



# **SNS COLLEGE OF ENGINEERING**

**Kurumbapalayam(Po), Coimbatore – 641 107**

**Accredited by NAAC-UGC with 'A' Grade**

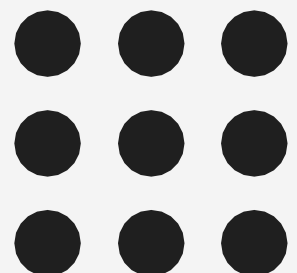
**Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai**

**Department of Artificial Intelligence and  
Data Science**

**Course Name – Computational Thinking and  
Python Programming**

**I Year / I Semester**

**Unit 1-Computational thinking and problem solving**



## What is a Computer?

A computer is an electronic device used to process data.

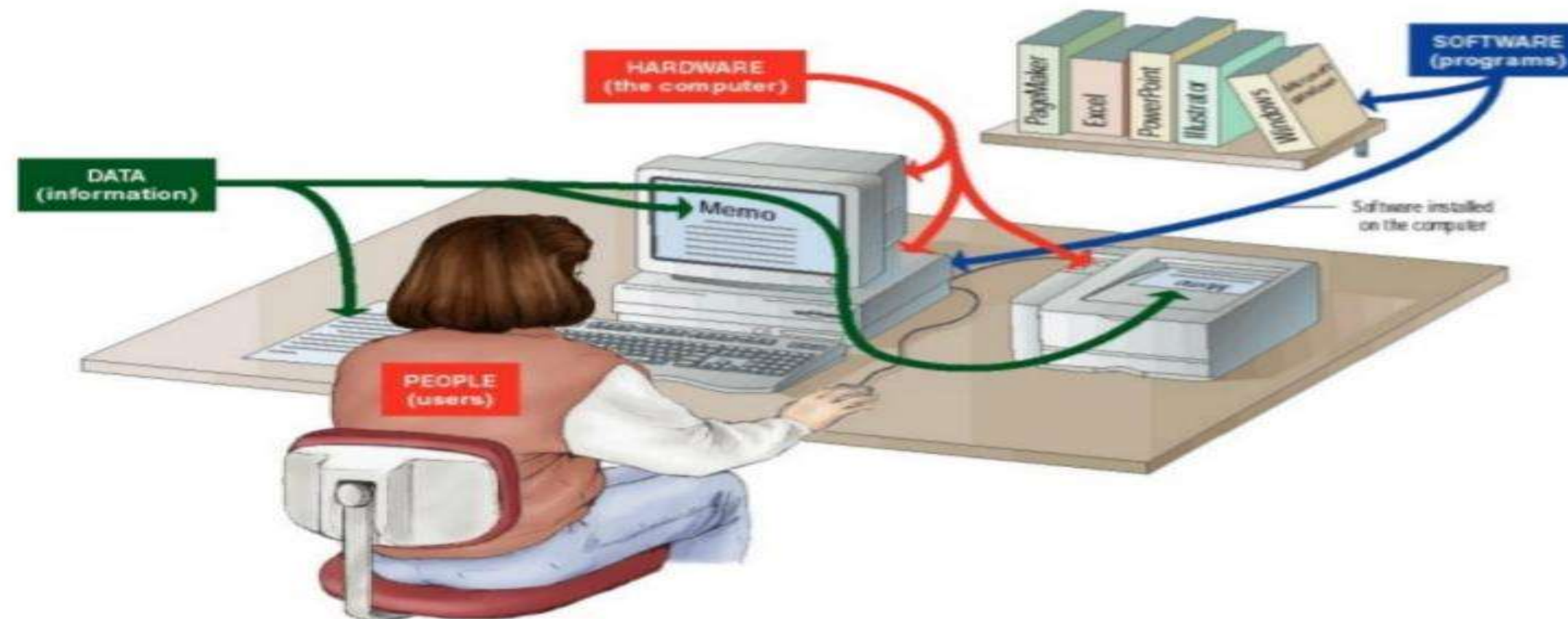
- A computer can convert data into information that is useful to people.
- A complete computer system includes four distinct parts:

Hardware

Software

Data

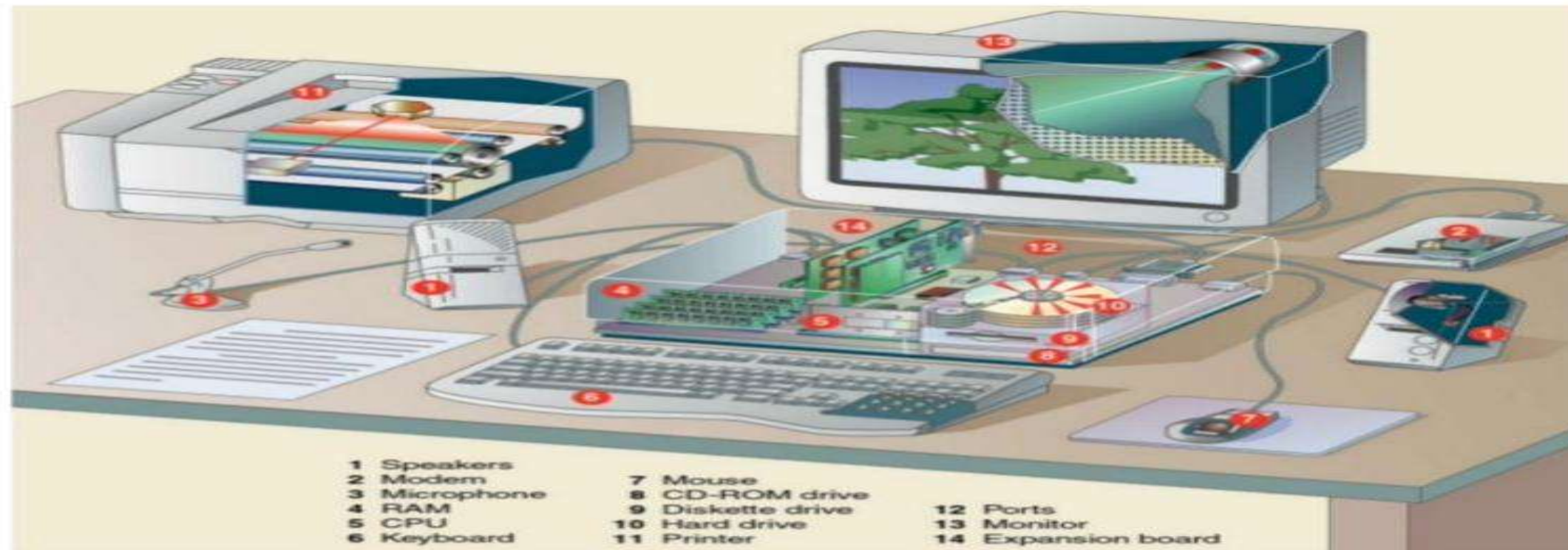
User





## Hardware

- A computer's hardware consists of electronic devices; the parts you can see and touch.
- The term "device" refers to any piece of hardware used by the computer, such as a keyboard, monitor, modem, mouse, etc.



## Software

- **Software – also called programs – consists of organized sets of instructions for controlling the computer.**
- **Some programs exist for the computer's use, to help it manage its own tasks and devices.**
- **Other programs exist for the user, and enable the computer to perform tasks for you, such as creating documents.**

## Data

- **Data consists of raw facts, which the computer can manipulate and process into information that is useful to people.**
- **Computerized data is digital, meaning that it has been reduced to digits, or numbers. The computer stores and reads all data as numbers.**
- **Although computers use data in digital form, they convert data into forms that people can understand, such as text, numerals, sounds, and images.**



## Users

- People are the computer's operators, or users.
- Some types of computers can operate without much intervention from people, but personal computers are designed specifically for use by people.

### *Computer Architecture*

- **Types of Hardware**
- **The CPU**
- **Memory**
- **How Memory is Measured**
- **Input and Output Devices**
- **Storage Devices**

### Types of Hardware

A computer's hardware devices are categorized as follows:

- **Processor**
- **Memory**
- **Input and output (I/O) devices**
- **Storage devices**

## Memory

- Memory also consists of chips attached to the motherboard.
- Memory holds data and program instructions as the CPU works with them. This memory is called Random Access Memory (RAM).
- The CPU can find any piece of data in RAM, when it needs it for processing.
- RAM is volatile, meaning it holds data only when the power is on. When the power is off, RAM's contents are lost.



## How Memory is Measured

- The smallest usable unit of measure for memory is the byte – the amount of memory required to hold one character, like the letter A or the numeral 2.
- Computers work with larger chunks of data, measured in multiple bytes, as shown below:

Unit	Approx. Value (bytes)	Actual Value (bytes)
Kilobyte (KB)	1,000	1,024
Megabyte (MB)	1,000,000	1,048,576
Gigabyte (GB)	1,000,000,000	1,073,741,824
Terabyte (TB)	1,000,000,000,000	1,099,511,627,776



## *Input and Output Devices*

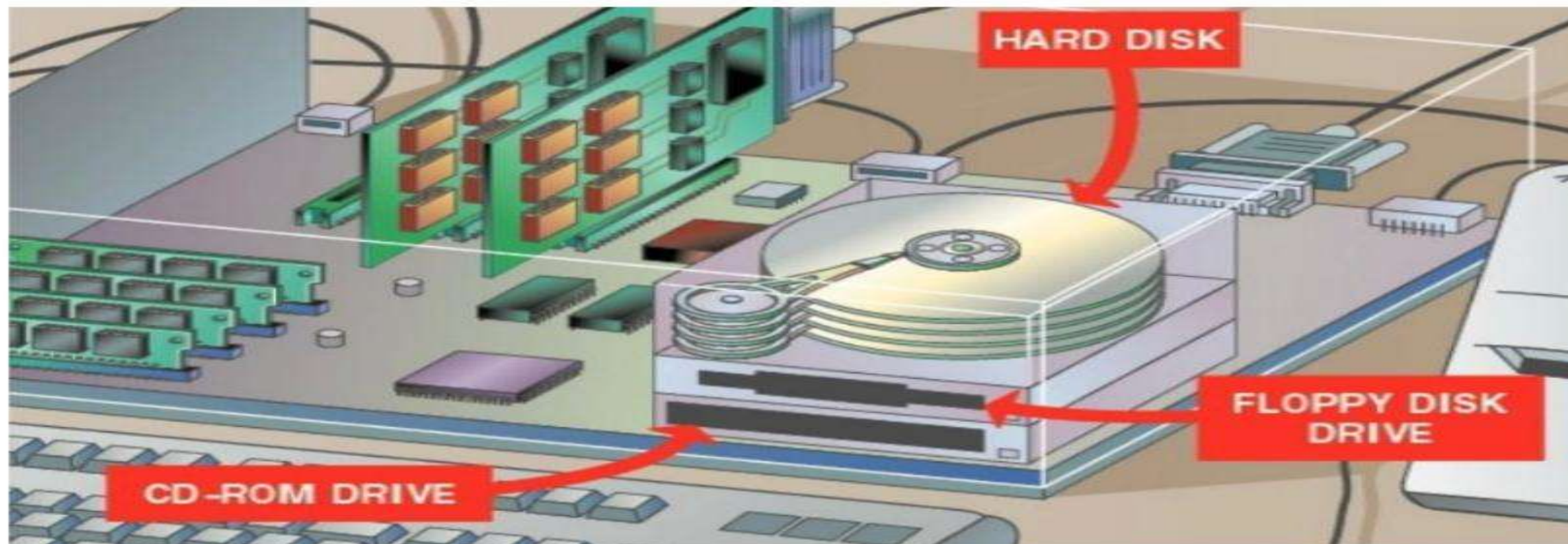
- **Input devices accept data and instructions from the user or from another computer system. The keyboard and mouse are examples of input devices.**
- **Output devices return processed data back to the user or to another computer system. The printer and monitor are examples.**
- **Communications devices (such as modems and network interface cards) perform both input and output, allowing computers to share information.**





## Storage Devices

- **Storage devices hold data not currently being used by the CPU. Data is commonly stored on a magnetic or optical disk. Each type uses a special medium for storing data on its surface.**
- **A disk drive is a device that reads data from and writes data to a disk. Most new computers feature a floppy disk drive, a hard disk drive, and an optical disk drive.**
- **The most common optical storage devices are CD-ROM and DVD-ROM drives.**





## Applications Software

- **Application software tells the computer how to accomplish tasks the user requires, such as creating a document or editing a graphic image.**
- **Some important kinds of application software are:**

**Word processing programs**  
**Database management**  
**Graphics programs**  
**Web design tools and browsers**  
**Communications programs**  
**Entertainment and education**

**Spreadsheet software**  
**Presentation programs**  
**Networking software**  
**Internet applications**  
**Utilities**  
**Multimedia authoring**

## Computer Classifications

- **Supercomputers**
- **Mainframe Computers**
- **Minicomputers**
- **Workstations**
- **Microcomputers, or Personal Computers**

## Mini Computers

- Minicomputers are smaller than mainframes but larger than microcomputers.
- Minicomputers usually have multiple terminals.
- Minicomputers may be used as network servers and Internet servers.



## Workstation

- Workstations are powerful single-user computers.
- Workstations are used for tasks that require a great deal of number-crunching power, such as product design and computer animation.
- Workstations are often used as network and Internet servers.





## Binary Numbers

- Computer processing is performed by transistors, which are switches with only two possible states: on and off.
- All computer data is converted to a series of binary numbers— 1 and 0. For example, you see a sentence as a collection of letters, but the computer sees each letter as a collection of 1s and 0s.
- If a transistor is assigned a value of 1, it is on. If it has a value of 0, it is off. A computer's transistors can be switched on and off millions of times each second.

### *The Binary Number System*

- To convert data into strings of numbers, computers use the binary number system.
- Humans use the decimal system (“deci” stands for “ten”).
- The binary number system works the same way as the decimal system, but has only two available symbols (0 and 1) rather than ten (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9).

Base 10	Base 2
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010

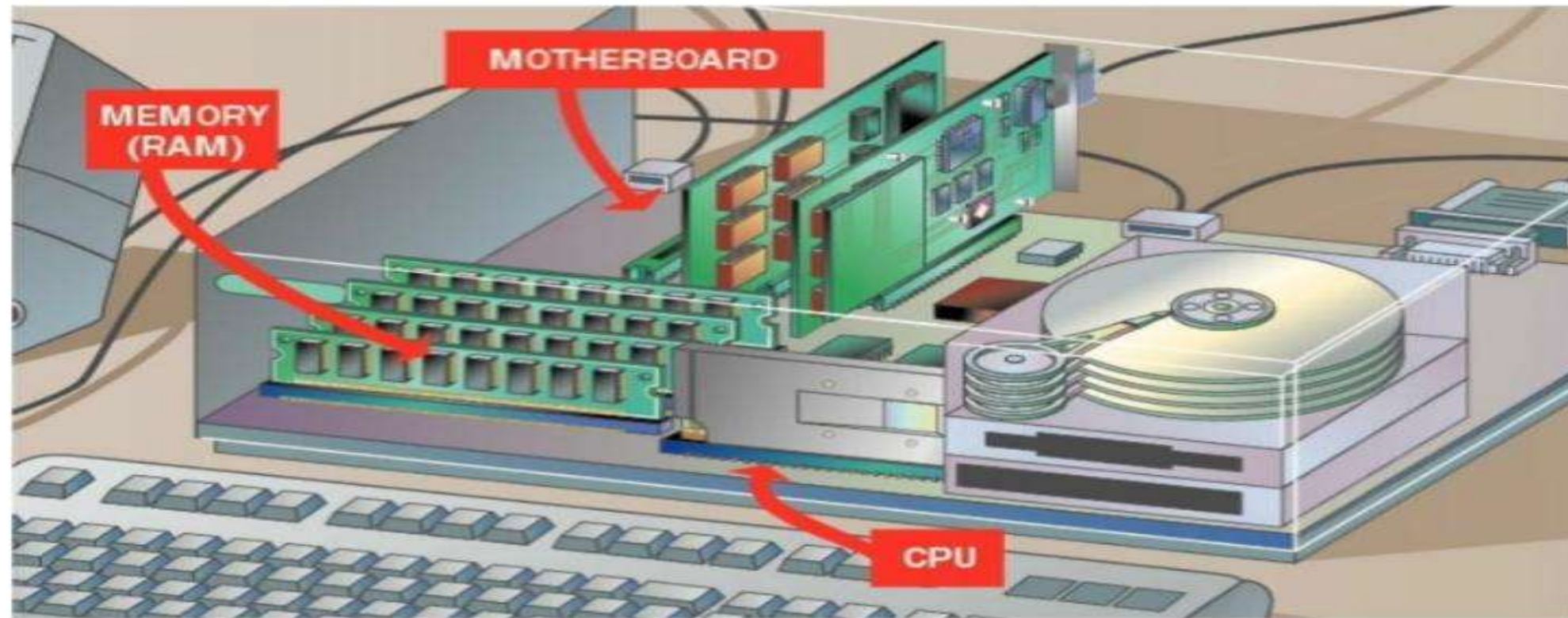
## *How Computers Represent Data - Text Codes*

- A text code is a system that uses binary numbers (1s and 0s) to represent characters understood by humans (letters and numerals).
- An early text code system, called EBCDIC, uses eight-bit codes, but is used primarily in older mainframe systems.
- In the most common text-code set, ASCII, each character consists of eight bits (one byte) of data. ASCII is used in nearly all personal computers.
- In the Unicode text-code set, each character consists of 16 bits (two bytes) of data.

### *Examples from the ASCII Text Code*

<b>Code</b>	<b>Character</b>
00110000	0
00110001	1
00110010	2
00110011	3
00110100	4
00110101	5
01000001	A
01000010	B
01000011	C
01000100	D
01000101	E





### *The Control Unit*

**The two main parts of a CPU are the control unit and the arithmetic logic unit (ALU)**

- **The control unit directs the flow of data through the CPU, and to and from other devices.**
- **The control unit stores the CPU's microcode, which contains the instructions for all the tasks the CPU can perform.**

## ALU Operations List

Arithmetic Operations	Logical Operations
+ Add	=, ≠ equal to, not equal to
- Subtract	>, > greater than, not greater than
x Multiply	<, < less than, not less than
÷ Divide	≥, ≥ greater than or equal to, not greater than or equal to
^ Raise by a power	≤, ≤ less than or equal to, not less than or equal to

### Memory

- **RAM stores data and program code needed by the CPU. The contents of RAM change rapidly and often.**
- **Read-only memory (ROM) is nonvolatile (or permanent). It holds instructions that run the computer when the power is first turned on.**
- **The CPU accesses each location in memory by using a unique number, called the memory address.**



## Types of RAM

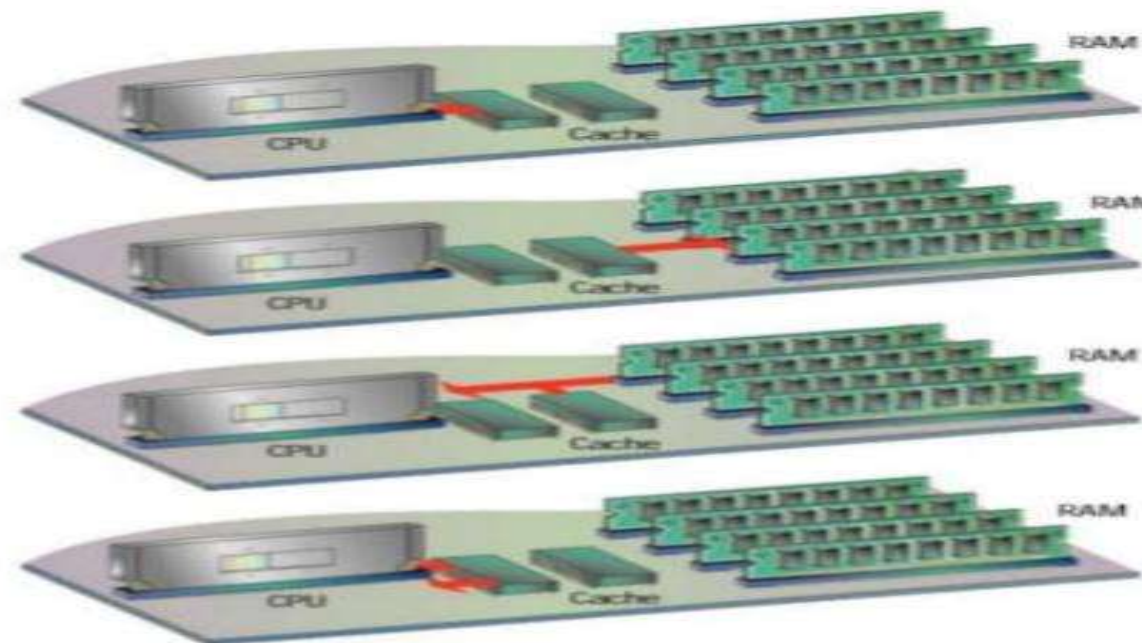
There are two basic types of RAM: **static and dynamic**

- **Dynamic RAM (DRAM) chips must be recharged with electricity very frequently, or they will lose their contents.**
- **Static RAM (SRAM) does not need to be recharged as often as DRAM, and can hold its contents longer.**

**Another type of RAM, called flash memory, can store its contents after power is turned off. Flash memory is used in digital cameras to store pictures.**

## Cache Memory

- **Cache memory is high-speed memory that holds the most recent data and instructions that have been loaded by the CPU.**
- **Cache is located directly on the CPU or between the CPU and RAM, making it faster than normal RAM.**
- **CPU-resident cache is called Level-1 (L1) cache. External cache is called Level-2 (L2) cache.**
- **The amount of cache memory has a tremendous impact on the computer's speed.**





## *Operating system*

- **The operating system manages all the other programs that run on the PC.**
- **The operating system provides services to programs and the user, including file management, memory management, and printing**
- **To provide services to programs, the OS makes system calls—requesting other hardware and software resources to perform tasks.**

### *Operating System - Multitasking*

- **Multitasking is the capability of running multiple processes simultaneously.**
- **A multitasking OS lets you run multiple programs at the same time.**
- **Through multitasking, you can do several chores at one time, such as printing a document while downloading a file from the Internet.**
- **There are two types of multitasking: cooperative and preemptive.**

# Generations of Computer

- The computer has evolved from a large-sized simple calculating machine to a smaller but much more powerful machine.

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- The evolution of computer to the current state is defined in terms of the generations of computer.
- Each generation of computer is designed based on a new technological development, resulting in better, cheaper and smaller computers that are more powerful, faster and efficient than their predecessors.



## Generations of Computer

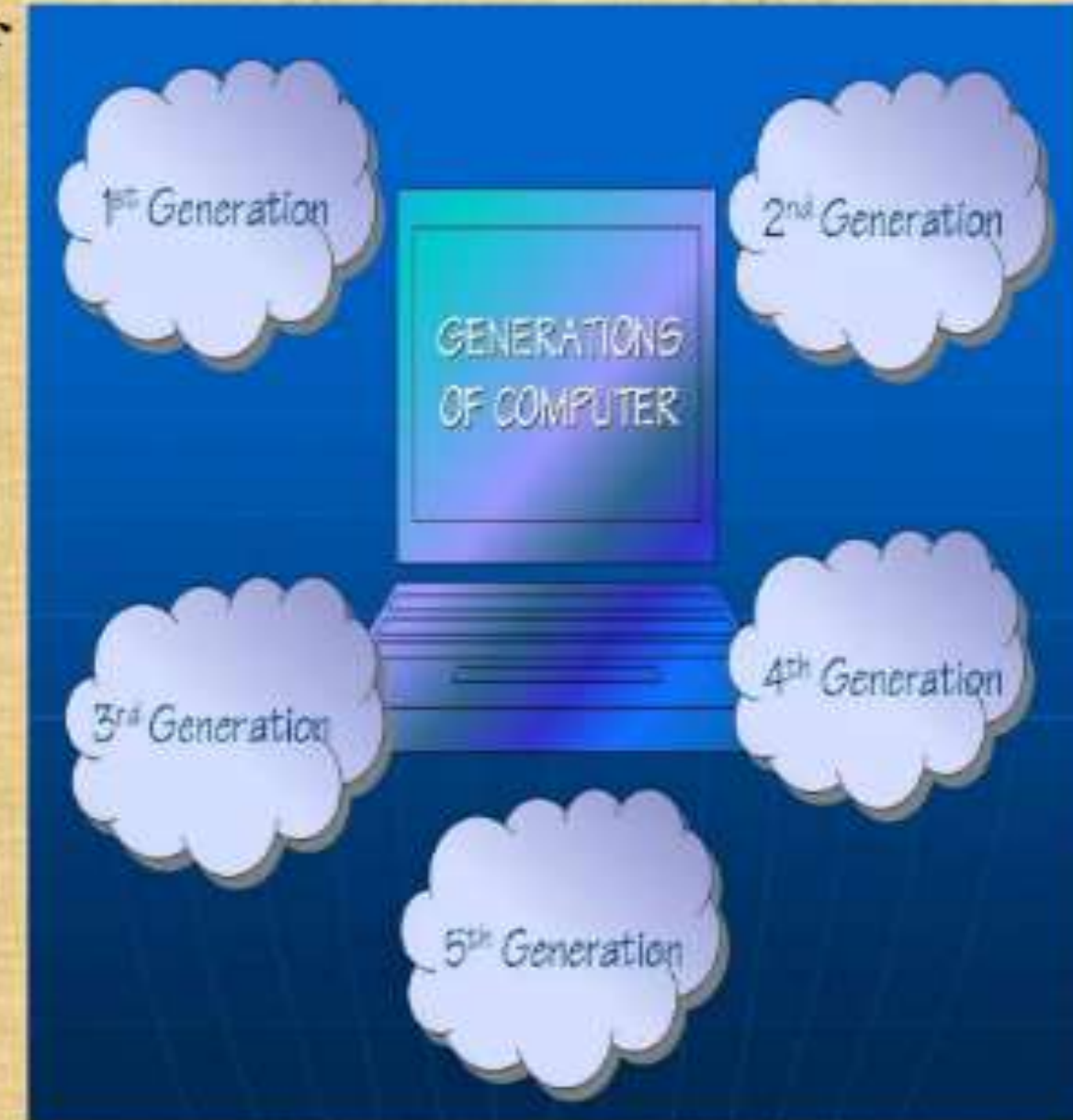
- Currently, there are five generations of computer. In the following subsections, we will discuss the generations of computer in terms of the technology used by them (hardware and software), computing characteristics (speed, i.e., number of instructions executed per second), physical appearance, and their applications.



# Generations of Computer

There are Five Generations of computers:-

1. First Generation(1946-1955)
2. Second Generation(1956-1965)
3. Third Generation(1966-1975)
4. Fourth Generation(1976-1985)
5. Fifth Generation(1986-onward)





# First Generation Computers (1940-1956)



- The first computers used vacuum tubes (a sealed glass tube containing a near-vacuum which allows the free passage of electric current.) for circuitry and magnetic drums for memory.
- They were often enormous and taking up entire room.
- First generation computers relied on machine language.
- They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions (defect or breakdown).
- The UNIVAC and ENIAC computers are examples of first-generation computing devices.



# First Generation Computers

## Advantages :

- It was only electronic device
- First device to hold memory



## Disadvantages :

- Too bulky i.e large in size
- Vacuum tubes burn frequently
- They were producing heat
- Maintenance problems





# Second Generation Computers (1956-1963)

- Transistors replaced vacuum tubes and ushered in the second generation of computers.
- Second-generation computers moved from cryptic binary machine language to symbolic.
- High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN.
- These were also the first computers that stored their instructions in their memory.

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# Second Generation Computers

## Advantages :

- Size reduced considerably
- The very fast
- Very much reliable



## Disadvantages :

- They over heated quickly
- Maintenance problems



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# Third Generation Computers (1964-1971)

- The development of the integrated circuit was the hallmark of the third generation of computers.
- Transistors were miniaturized and placed on silicon chips, called semiconductors.
- Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system.
- Allowed the device to run many different applications at one time.



# Third generation computers

## Advantages :

- ICs are very small in size
- Improved performance
- Production cost cheap

## Disadvantages :

- ICs are sophisticated





# Fourth Generation Computers (1971-present)

- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip.
- The Intel 4004 chip, developed in 1971, located all the components of the computer.
- From the central processing unit and memory to input/output controls—on a single chip.
- . Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

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# Fourth Generation Computers





# Fifth Generation Computers (present and beyond)

- Fifth generation computing devices, based on artificial intelligence.
- Are still in development, though there are some applications, such as voice recognition.
- The use of parallel processing and superconductors is helping to make artificial intelligence a reality.
- The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.



# Fifth Generation Computers

- Click to add text

