CS - 03

Computer Fundamentals And Emerging Technology

Introduction:

- What is Computer?
- Characteristics
- Data Processing

Characteristics Of Computer :

- Speed
- Accuracy
- Diligence
- Versatility
- Reliability
- Memory
- Automation
- No Feelings
- No IQ

Cont…

1. **Speed** :   Computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. It can perform millions of instructions per second. Time takes is in milliseconds or nanoseconds.

2. **Accuracy**:   They perform calculations with 100% accuracy. Error may occur due to data inaccuracy or inconsistency.

3. **Diligence** :   A computer can perform millions of tasks with same accuracy. It doesn't feel any lack of concentration.

4. **Versatility** :   It refers to the capability of a computer to perform different kind of work with same accuracy and efficiency.

Cont…

5. **<u>Reliability</u>** : A computer is reliable if we give same set of inputs any number of times, we will get the same result.

6. **<u>Automation</u>** : Computer performs all the task automatically , it performs tasks without human interfere.

7. **<u>Memory</u>** : 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.

Data Processing Cycle :

- It shows how computer takes data from users, process it and convert into Information

- First, Computer takes data as Input

- Stores that data/ instructions in its memory and use it when required

- Processes the data and converts it into useful information

- Generates the output

- Also, controls all the above four steps

Cont...

Input	→	Computer Process	→	Information
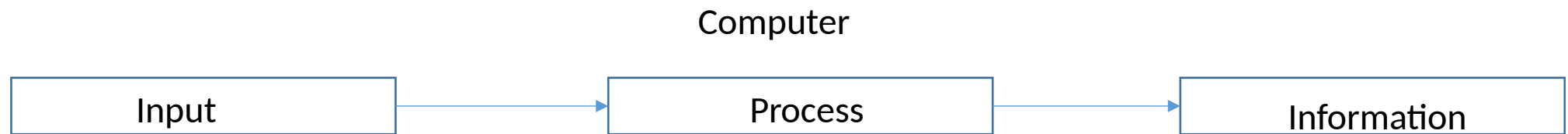
Classification Of Computer By Data Processed

- The computers are classified based on the technology being used and how data is processed

- Computers are classified in 3 types :

1. Analog Computers

2. Digital Computers

3. Hybrid Computers

1. Analog Computers :

- An analog computer is a type of computer that uses the continuously changeable aspects of physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved

- Analog computers were widely used in scientific and industrial applications even after the digital computers

- They do not use discrete values but use continuous values

- These computers work on analog signals.

- Used in our daily life such as refrigerator, speedometer etc

# Image:

2. Digital Computers :

- These are the computers which perform various computational as well as some other general purpose works

- The information in such computer is represented by variables taking a limited number of discrete values

- These computers work on digital signals

- But at a time it only takes one value.

- Digital computers use the **binary number system**, which has two digits 0 and 1 called bit

- Main advantage of digital computers is its speed and accuracy

Cont..

- Examples of digital computers are:
- Laptops, desktops, calculators, smartphones etc
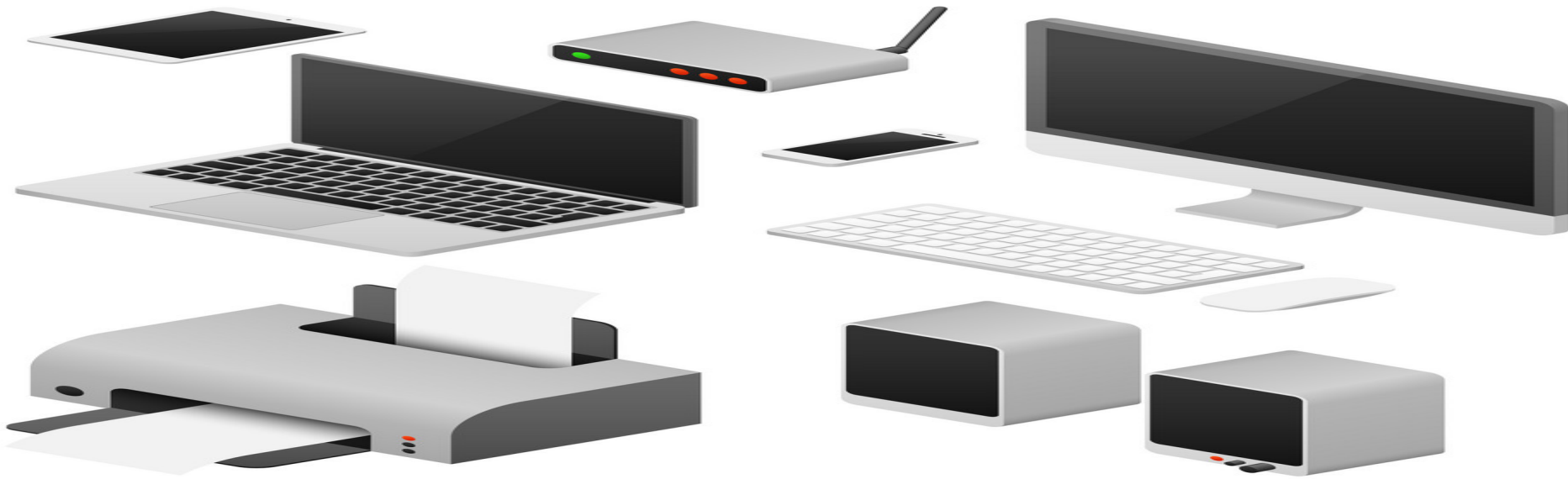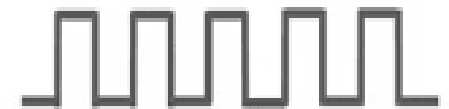
Signals : 0- Off, 1-On
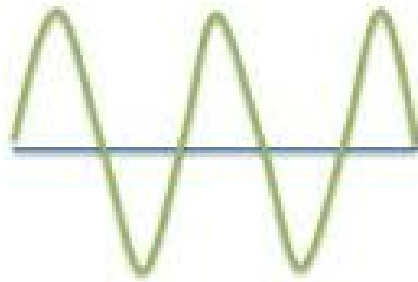
Analog Signal Vs 0100111101 Digital Signal

Analog Signal

Digital Signal

Representation of Signals

3. Hybrid Computers :

- Hybrid computers are computers that includes features of analog computers and digital computers

- The digital components provide logical and numerical operations while analog components serve as a solver of equations

- It is mixer of analog and digital computers

- It takes accuracy of analog computers and speed of digital computers

- It produces quick results

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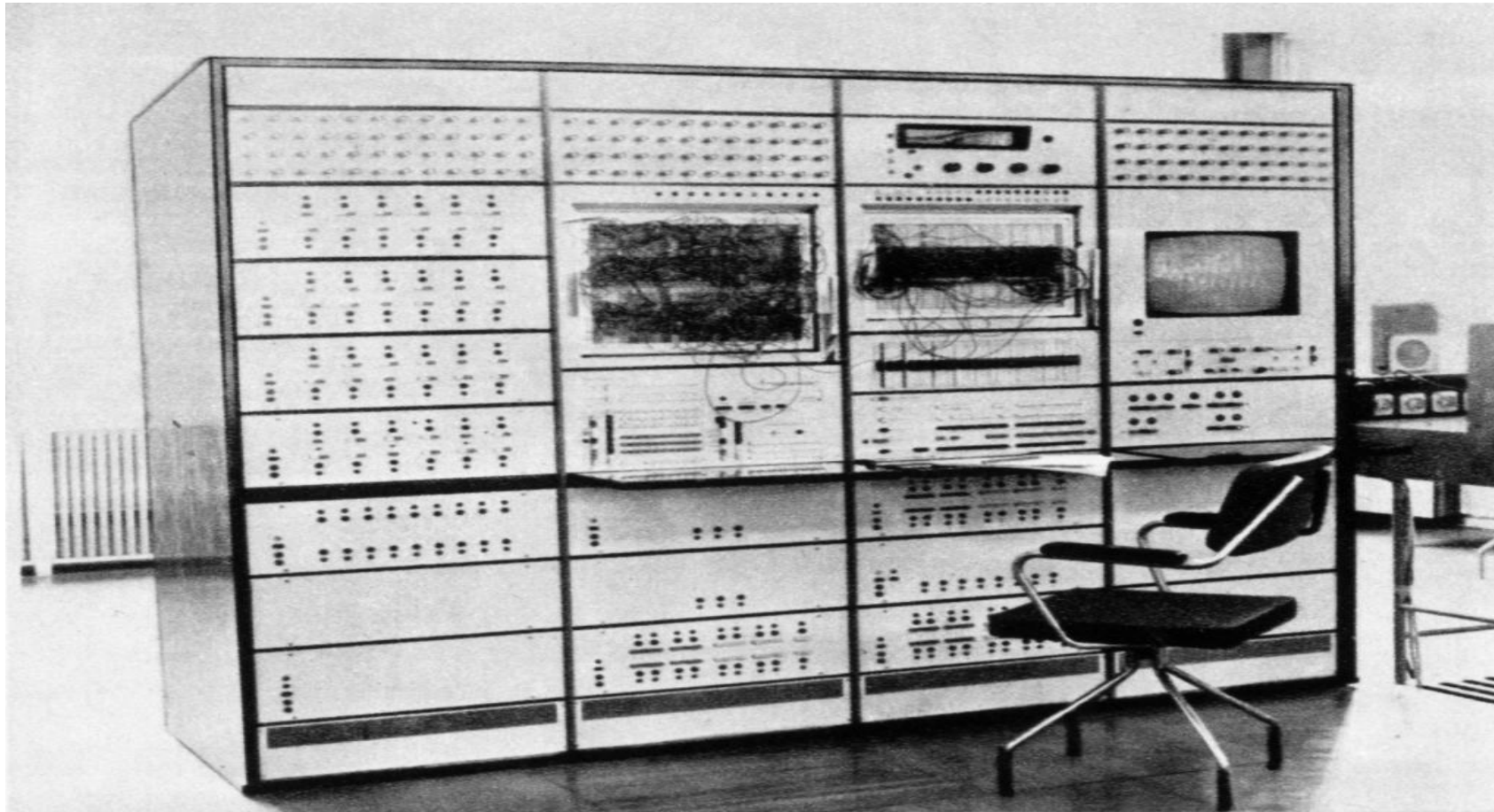
History Of Computers :

- Growth in the computer industry is determined by the development in technology

- Each generation of computer development is characterized by one or more hardware development

- Computer generations are divided into 5 phases

- First Generation (1942-1955)

- Second Generation (1955-1964)

- Third Generation (1964-1975)

- Forth Generation (1975-1980)

- Fifth Generation (1980-Present)

First Generation Computers :

- The period of first generation was 1942 to 1955

- The components of first generation used **Vacuum tubes** as the basic component for memory and circuit for CPU

- These tubes, like electric bulbs, produced a lot of heat and also very expensive and could be afforded only by very large organizations

- In this generation, mainly **batch processing operating system** were used

- **Punched cards**, **paper tape** and **magnetic tape** were used as input and output devices

- It used **machine code** as programming language

Main Features Of First Generation Computers

- Vacuum tube technology

- Unreliable

- Supported machine language only

- Very costly

- Generated lot of heat

- Slow input and output devices

- Huge size

- Need of Ac

- Non- portable

- Consumed lot of electricity

Computers Of This Generation :

- **ENIAC**
- **EDVAC**
- **UNIVAC**
- IBM-701
- IBM-650

Second Generation Computers :

- The period of second generation computers was 1955-1964

- In this generation, **transistors** were used

- That were cheaper, consumed less power, more compact in size, more reliable, faster than the first generation computers

- In this generation, magnetic cores were used as primary memory and magnetic tape and magnetic disks as secondary storage devices

- In this generation, assembly language and high-level language like FORTRAN, COBOL were used

- Computers used batch operating systems and multiprogramming OS

Main Features Of Second Generation Computers :

- Use of transistors

- Reliable in comparison to first generation computers

- Smaller in size in comparison to first generation computers

- Generated less heat as compared to first generation

- Consumed less electricity as compared to first generation

- Faster as compared to first generation

- Still very costly

- AC needed

- Supported machine and assembly language

Computers Of Second Generation :

- IBM 1620
- IBM 7094
- CDC 1604
- UNIVAC 1108

Third Generation Computers :

- The duration was 1964-1975
- The third generation computer used **integrated circuits (IC)** in place of transistors
- A single IC has many transistors, registers and capacitors along with circuits
- Ics were made up of **Silicon**
- The IC was invented by **Jack Kilby**
- This made computers smaller in size and reliable
- In this generation, remote processing, time sharing, multi-programming operating systems were used
- High level languages were also used in this generation

Main Features Of Third Generation Computer

- Used IC
- More reliable in comparison to previous generations
- Smaller in size
- Generated less heat
- Faster
- Less maintenance
- Still costly
- AC needed

- Consumed less electricity
- Supported high-level language
- LSI technology (Large Scale Integration) 1000
- MSI(Medim scale int…)   100
- SSI (Small scale int…) 10

Computers Of This Generation :

- IBM 360 series
- Honeywell 6000 series
- PDP (Personal Data Processor)
- IBM 370/168
- TDC-316

Fourth Generation Computers :

- The period was 1975-1980

- The computers used **Very Large Scale Integration (VLSI) circuits**

- VLSI circuits having about 5000 transistors and other elements on a single chip made it possible to have **microcomputers**

- They became more powerful, compact, reliable and affordable

- As a result, personal computers (PC) were invented

- In this generation, time sharing, network systems were used

- All high level languages like C, C++, DBASE are used

Main Features Of Fourth Generation Computers :

- VLSI technology used

- Very cheap

- Portable

- Reliable

- Use of PC

- Very small in size

- No AC needed

- Concept of internet was introduced

- Development in network

- Became easily available

Computers Of This Generation :

- DEC 10
- STAR 1000
- PDP 11
- **CRAY-1 (Super Computer)**
- Cray-X-MP (Super Computer)

Fifth Generation Computers :

- The duration was 1980 to till date

- In this generation, VLSI became ULSI (Ultra Large Scale Integration) technology, resulting the production of **microprocessors** chips having 10 million components

- This generation is based on **parallel processing and AI (Artificial Intelligence)**

- AI is an emerging branch of computer science, which method of making computers think like human beings

- C, C++, Java, .Net are used in this generation

AI Includes :

- Robotics
- Neural networks
- Game playing
- Development of expert systems for decision making
- Understanding natural language

Main Features Of This Generation :

- ULSI technology
- AI development
- Parallel processing
- More user friendly interfaces with multimedia features
- Very powerful
- Cheap

Computers of This Generation :

- Desktop
- Laptops
- Notebook
- Ultrabook
- Chromebook
- Tablets
- Smart phones

Classification of computers by processing capabilities :

- Based on processing capabilities and size of computers can be broadly categorized as follows :

1. Micro Computers

2. Mini Computers

3. Mainframe Computers

4. Super Computers

1. Micro Computers :

- Microcomputers are the most common kind of computers in use as of today
- The term "Microcomputer" was introduced with the advent of system based on **single chip microprocessor**
- Microcomputers are classified into two types:

1. Desktops

2. Portables

The difference is portables can be used while travelling whereas desktops cannot be carried around

Cont…

- The different portable computers are :

- Laptops

- Palmtops (hand-held)

- Notebooks

- Wearable computers

2. Mini Computers :

- A minicomputers are a medium-sized computers
- That is more powerful than a microcomputer
- These computers are usually designed to serve multiple users simultaneously (parallel processing)
- They are more expensive than microcomputers
- Examples are : Digital alpha, Sun ultra

3. Mainframe Computers :

- Computers with large storage capacity and very high speed of processing (compared to mini and micro) are known as mainframe computers

- They support a large number of terminals for simultaneous use by a number of users like ATM transactions

- They are also used as central host computers in distributed data processing system

- Mainframe computers are powerful, used primarily by corporate and government organizations for critical applications, bulk data processing

4. Super Computers :

- Super computers have extremely large storage capacity and computing speeds which are many times faster than other computers

- A super computer is measured in terms of tens of **millions instructions per second (mips)**, an operation is made up of numerous instructions

- These are used mainly for large scale numerical problems in scientific and engineering disciplines such as weather analysis

- Examples : Param, Cray, IBM blue gene

Input Devices :

- Input devices enable users to send data, information or control signals to a computer
- The CPU of a computer receives the input and processes it to produce the output
- Some of the popular input devices are :

1. Keyboard
2. Mouse
3. Scanner
4. Joystick
5. Light pen
6. Microphone
7. Camera etc..

Keyboard :

- The keyboard is a basic input device that is used to enter data into a computer or any other electronic device by pressing keys

- It has different sets of keys for letters, numbers, characters, and functions

- Keyboards are connected to a computer through USB or a Bluetooth device for wireless communication

- Types of keyboards : There can be different types of keyboards based on the region and languages used. Some types are :

1. QWERTY Keyboard

2. AZERTY Keyboard (Standard French Keyboard)

3. DVORAK Keyboard (For better typing speed)

Mouse :

- The mouse is a hand-held input device which is used to move cursor or pointer across the screen

- It is designed to be used on a flat surface and generally has left and right button and a scroll wheel between them

- Laptop computers come with a **touchpad** that works as a mouse

- It lets you control the movement of cursor or pointer by moving your finger over the touchpad

- The mouse was invented by **Douglas C**. in 1963

- Early it had a roller ball integrated as a movement sensor

Cont….

- Modern mouse devices come with **optical technology** that controls cursor movements by a visible or invisible light beam

- A mouse is connected to a computer through different ports depending on the type of computer and type of a mouse

- Common types of mouse :

1. Trackball mouse

2. Mechanical mouse

3. Optical mouse

4. Cordless or wireless mouse

Trackball Mouse :

- It has the ball mechanism to move the pointer or cursor on the screen

- The ball is half inserted in the device and can be easily rolled with finger, thumb or palm to move the pointer on the screen

- The device has sensor to detect the rotation of ball

Mechanical Mouse :

- It has a system of a ball and several rollers to track its movements

- It can be used for high performance

- The drawback is that they tend to get dust into the mechanics and thus requires regular cleaning

Optical Mouse :

- It uses optical electronics to track its movement

- It is more reliable than a mechanical mouse and also requires less maintenance

- Plain non-glossy mouse mat should be used for best working

- Its performance is affected by the surface on which it is operated

Cordless Or Wireless Mouse :

- As the name suggests, this type of mouse lacks cable and uses wireless technology such as infrared or Bluetooth or wi-fi to control the movement of the cursor

- It is used to improve the experience of using a mouse, it uses batteries for its power supply

Scanner :

- The scanner uses the pictures and pages of text as input

- It scans the picture or a document

- The scanned picture or document is then converted into a digital format or file and is displayed on the screen as an output

- It uses **optical character recognition** techniques to convert images into digital ones

- Some of the common types of scanners are :

1. Flatbed Scanner :

- It has a glass pane and a moving optical CIS or CCD array

- The light illuminates the pane, and then the image is placed on the glass pane

- The light moves across the glass pane and scans the document and produces its digital copy

2. Handheld Scanner :

- It is a small manual scanning device which is held by hand and is rolled over a flat image that is to be scanned

- The drawback is using this device is that the hand should be steady while scanning

- Otherwise, it may distort the image

- One of the commonly used handheld scanners is the barcode scanner which you would have seen in shopping stores

Cont..

Sheetfed Scanner :

- In this scanner, the document is inserted into the slot provided in the scanner

- the main component of this scanner include sheet-feeder, scanning module, and calibration sheet

- The light does not move in this scanner, instead, the document moves through the scanner

- It is suitable for scanning single page documents, not for thick objects like books, magazines, etc
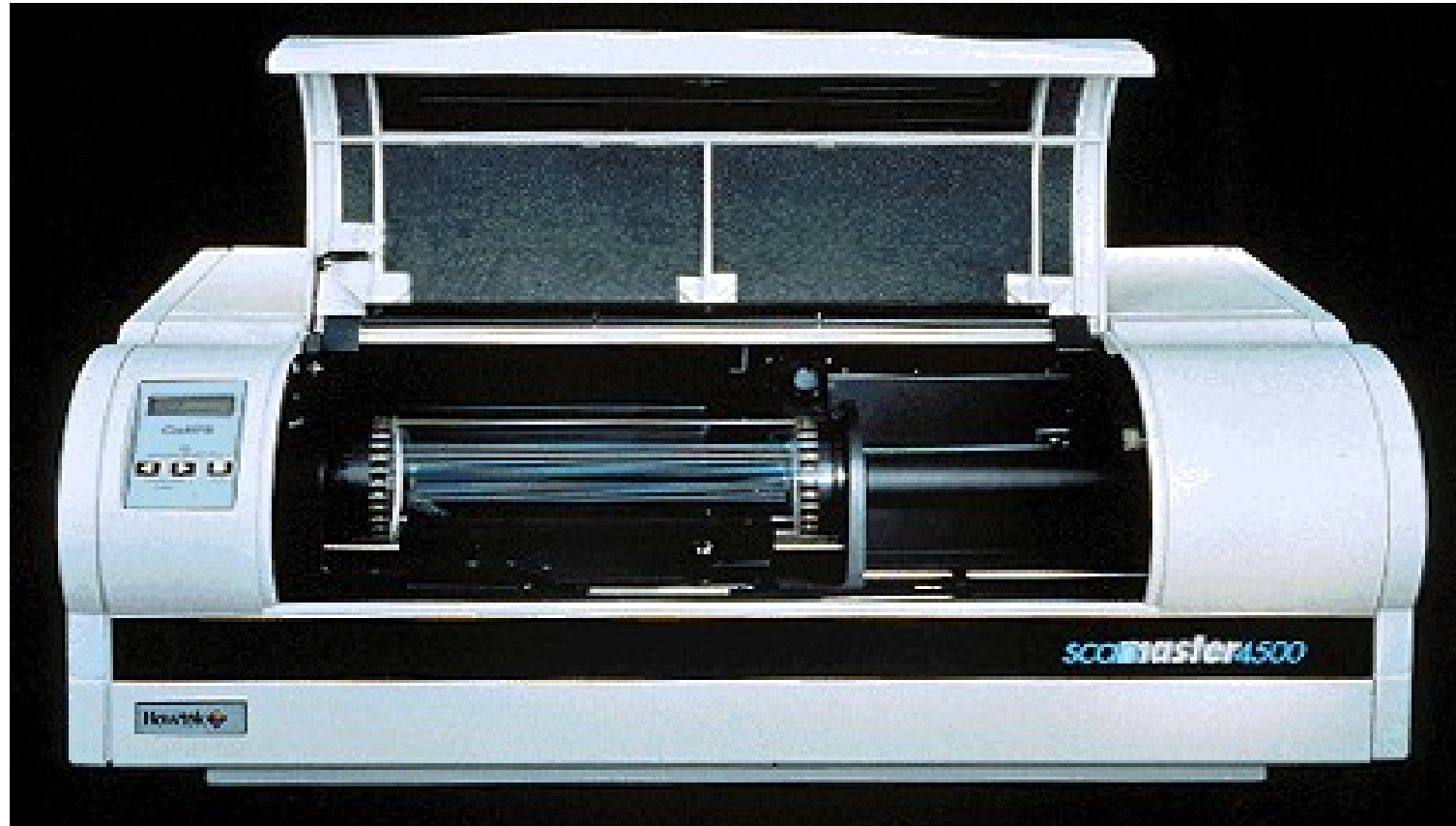
Cont.

Drum Scanner :

- Drum scanner has photomultiplier tube (PMT) to scan images

- It does not have a charge-coupled device like a flatbed scanner

- The tube is very sensitive to light, the image is placed on a glass tube, and the light moves across the image which produces a reflection of the image which is captured by the PMT and processed

- This scanners have high resolution and suitable for detailed scans

Cont…

Photo Scanner :

- It is designed to scan photographs

- It has high resolution and color depth, which are required for scanning photographs

- Some photo scanners come with in-built software for cleaning and restoring old photographs

Cont…

Joystick :

- A joystick is also a input pointing device like mouse
- It is made up of a stick with a spherical base
- The base is fitted in a socket that allows free movement of the stick
- The movement of stick controls the cursor or pointer on the screen
- The first joystick was invented by C. B. Mirick at USA
- A joystick can be of different types such as displacement joysticks, finger operated joysticks, hand operated, isometric joystick
- In joystick, the cursor keeps moving in the direction of joystick and the cursor of mouse moves when the mouse moves

Joystick :

Logitech Freedom 2.4 Joystick

ComputerHope.com

Light Pen :

- A light pen is a computer input device that looks like a pen

- The tip of the light pen contains a light sensitive detector that enables the user to point to or select objects on the display screen

- Its light sensitive tip detects the object location and sends the corresponding signals to CPU

- It is not compatible with LCD so it is not in use today

- It also helps you draw on the screen if needed

Light Pen :

<u>Microphone :</u>

- The microphone is the computer input device that is used to input the sound

- I receives the sound vibrations and converts them into audio signals or sends to a recording medium

- The audio signals are converted into digital data and stored in the computer

- The microphone also enables the user to telecommunicate with others

- It is used to add sound to presentation and webcams for video conferencing

Microphone :

Central Processing Unit :

- A central Processing Unit also called CPU or processor is the electronic circuitry within a computer that executes instructions that make up computer program

- The CPU performs basic arithmetic, logic, controlling and input/output operations specified by the instructions in the programs

- Principal components of a CPU include the arithmetic logical unit (ALU) that performs arithmetic and logical operations, processor registers that supply operands to ALU and stores results

- Modern CPU consist of integrated chip (IC)

- CPU contains many memory , peripherals and other computer components

Cont…

- It is also known as brain of computer
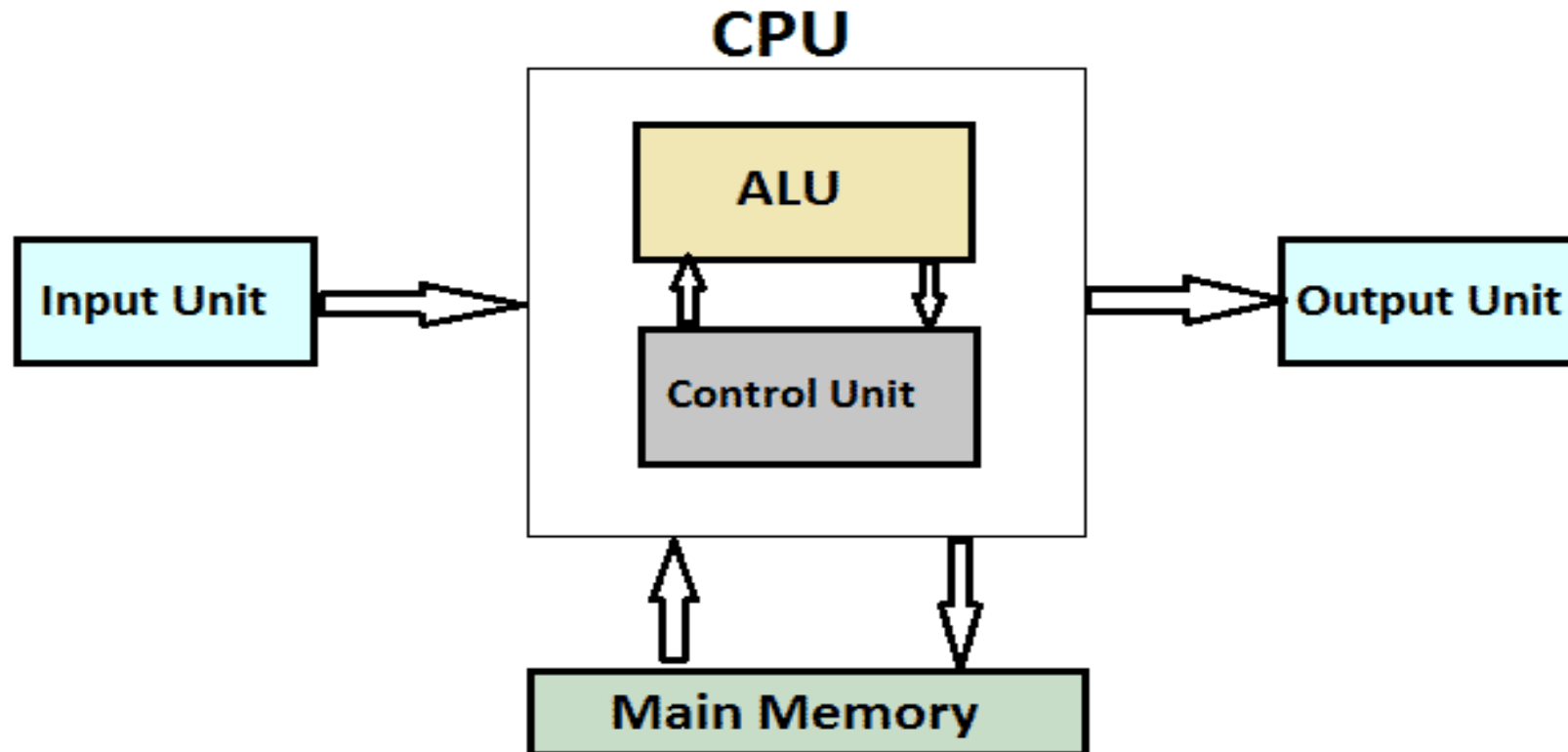
Memory or Storage Unit :

- This unit can store instructions, data and intermediate results

- This unit supplies information to other units of the computer when needed

- It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM)

- Its size affects speed, power and capability

- Primary and secondary memory are two types of memories in the computer

- They stores data and instructions required for processing

Cont…

- Stores intermediate result

- Stores final results of processing before these results are released to output devices

- All inputs and outputs are transmitted through the main memory

Control Unit :

- This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations

- Function of this units are:

- It is responsible for controlling the transfer of data and instructions among other units of the computer

- It manages and coordinates all the units of the computer

- It obtains the instructions from the memory, interprets them, and directs the operation of the computer

- It communicates with i/o devices for transfer of data or results from storage

- It does not process or store data

ALU :

- This unit consist of two subsections:

- Arithmetic section

- Logic section

- Arithmetic Section : Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, division

- Logic Section : Function of logic section is to perform logic operations like comparing, selecting, matching and merging of data

Output Devices :

- The output devices display the result of the processing of raw data that is entered in the computer through an input devices

- There are a number of output devices that display output in different ways such as text, images, hard copies and audio video

- Some of popular output devices are :

1.   Monitor

- CRT Monitors

- LCD Monitors

- LED Monitors

- Plasma Monitors

Cont….

2. Printers

- Impact Printers
    - Character Printers
        - Dot matrix printers
        - Daisy Wheel Printers
    - Line Prin   ters
        - Drum Printers
        - Chain Printers
- Non impact Printers
    - Laser Printers
    - Inkjet Printers

Monitors :

- The monitor is the display unit or screen of the computer

- It is the main output device that displays the processed data or information as text, images, audio or video

- The types of monitors are given below :

1. CRT Monitors :

- CRT monitors are based on the Cathode Ray Tubes

- They are like vacuum tubes which produce images in the form of video signals

- Cathode ray tube produces a beam of electrons through electron guns that strike on the inner phosphorescent surface of the screen to produce images on the screen

Cont…

- The monitor contains millions of phosphorus dots of red, green, and blue color

- These dots starts to glow when struck by electron beams and it is called cathodoluminescence