory), or permanently, like ROM (read-only memory). Memory devices utilize integrated circuits and are used by operating systems, software, and hardware.

Computer Memory has two types :

1. Primary (Main) Memory.
2. Secondary Memory.

MEMORY

PRIMARY

ROM
— PROM
— EPROM
— EEPROM

RAM

SRAM   DRAM

SECONDARY
— HDD
— FDD
— DVD
— Pendrive
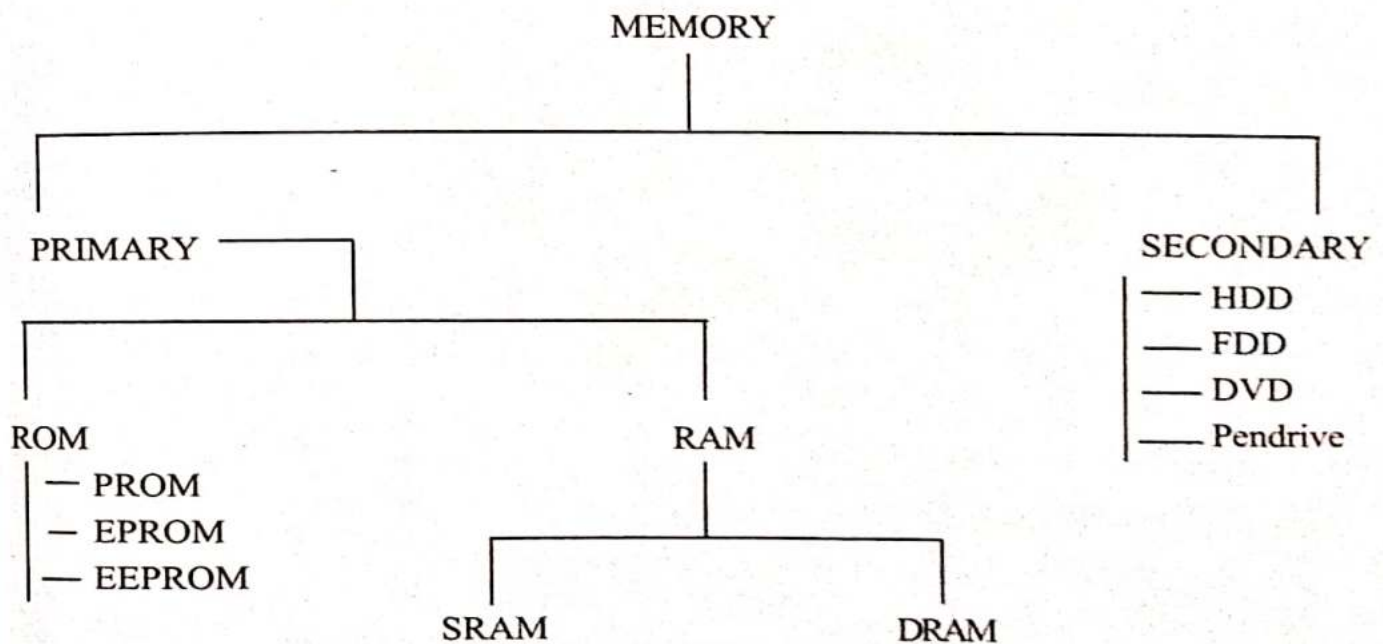
1.7.1 Primary Memory (Main Memory)

The Primary/main memory in a computer is called internal memory. It is also known as RAM. This is the part of the computer that stores operating system software,

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software applications and other information for the central processing unit (CPU) to have fast and direct access when needed to perform tasks.

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory.

It is divided into two subcategories RAM and ROM.
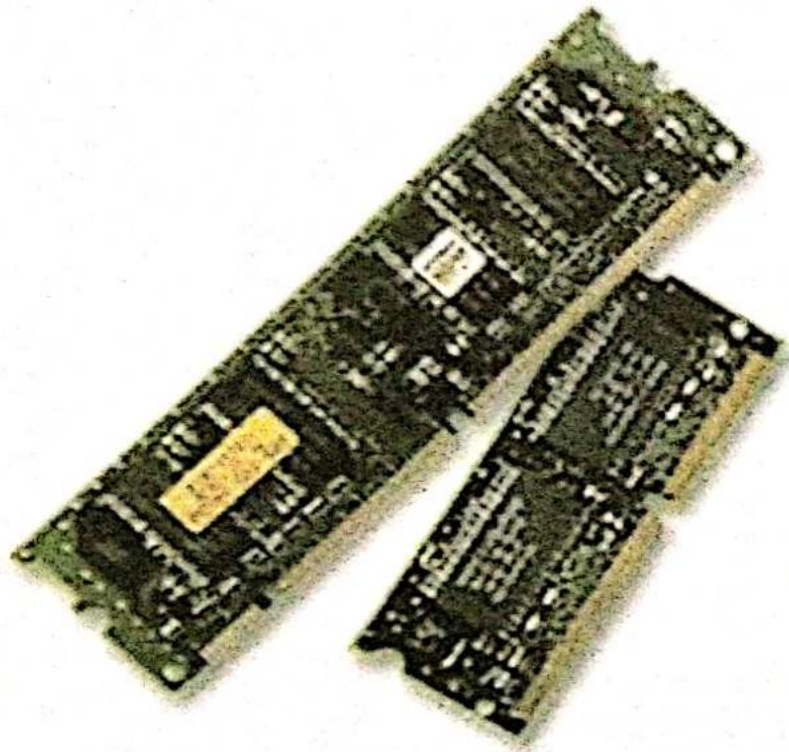
Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

1. **Random Access Memory (RAM) :** The primary storage is referred to as random access memory (RAM) due to the random selection of memory locations. It performs both read and write operations on memory. If power failures happened in systems during memory access then you will lose your data permanently. So, RAM is volatile memory. RAM categorized into following types.

   - **SRAM :-** SRAM (Static Random Access Memory) that retains data bits in its memory as **long** as power is being supplied.

   - **DRAM :-** Dynamic Random Access Memory which stores bits in cells consisting of a capacitor and a transistor

   - **DRDRAM :-** Stands for Direct Rambus Dynamic Random Access Memory.

2. **Read Only Memory (ROM) :** ROM is permanent memory location that offer huge types of standards to save data. But it work with read only operation. No data lose happen whenever power failure occur during the ROM memory work in computers. ROM is also known as non volatile memory.

   - Stores crucial information essential to operate the system, like the program essential to boot the computer.

   - It is not volatile.

   - Always retains its data.

   - Used in embedded systems or where the programming needs no change.

   - Used in calculators and peripheral devices.

   ROM has several models such names are following.

1. **PROM :** Programmable Read Only Memory (PROM) maintains large storage media but can't offer the erase features in ROM. This type of ROM maintains PROM chips to write data once and read many. The programs or instructions designed in PROM can't be erased by other programs.

2. **EPROM :** Erasable Programmable Read Only Memory designed for recover the problems of PROM and ROM. Users can delete the data of EPROM thorough pass on ultraviolet light and it erases chip is reprogrammed.

3. **EEPROM :** Electrically Erasable Programmable Read Only Memory similar to the EPROM but it uses electrical beam for erase the data of ROM.

1.7.2 Secondary Memory

Secondary memory is computer memory that is non-volatile and persistent in nature and is not directly accessed by a computer/processor. It allows a user to store data that may be instantly and easily retrieved, transported and used by applications and services.

```
                    ┌──────────────┐
                    │  Secondary   │
                    │   Memory     │
                    └──────┬───────┘
            ┌──────────────┴──────────────┐
      ┌─────┴──────┐              ┌────────┴────────┐
      │   Fixed    │              │   Removable     │
      │  Devices   │              │    Devices      │
      └─────┬──────┘              └────────┬────────┘
      ┌─────┴─────┐                  ┌─────┴──────┐
 ┌────┴───┐  ┌────┴────┐        ┌────┴────┐  ┌────┴──────┐
 │Hard Disk│  │ CD/DVD │        │Pen Drive│  │Blue Ray Disk│
 │  Drive  │  │ Drive  │        │         │  │           │
 └─────────┘  └────────┘        └─────────┘  └───────────┘
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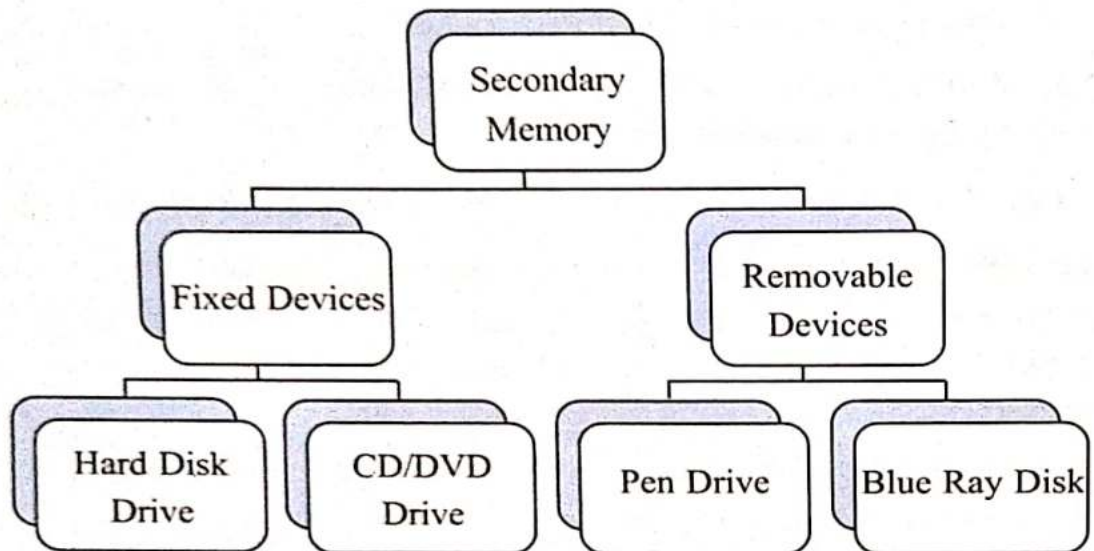
This type of memory is also known as external/Auxiliary memory or non-volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories, instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.
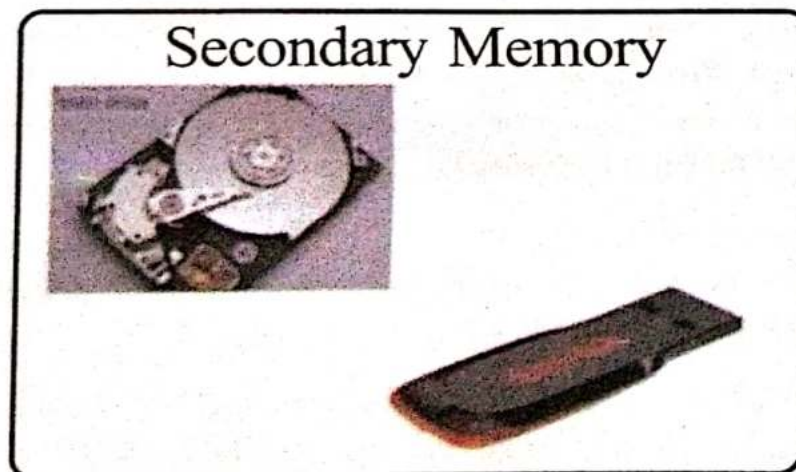
Secondary Memory

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

Types of Secondary memory :

- Hard Disk
- Floppy Disk
- Magnetic Tape/Disk
- DVD
- Pen Drive

1. **Hard Disk :** Hard Disk Another form of auxiliary storage. A hard disk consists of one or more rigid metal plates coated with a metal oxide material that allows data to be magnetically recorded on the surface of the platters. The hard disk platters spin at 5 a high rate of speed, typically 5400 to 7200 revolutions per minute (RPM). Storage capacities of hard disks for personal computers range from 10 GB to 120 GB (one billion bytes are called a gigabyte).


HARD DRIVE

2. **Floppy Disk :** A **floppy** disk is a disk storage medium composed of a disk of thin and flexible magnetic storage.

Floppy disks are typically 3.5" and 5.25" in size (diameter) and it can hold maximum 1.44 MB of data.

3. **Magnetic Disk/Tape :** Magnetic Disk/Tape are used for recording and storing data for computer processing. It is plastic reel similar to long lengths of movie film. A tape is usually ½" wide and 2400 feet in length and it is coated with particles of ferric oxide on which data can be recorded magnetically.

The Magnetic Disk is Flat, circular platter with metallic coating that is rotated beneath read/write heads. It is a Random access device; read/write head can be moved to any location on the platter
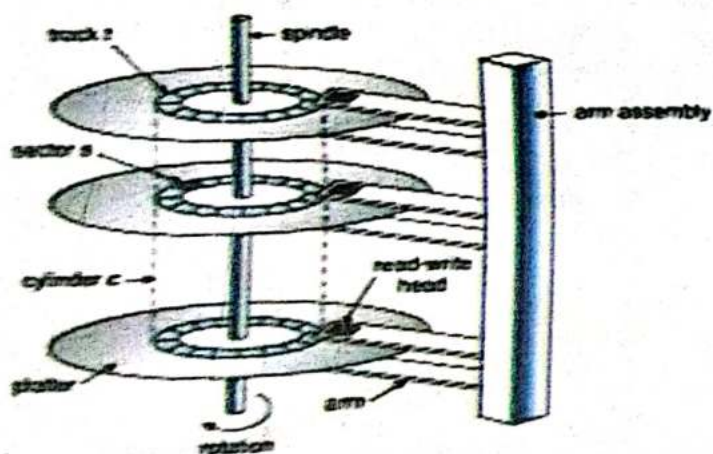
4. **DVD :** Stands for "Digital Versatile Disc or digital video disk . DVD is an optical disc technology with a 4.7 gigabyte storage capacity on a single-sided, one-layered disk". A DVD is a type of optical media used for storing digital data. It is the same size as a CD, but has a larger storage capacity. Some DVDs are formatted specifically for video playback, while others may contain different types of data, such as software programs and computer files.
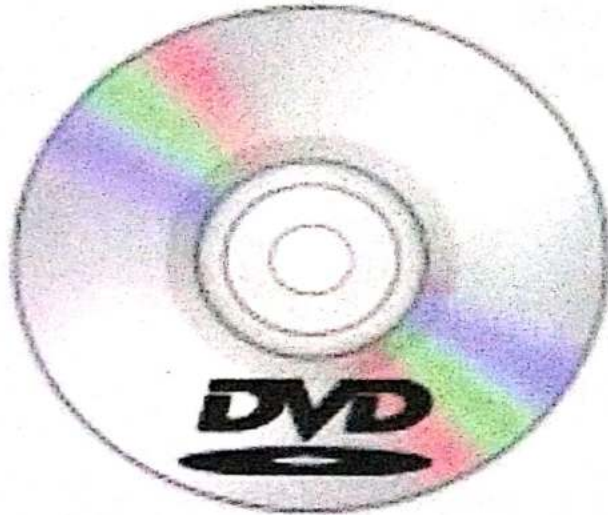
5. **Pen Drive :** Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is non-volatile. It is also called USB drive, key drive or flash memory.

A **pen drive is** small storage device shaped like a **pen** with built-in data storage that connects to a computer by **a USB** port. An example of a **pen drive** is a **pen** with a hidden USB port for saving data.

1.8   Units of Computer memory :

Memory units are used to measure and represent data. Some of the commonly used memory units are:

1)   **Bit** : The computer memory units start from bit. A bit is the smallest memory unit to measure data stored in main memory and storage devices. A bit can have only one binary value out of 0 and 1.

1 bit (binary digit)= value of 0 or 1

2)   **Byte** : It is the fundamental unit to measure data. It contains 8 bits or is equal to 1 byte. Thus a byte can represent 2*8 or 256 values.

- Bit   = 0 or 1
- 1 Nibble   = 4 bits
- 1 byte (B)   = 8 bits
- 1 Kilobytes (KB)   = 1024 bytes
- 1 Megabyte (MB)   = 1024 KB
- 1 Gigabyte (GB)   = 1024 MB
- 1 Terabyte (TB)   = 1024 GB
- 1 Exabyte (EB)   = 1024 TB
- 1 Zettabyte (ZB)   = 1024 EB
- 1 Yottabyte (YB)   = 1024 ZB

1.9   **Input and Output units :-**

Input Unit/Device:

"An input device is any device that provides input to a computer . Input device is device through which user communicate with the computer."

"Input devices are those devices which takes input from user's in the simple form and convert the data into information."

There are many input devices :

- Keyboard
- Mouse
- Scanner

- Joystick
- Light Pen
- Touch Screen
- Digital Camera
- BCR
- OCR
- MICR

1. **Keyboard :** Keyboard is the most common and very popular input device which helps to input data to the computer. Keyboard is a well known input device which contains alphabets, numeric digits, special keys, function keys etc.

    Alphabets:- A to Z, a to z.

    Numeric key:- 0 to 9

    Special keys:- shift, spacebar, ctrl, alt, etc.

    Functions key:- F1,F2......F12

2. **Mouse :** Mouse is the most popular pointing Input 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.

3. **Scanner :** Scanner is an input device used to translate paper documents (documents may contain text, graphic, pictures or even handwritten material) into an electronic format that can be stored in a computer. It is just like a photocopy machine except that instead of copying the document on paper it copies the document to computer. This copied document is stored in computer in the form of bitmap file, which can be edited and printed.

Scanners are of three types :

1. **Drum Scanner :** In this type of a scanner, paper having image is passed over a drum or roller where image is captured.

2. **Flatbed Scanner :** It works like a photocopier. It can scan and store images from books without removing page from book.

3. **Line Scanner :** It is a small handy scanner and is used in for scanning text line by line.

4. **Joystick :** A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. A joystick, also known as the control column. Joysticks are often used to control video games, and usually have one or more push-buttons whose state can also be read by the computer.

Joysticks consist of a base and a stick that can be moved in any direction. The stick can be moved slowly or quickly and in different amounts. Some joysticks have sticks that can also be rotated to the left or right.

5. **Light Pen :** A light pen is a light-sensitive computer input device, basically a stylus, that is used to select text, draw pictures and interact with user interface elements on a computer screen or monitor. The light pen works well with CRT monitors because of the way such monitors scan the screen, which is one pixel at a time, giving the computer a way to keep track of the expected scanning time by the electron beam and infer the pen's position based on the latest timestamp of the scanning.

6. **Touch screen :** A touch screen is an input device. A touch screen is a display device that allows the user to interact with a computer by using their finger. They can be quite useful as an alternative to a mouse or keyboard for navigating a GUI (graphical user interface). Touch screens are used on a variety of devices such as computer and laptop displays, smart phones, tablets.

   Today, all kinds of devices, both big and small, make use of touch screens.

7. **Digital Camera :** A digital camera is an input device that captures images (and sometimes video) digitally. Digital cameras use an image sensor chip to capture the image, rather than the film used by a traditional camera.

   A digital camera is a similar to a traditional film-based camera, but it captures images digitally. A digital camera stores images digitally rather than recording them on film. Once a picture has been taken, it can be downloaded to a computer system, and then manipulated with a graphics program and printed.

8. **BCR :** A BCR stands for Bar Code Reader. It is an electronic input device. It consists of a light source, a lens and a light sensor translating for optical impulses

into electrical signals. Barcode is a set of lines of different widths and sizes representing data, that when read help identify the scanned object.

A BCR (Bar Code Reader) or scanner, also known as a POS (point of sale) scanner is a hardware input device capable of reading a barcode using a laser. It can also print out the details of the product or log information about that product into a database

9. **OCR (Optical Character Recognition/Reader)** : Stands for "Optical Character Recognition/Reader." OCR is a technology that recognizes text within a digital image. It is commonly used to recognize text in scanned documents, but it serves many other purposes as well. Optical character recognition or optical character reader (OCR) is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document.

10.   **MICR** : MICR stands for Magnetic Ink Character Recognition/Reader, is an input device. Magnetic Ink Character Recognition/Reader code, known in short as MICR code, is a character-recognition technology used mainly by the Banking industry to ease the processing and clearance of cheques and other documents. This includes the bank's routing number, the customer's account number, and the cheque number. The magnetic ink character recognition line is printed using technology that allows certain computers to read and process the printed information.
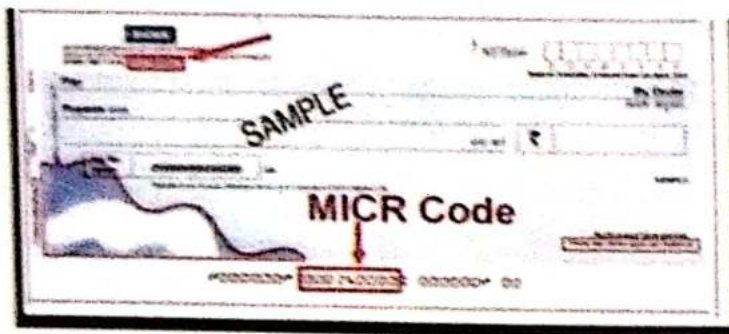
Scan MICR Code On Bank Cheque
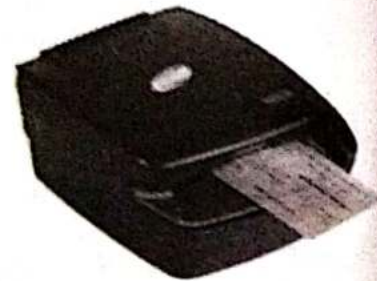
1.10   Output unit/device

The devices which are used to display the results or information are called **Output units or Devices.** You can view the output on the monitor or you can print it on a paper using a printer. Monitor and printer are the commonly used output devices. An **output** device can receive data from another device and generate output with that data.

There are many Output devices :

- Monitor (VDU)
- Printer
- Plotter
- Speaker

I.   **Monitor (VDU)** : This is the most common output device connected with the computer to display the processed information. Monitor, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It comes

in many different shapes, sizes. It is also called the soft copy output device. It looks like as television screen. 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. CRT Monitors of many different types available in the market. The smaller the pixels, the better the image clarity or resolution.

CRT Monitor

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

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Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement 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 computer, and graphics display.

LCD Monitor

The flat-panel display is divided into two categories –

* **Emissive Displays :** Emissive displays are devices that convert electrical energy into light. For example, plasma panel 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 Display).

II. **Printer :** This is an important output device of the computer system. It gives a printed output of the results that appears on the monitor screen. Printed output is also called Hard Copy output. Because Printer is used to print information on paper.

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There are two types of printers :

- Impact Printers
- Non-Impact Printers

```
                              Printer
                                 |
         ┌───────────────────────┴───────────────────────┐
         ▼                                                ▼
       Impact                                         Non-Impact
         |                                                |
    ┌────┴────┐                                     ┌──────┴──────┐
    ▼         ▼                                     ▼             ▼
Character   Lines Printer                     Character      Page Printer
 Printer                                       Printer            |
    |                                             |               |
    ▼                                             ▼               ▼
Dot Matrix                                     Ink-Jet          Laser
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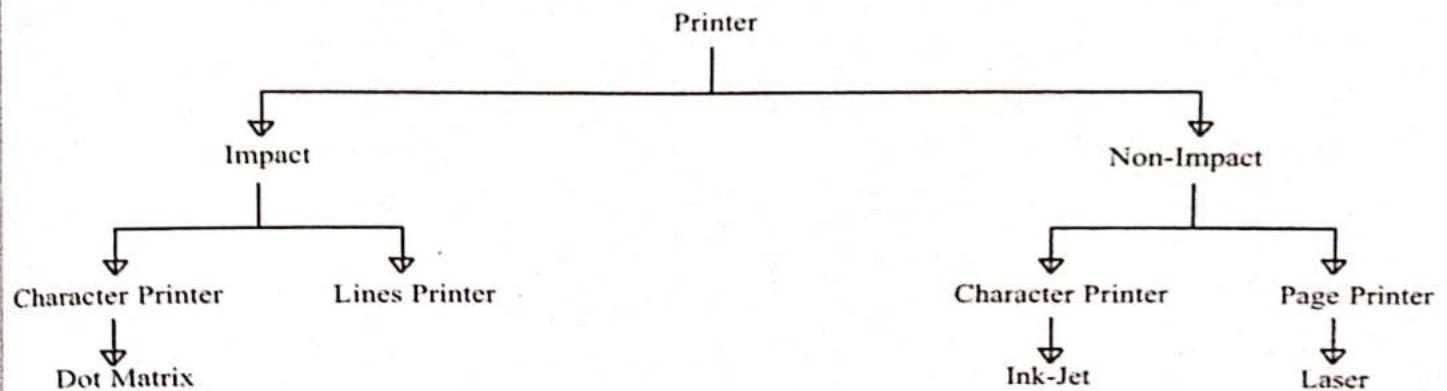
1. **Impact Printers :** An impact printer is a type of printer that works by direct contact of an ink ribbon with paper. A metal or plastic head strikes the ink ribbon, whereby the ribbon is pressed against the paper and the desired character (letter, digit, dot, line) impression is printed on the sheet.

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

These printers are of two types –
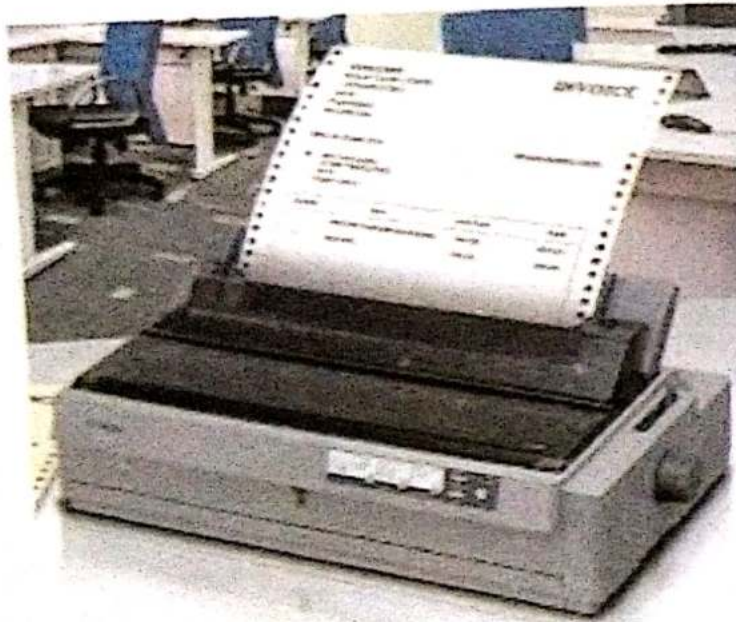
- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time. Example of character printer is Dot Matrix Printer(DMP).

- **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 pattern of dots and head consists of a Matrix. So it is called Dot Matrix Printer.

Advantages

- Inexpensive
- Widely Used
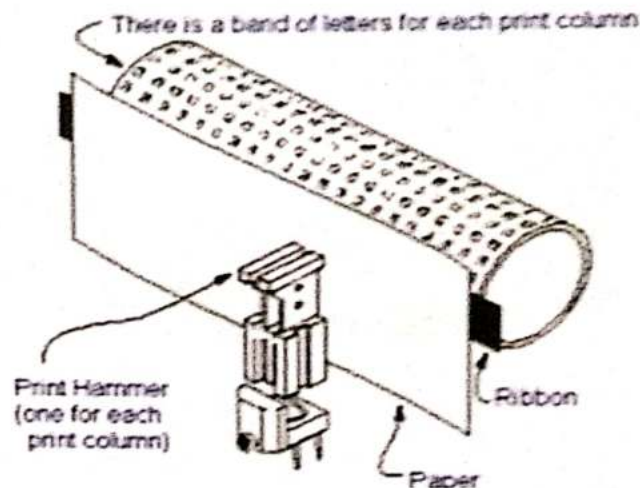- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

Line Printers :--

Line Printer can Print One Line at a Time. The line printer is a form of high speed impact printer. They can Print 300 to 3000 Lines per Minute. So that they are very fast. Large Computer system typically use Line Printer. Example of Line printer is Drum printer.

Drum Printers:- Drum Printer consists of a Drum which consists of a number of characters; those are Printed on the drum. And the number of characters or number of tracks are divided, after examining the width of the paper.

There is a band of letters for each print column

Print Hammer (one for each print column)

Ribbon

Paper

2. **Non-impact Printers :** Non-impact printers form characters and images without direct physical contact between the printing mechanism and the paper. For example, inkjet printers spray tiny drops of ink onto the page, while laser printers have a cylindrical drum that rolls electrically charged ink onto the paper. Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

**Characteristics of Non-impact Printers**

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

Non-impact printers are of two types –

- Laser Printers
- Inkjet Printers

Laser Printers

A **laser** printer (also known as **Page Printers** as they prints the whole page at once) represent a real technological revolution. It produces high-quality text and graphics. *Laser printer is a type of printer* which makes use of a laser beam to produce an image on the drum or you can say that it is a printer that makes use of a focused beam of light to transfer text and images onto paper. 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.
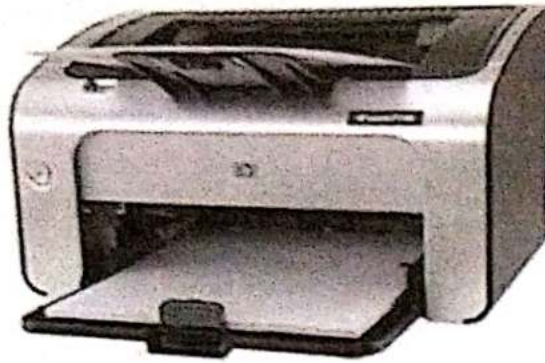
Advantages

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

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. Color printing is also possible.

Advantages

- High quality printing
- More reliable

Disadvantages

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

III. **Plotter :** A plotter is a computer vector graphic printer that gives a hard copy of the output based on instructions from the system. Plotters are widely used to print designs of things such as cars, ships and buildings on a piece of paper using a pen. Plotters are different than a printer in that they are more precise and they are most commonly used in engineering and architecture where precision is mandatory. They are also more expensive than ordinary printers.
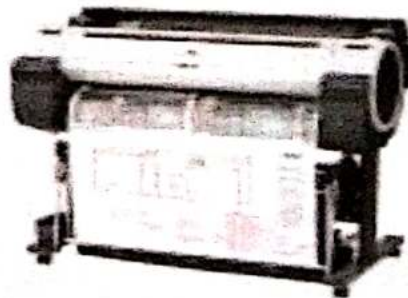
IV. **Speaker :** Speakers are one of the most common output devices used with computer systems. Some speakers are designed to work specifically with computers, while others can be hooked up to any type of sound system. A computer speaker is a hardware device that connects to a computer to generate sound.
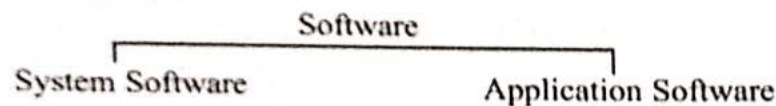
1.11 Software

A computer consist of two parts Hardware & Software. The hardware devices need user instructions to function. A software is set of programs, which are the set of instructions. These instructions are written in a special computer language that computer can understand. These languages are known as Programming Languages.

A set of instructions that achieve a single outcome are called program or procedure. Many programs functioning together to do a task make a **software**.

For example, a word-processing software enables the user to create, edit and save documents. A web browser enables the user to view and share web pages and multimedia files.

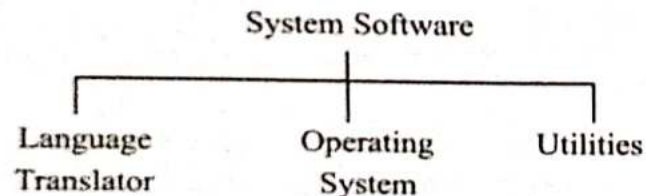**A computer software is classified in two parts-**

* System Software
* Application Software

```
                        Software
         ┌─────────────────────────────────────┐
    System Software                     Application Software
```

1. System Software :-

A system software consist of many programs for controlling many Input/output operation. An operating system is example of system software.

A system software is further classified into three parts :

```
                     System Software
         ┌───────────────┬───────────────┐
     Language        Operating       Utilities
     Translator        System
```

* **Language Translator :-**

A program that convert programming source code to machine readable codes are known as language translator.

There are three types of language translator

(1) **Interpreter :-** Interpreter is a program that convert high level language to machine level language. The basic property of Interpreter is that it first scan one line of a program or source code, if this is error free then it executes either

it will stop the execution. So an interpreter will check a program line by line and execute it, if it is error free. This process takes more time in execution of any program.

(2) **Compiler :-** A compiler is a program used to covert high-level language into machine level. The basic property of compiler is that it first scan all file at a time and check for any error, if no error found then change the program into machine level either show all the errors present in the program. So it takes very less time for execution.

(3) **Assembler :-** An assembler is a program written to convert assembly level language into machine level language.

2. **Operating system :-** An operating system is the system software which is used to operate the computer. An operating system manages a computer resources very efficiently, takes care of scheduling of multiple jobs for execution and manages the flow of data, instructions between input/output unit and the main memory. e.g. Windows, Unix, Linux etc.

3. **Utilities :-** Utility program are the programs which are often used by application program. These utility programs are created by the manufacturer. e.g. Text Editors, Sorting, Formatting etc.

2. **Application software** is a term which is used for **software** created for a specific purpose. It is generally a program or collection of programs used by end users. It can be called an **application** or simply an app. A **software** which is developed to help the user to perform specific tasks is called **application software**.

e.g

- *Microsoft Excel* – Used to prepare excel sheets.
- *VLC Media Player* – Used to play audio/video files.
- *Adobe Photoshop* – Used for designing and animation and many more.

Various Application Software Are :

- Word processing software
- Database programs
- Entertainment software
- Business software

- Educational software
- Computer-aided design(CAD) software
- Spreadsheet software etc.

1.12 Number System :

Introduction :

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.
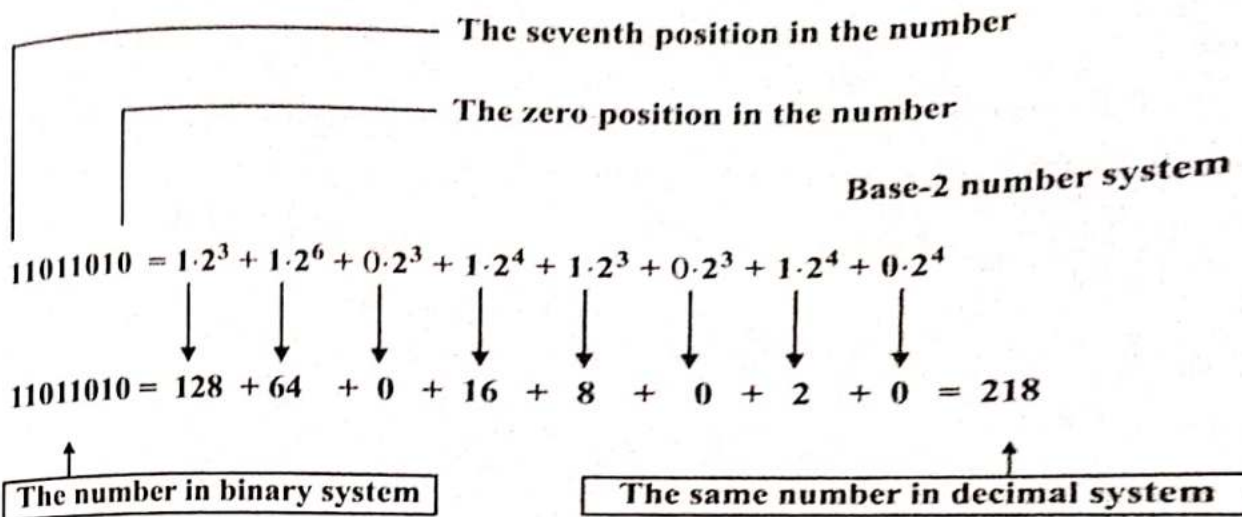
Number systems are the technique to represent numbers in the computer system architecture, every value that you are saving or getting into/from computer memory has a defined number system.

The value of each digit in a number can be determined using –

- The digit
- The position of the digit in the number
- The base of the number system (where the base is defined as the total number of digits available in the number system)

Def : Number System, the technique to represent and work with numbers is called number system. Decimal number system is the most common number system. Other popular number systems include binary number system, octal number system, hexadecimal number system, etc.

S.No.	Number System and Description
1	**Binary Number System** Base 2. Digits used : 0, 1
2	**Octal Number System** Base 8. Digits used : 0 to 7
3	**Hexa Decimal Number System** Base 16. Digits used: 0 to 9, Letters used : A-F

The seventh position in the number

The zero position in the number

Base-2 number system

$$11011010 = 1 \cdot 2^3 + 1 \cdot 2^6 + 0 \cdot 2^3 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^3 + 1 \cdot 2^4 + 0 \cdot 2^4$$

$$11011010 = 128 + 64 + 0 + 16 + 8 + 0 + 2 + 0 = 218$$

The number in binary system

The same number in decimal system

1. **Decimal Number System :** Decimal number system is a base 10 number system having 10 digits from 0 to 9. This means that any numerical quantity can be represented using these 10 digits. Decimal number system is also a positional value system. This means that the value of digits will depend on its position.

Let us take an example to understand this :

$1000 = 10*10*10$ which can also be written as 10^3.

$100 = 10*10$ or 10^2. and $10 = 10^1$. and $1 = 10^0$.

- $892 = 8*10^2 + 9*10^1 + 2*10^0$

- $1147 = 1*10^3 + 1*10^2 + 4*10^1 + 7*10^0$

- $53 = 5*10^1 + 3*10^0$

Decimal to Binary Conversion			Result
Decimal Number is : $(12345)_{10}$			Binary Number is $(11000000111001)_2$
2	12345	1 LSB	
2	6172	0	
2	3086	0	
2	1543	1	
2	771	1	
2	385	1	
2	192	0	
2	96	0	
2	48	0	
2	24	0	
2	12	0	
2	6	0	
2	3	1	
	1	1 MSB	

(33) (Computer Science-XI)

This table illustrates an example of decimal value of 149 and the location of LSB. In this particular example, the position of unit value (decimal 1 or 0) is located in bit position 0 (n=0), MSB stands for Most Significant Bit, while LSB stands for Least Significant Bit.

Binary (Decimal: 149)	1	0	0	1	0	1	0	1
Bit weight for given bit position n (2ⁿ)	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Bit position label	MSB							LSB

Another example of Decimal conversion to binary :

```
2 | 87 ——→ 1
  |
2 | 43 ——→ 1
  |
2 | 21 ——→ 1
  |
2 | 10 ——→ 0
  |
2 | 5 ——→ 1
  |
2 | 2 ——→ 0
  |
    1
```

Answer :

$$87_{10} = 1010111_2$$

Decimal   Binary

2. **Binary Number System :** "A Binary number system has only two digits that are 0 and 1. Every number (value) represents with 0 and 1 in this number system. The base of binary number system is 2, because it has only two digits."

The easiest way to vary instructions through electric signals is two-state system – on and off. On is represented as 1 and off as 0, though 0 is not actually no signal but signal at a lower voltage. The number system having just these two digits – 0 and 1 – is called **binary number system**.

Each binary digit is also called a **bit**. Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

2^5	2^4	2^3	2^2	2^1	2^0

Conversion of Binary to Decimal example :

a) **Binary Number: 11010_2 or 11010**

$$11010_2 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$$
$$= 16 + 8 + 0 + 2 + 0$$
$$= 26_{10}$$

b) **Binary Number : 10101_2**

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note - 10101_2 is normally written as 10101.

SUMMARY

- **Computer** is an electronic device that takes input, process it and gives the results.
- **Data** is raw material of information.
- **Information** proper collection of data is called information.
- **CPU** stands for central processing unit, is known as brain of computer.
- **1ˢᵗ generation (1940-1956)** of computer used vacuum tubes.
- **2ⁿᵈ generation (1956-1963)** of computer used transistors.
- **3ʳᵈ generation (1964-1971)** of computer used ICs.

- **4th generation (1972-2010)** of computer used microprocessors..
- **5th generation (2010 onward)** of computer used artificial intelligence.
- **Memory** is used to store data and instructions.
- **RAM** stands Random Access Memory. It is volatile memory.
- **ROM** stands Read Only Memory. It is non-volatile memory.
- **OCR**- Optical Character Reader/Recognition.
- **MICR**- Magnetic Ink Character Reader/Recognition.
- **OMR**- Optical Marker Reader/Recognition.
- **BCR**- Bar Code Reader.
- **CRT**-Cathode Ray Tube.
- **LCD**-Liquid Crystal Display
- **LED**-Light Emitting Diode.
- **Printer** is an output device which display results in the form of hard copy.
- **Laser Printer** is known as page printer which produce high quality text and graphics.
- **Plotter** is an output device that used in engineering and architecture field.
- **Software** is a program which is set of instruction.
- **Binary Number System** has only two number system i.e. 0 and 1.
- **Decimal Number System** is a base 10 number system having 10 digit from 0 to 9.

TRUE/FALSE

1.	Computer is an electronic machine or device.	**True**
2.	Data is raw material of information.	**True**
3.	Control unit does not coordinate all operations of computer system.	**False**
4.	First Generation of computer was used ICs.	**False**
5.	Ram is Volatile memory.	**True**
6.	1 Nibble is equal to 8 bits.	**False**
7.	Interpreter checks the program line by line.	**True**
8.	Scanner is an input device.	**True**
9.	VDU stands for visual display unit.	**True.**
10.	CPU is the brain of computer system.	**True.**

EXERCISE

Q1. What is Computer ? Write its characteristics.

Q2. What are the applications of computer ?

Q3. What is CPU? Explain its Block Diagram.

Q4. Explain the Generation of computer ?

Q5. What do you mean by memory ? Explain its types.

Q6. What is RAM and ROM ?

Q7. What is Hard Disk ?

Q8. Explain the units of memory ?

Q9. What are input and output units? Explain it.

Q10. What is Keyboard ? Explain it.

Q11. What do you mean by Scanner ?

Q12. What do you mean by Monitor/VDU ?

Q13. What is Printer ? How many types of Printer ?

Q14. Differentiate between Impact and non impact printer.

Q15. What is Laser Printer ?

Q16. What is Inkjet Printer ?

Q17. What is DMP Printer ?

Q18. What is Plotter ?

Q19. What is Software ? Explain it.

Q20. Explain the System and application software ?

Q21. Explain Number system along with Binary and Decimal number system ?

Q22. **Convert the following into Binary to Decimal numbers :**

a.) 11010_2 b.) 10101_2

Q23. **Convert the following into Decimal to Binary numbers :**

a.) 87_{10} b.) 53_{10}

—End—