1 Introduction to Computer

Introduction

In today's world, computers have become an essential part of day-to-day life. We watch movies, play games, and do homework with the help of computers. This chapter introduces the fundamental concepts of computers. A computer is an electronic machine that processes data, performs tasks like writing, calculating, drawing, browsing the Internet and stores information for future use. This chapter explains the meaning and origin of the word "computer" and differentiates between hardware, software and firmware. The evolution of computers through hardware and software is described across five generations. We shall also learn about various types of software. The advantages of computers are discussed, including speed, accuracy, automation, versatility and storage. We shall learn about the basic components and the overall architecture of the computer. Input and output devices such as keyboards, mouse, scanners, speakers and monitors are introduced with examples.

What is a Computer?

The word "computer" comes from the Latin word "computare" which means "to calculate." Long ago, the word "computer" was used for people who solved math problems by hand or with the help of simple tools. But as technology grew, especially in the 21st century, the word "computer" started to mean electronic machines that can not only do calculations but also solve problems, manage data and help us do many tasks automatically. As discussed in the introduction part, a computer is an electronic device that takes input in the form of data and instructions, processes it using a set of instructions, and gives output. It can also store data for future use. Computers work very fast, are accurate, and help us in many other daily tasks.

Hardware, Software and Firmware

Let us understand few important terms related to computers, such as hardware, software and firmware.

Hardware refers to the physical parts of a computer system. These are the components that we can see and touch. Hardware is essential for the working of a computer. Some of the key hardware components are: Central Processing Unit (CPU), Monitor, Keyboard, Mouse, Speakers etc.

Software is a collection of programs, procedures and documentation that performs different tasks on a computer system. It is not a physical component, so it cannot be touched. Software acts as an interface between the user and the hardware. As per figure 1.1, there are two main types of software: System software and Application software.

Firmware is a special type of software that is embedded directly into a hardware device. It provides the low-level control for the device's specific hardware. Unlike regular software, firmware is stored in non-volatile memory and is not meant to be changed frequently. Examples include Basic Input/Output System, software in routers, and control software in washing machines and microwaves.

Types of Software

Now let us understand different types of software used in computers. It covers Application Software and System Software with simple examples. By learning these concepts, we shall gain basic knowledge of how software works and supports daily tasks on digital devices.
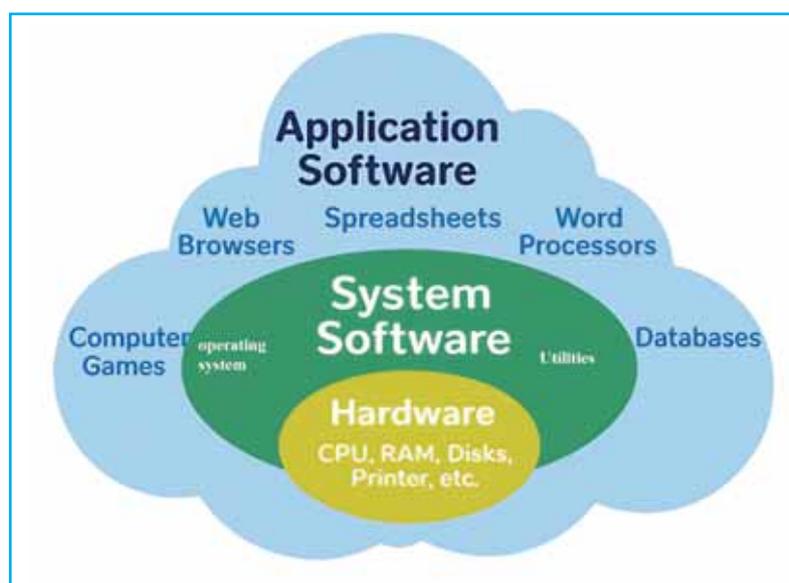

Figure 1.1 : Types of Software and Hardware Examples

Application Software: These are designed to help users perform specific tasks such as writing, designing, or playing games. Examples include Microsoft Word, PowerPoint, VLC Media Player, and Tally.

System Software: These manage and control the hardware and allow the application software to function. It includes the operating system (like Windows, Linux), device drivers, and utility programs like antivirus software. Both of the above can be further clasified as :

Open Source Software: These are software whose source code is available to everyone. It can be used, modified, and distributed freely. It promotes collaboration and learning. Example: Linux, LibreOffice.

Proprietary Software: These are commercial software that are owned by a company or individual. The source code is not shared with users, and one must purchase a license to use it. Example: Microsoft Windows, Adobe Photoshop.

Advantages of a Computer

Computers offer many advantages that make them essential in our daily life. They help in storing vast data, automating work and handling multiple jobs like writing, learning, gaming and designing. Their reliability and versatility make them essential in education, business, communication and daily life; improving productivity and saving time for users. Computers offer below advantages, which we discuss one by one.

- Speed
- Automation
- Storage
- Accuracy
- Versatility
- Diligence

Speed

Computers are incredibly fast, processing millions of instructions every second. This amazing speed allows them to complete jobs very quickly and efficiently. Complex math problems that could take people hours or even days to solve can be handled by computers in just seconds.

Accuracy

Computers are extremely accurate machines. As long as the information given to them and the instructions they follow is correct, they will always produce the right results. Unlike us, they never make mistakes in calculations. This perfect accuracy is why we rely on computers for precise tasks like science experiments, managing money, and building bridges or machines.

Automation

Once a computer is given instructions for a task, it can perform that task automatically, without needing constant human help. We see it everywhere: robots building things in factories, traffic lights changing on their own, and even in common appliances like our washing machine or microwave oven working automatically.

Versatility

Think of computers as amazing all rounder! They can handle countless different jobs. We can use them to write reports, make videos, play games, or control robots. Because we can do such a wide variety of tasks so well, computers are useful tools for almost everyone, whether we are a student, a scientist or a business owner.

Storage

Computers can hold enormous amounts of information like documents, photos, videos, and programs in a surprisingly small space. We can save this data and get it back whenever we need it. We use storage devices such as hard drives, solid-state drives, USB (Universal Serial Bus) drives, and even online cloud storage. It is discussed in more detail later.
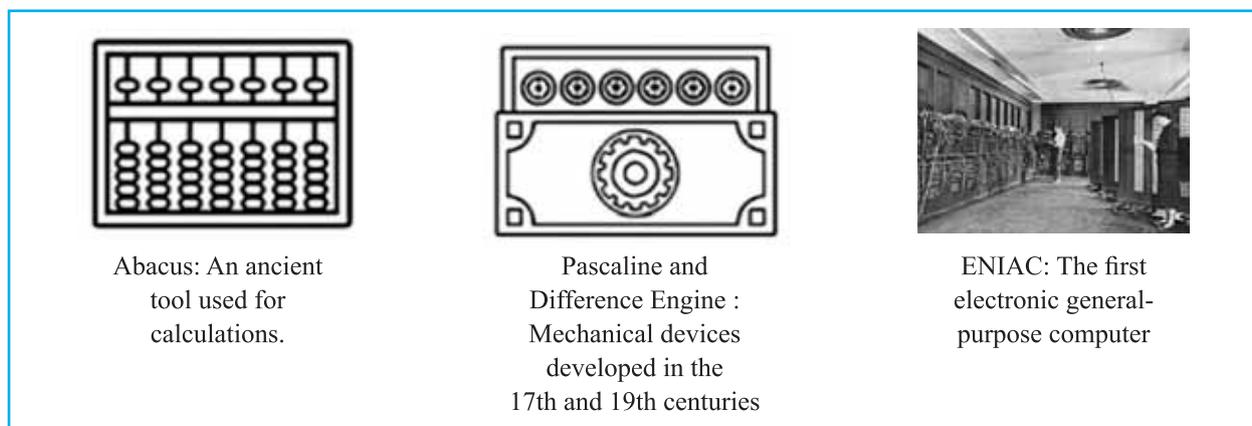
Diligence

Unlike people, computers do not get tired. Computers can work non-stop for hours, days, or even longer without slowing down. This ability to work constantly 24 x 7, makes them perfect for jobs that are very repetitive.

The Journey of Hardware in Computer Evolution

The journey of computers began long before the modern machines we use today. Early humans created simple tools like the Abacus, which used beads and rods for counting and basic calculations. This was followed by mechanical calculators like the Pascaline, invented by blaise Pascal, and the Difference Engine, designed by Charles Babbage known as the "Father of the Computer." These inventions laid the foundation for future computing devices. The major breakthrough came with ENIAC (Electronic and Numerical Integrator and Calculator), the first electronic general-purpose computer. It was massive in size and vacuum tubes to perform thousands of calculations in a short

time. ENIAC proved that machines could solve complex problems faster than humans. After these inventions, the evolution of computers took off rapidly. From large, room-sized machines to the compact and powerful computers we use today, technology has transformed every part of our life. Let us explore evolution of computer through hardware and software as shown in figure 1.2.

Abacus: An ancient tool used for calculations.	Pascaline and Difference Engine : Mechanical devices developed in the 17th and 19th centuries	ENIAC: The first electronic general-purpose computer

Figure 1.2 : Early Computing Devices

First Generation – Vacuum Tubes

The first generation of computers used vacuum tubes for processing and storage. These computers were extremely large, often taking up entire rooms. They were very slow, produced a lot of heat, and required a lot of electricity. Data was entered using punched cards and output was also received through them. Programming was done in machine language, which was difficult to write and understand. These computers were mainly used for scientific calculations and military applications. A well-known example is the ENIAC, one of the earliest electronic general-purpose computers.

Second Generation – Transistors

Second-generation computers replaced vacuum tubes with transistors. Transistors were much smaller, generated less heat, and were more reliable, making the computers faster and more efficient. These computers also used magnetic tape for storage. Programming languages like Assembly language and early versions of high-level languages were used. They became more common in business and government institutions. An example of a second-generation computer is the IBM 1401.

Third Generation – Integrated Circuits (IC)

Third-generation computers used integrated circuits (IC), which allowed many transistors to be placed on a single chip. This development made computers smaller, more powerful and more efficient. They consumed less power and were more affordable. For the first time, users interacted with computers using keyboards and monitors. These computers supported high-level programming languages like BASIC and COBOL and were the beginning of personal computing. They marked a big step toward modern computers.

Fourth Generation – Microprocessors

Fourth-generation computers introduced microprocessors, where the entire CPU was placed on a single chip. This made computers even smaller, cheaper and faster. These computers became

common in homes, schools and offices. They used hard disks and SSDs for storage and supported a wide variety of applications. Operating systems like Windows and Linux became popular. The internet and modern software developed rapidly during this time. Laptops, desktops and tablets are examples of fourth-generation computers.

Fifth Generation – AI, Quantum, Cloud

Fifth-generation computers focus on advanced technologies such as Artificial Intelligence (AI), cloud computing and quantum computing. These computers can understand human language, learn from experience and make decisions. They are used in smart phones, smart watches, voice assistants like Alexa, and self-driving cars. Cloud technology allows users to store and access data from anywhere. Fifth-generation computers are smart, powerful and play a big role in today's digital world.

The Journey of Software in Computer Evolution

The journey of software in computer evolution has played a crucial role in shaping the five generations of computers. In the first generation software was almost non-existent. Programs were written in machine language, using binary code (0s and 1s), which made programming extremely difficult and time-consuming. The second generation introduced assembly language, which allowed symbolic instructions and simplified coding to some extent, though it still required knowledge of hardware. The third generation marked a major shift with the development of high-level programming languages like FORTRAN, COBOL, and BASIC. It also introduced operating systems that allowed better file management and multitasking. The fourth generation saw significant advancements with the arrival of graphical user interfaces (GUIs) and user-friendly software such as Microsoft Windows, Photoshop, and office applications. These made computers more accessible to non-technical users. Operating systems like UNIX and Linux gained popularity in academia and enterprises. Finally, the fifth generation (present and beyond) focuses on artificial intelligence (AI), natural language processing (NLP) and cloud-based software. Intelligent applications like virtual assistants, smart home software and AI-powered chatbots represent this generation. Software has grown from complex, hardware-specific code to intelligent systems capable of learning and adapting to user needs across platforms.

Indian Computer History

India's first domestically designed and built digital computer was the TIFRAC (Tata Institute of Fundamental Research Automatic Calculator). Developed at Mumbai's Tata Institute of Fundamental Research (TIFR), the project was spearheaded by Professor R. Narasimhan and Dr. Homi J. Bhabha. TIFRAC officially became operational in February 1960. This computer represented a landmark achievement in India's technological progress. Its construction utilized 2,700 vacuum tubes, 1,700 germanium diodes, and 12,500 resistors. Notably, TIFRAC featured an early core memory system with a capacity of 2,048 words, each 40 bits long. An image of TIFRAC is shown in figure 1.3.

Figure 1.3 : TIFRAC (Tata Institute of Fundamental Research Automatic Calculator)

Block Diagram of a Computer

A computer system is made up of I/O devices and a Central Processing Unit (CPU). Figure 1.4 shows the block diagram of CPU, which consists of the Control Unit, Arithmetic and Logic Unit, and Memory Unit, to produce the final output. Arrows indicate data flow and interactions among the core components.
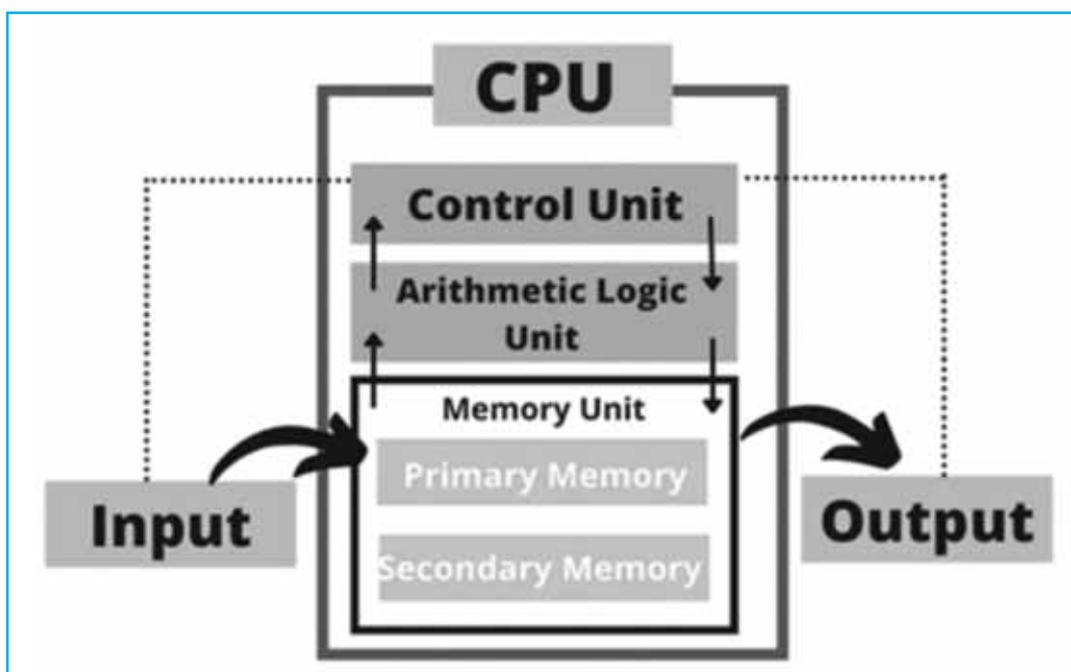

Figure 1.4 : Block Diagram of Computer

Computers cannot think or act on their own. They need instructions and data from the user. Input devices are the tools that help us send information to the computer. These devices allow us to enter data like text, images, sound, and instructions so the computer can process and respond. Output devices are the tools that help the computer send information to us. These devices allow the computer to display or present data like text, images, sound, and results so that users can see, hear, or receive the processed information.

Input

Input means the data that we give to a computer to be worked on. This is the first step in how a computer works. We usually give input through devices called input devices. Some common input devices are: Keyboard, Mouse, Scanner, Microphone, Camera and Touch Screen.

Keyboard

Figure 1.5 shows a keyboard. It is one of the most important input devices. It has keys for typing letters (A-Z), numbers (0-9), and special symbols (like @, #, %, etc.). It also includes function keys, arrow keys, and control keys like Shift, Ctrl, and Alt. Students use the keyboard to type homework, search on internet, and write messages or emails.
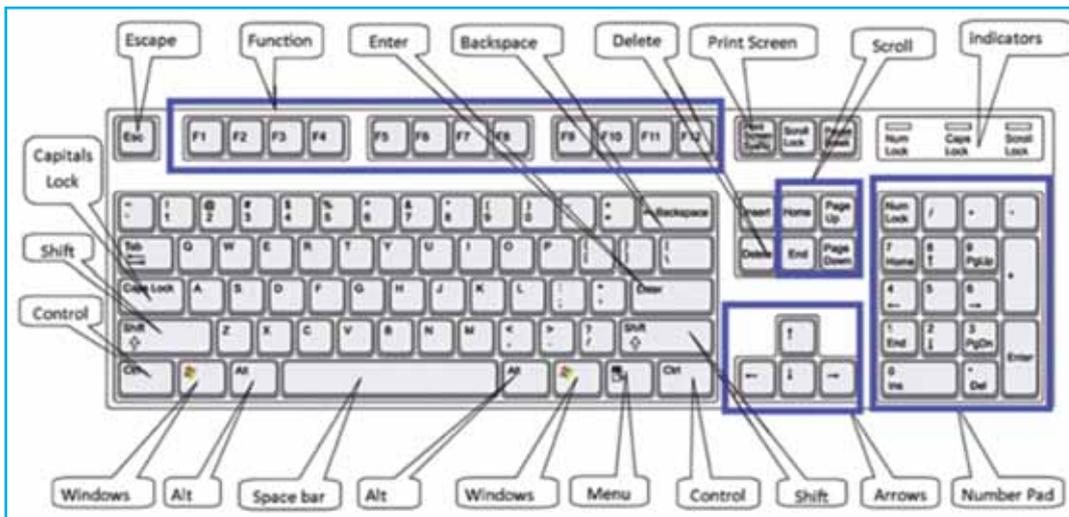
Figure 1.5 : QWERTY – Keyboard

Let us understand keyboard keys and their functions in table 1.1

Key Name	Function
Digits (0–9)	Used for entering numbers
English Alphabets (a–z)	Used for typing words and sentences
Mathematical Operators (+, -, *, /)	Used for mathematical operations
Punctuation Marks and Symbols	Used for grammar and special functions
Function Keys (F1 to F12)	Perform specific functions depending on the software
Enter Key	Used to execute a command or move to the next line
Spacebar	Inserts a space between words
Shift	Used to type capital letters and upper symbols on keys
Caps Lock	Toggles capital letters on and off
Backspace	Deletes the character before the cursor
Delete	Removes the character after the cursor
Tab	Moves the cursor to the next tab stop (used for indentation)
Control (Ctrl)	Used with other keys for shortcuts (e.g., Ctrl+C to copy)
Escape (Esc)	Cancels or exits the current operation
Arrow Keys	Arrow keys to move the cursor up, down, left, or right
Alter (Alt)	Used with other keys to perform special commands

Table 1.1 : Keyboard keys and their Functions

Mouse

A mouse is a pointing device used to move the cursor on the computer screen. It usually has two buttons left and right and a scroll wheel. We use the mouse to click on icons, open files, select text and drag-and-drop items. It helps in navigating and controlling the computer easily. It is shown in figure 1.6

Figure 1.6 : Mouse

Scanner

A scanner is used to convert printed documents and images into digital format. When we place a page or photo on the scanner, it makes a digital copy that can be saved on the computer. This is helpful for saving handwritten notes or old photographs in digital form. It is shown in figure 1.7

Figure 1.7 : Scanner

Microphone

A microphone accepts sound and sends it to the computer. It is shown in figure 1.8. It is used for voice typing, online meetings, and recording songs or speeches. Many students use microphones to attend online classes and speak in video calls or voice chats.

Figure 1.8 : Microphone

Camera (Webcam)

A camera, especially a webcam, captures images and videos. It is used in video calls, online classes, and recording educational videos. Today laptops have built-in cameras. Students can use them to participate in virtual classrooms or record presentations. It is shown in figure 1.9

Figure 1.9 : Camera (Webcam)

Touch screen

A touch screen allows users to interact directly with the devices by touching it with an icon. It combines both input and output functions. Touch screens are common in smart phones, tablets and smart boards. Students use them to play educational games, open apps, and scroll through pages without using a mouse or keyboard. It is shown in figure 1.10

Figure 1.10 : Touch Screen

Joystick

A joystick is an input device consisting of a vertical stick that moves a graphic cursor in the same direction as the stick. It often has a button on top to select the option the cursor is pointing to. Joysticks are most commonly used with video games, training simulators and for controlling robots. Joystick is shown in figure 1.11.
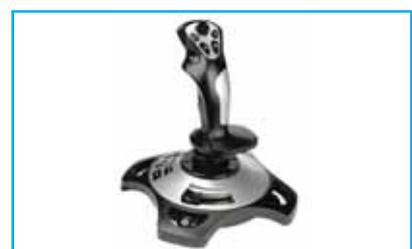

Figure 1.11 : Joystick

Central Processing Unit (CPU)

After getting the input, the computer begins to work on it by following the instructions from a program. This work is done by the **Central Processing Unit (CPU)**, which is often called the "brain" of the computer. CPU is the primary unit that performs calculations and executes instructions. It consists of the Arithmetic and Logic Unit (ALU) and the Control Unit (CU). The ALU performs arithmetical operations and logical comparisons, while the CU directs data flow and instruction sequences. CPU is shown in figure 1.12.

Control Unit (CU)

The Control Unit is like traffic police of the computer. It controls and manages all parts of the computer. It does not process data, but it makes sure that everything works in the right order. It decides which instruction to execute next. It sends signals to other parts like the ALU and memory to work properly. It controls the input and output devices as well.

Figure 1.12 : CPU

Arithmetic and Logic Unit

The Arithmetic Unit is a part of the ALU. It does all the arithmetical calculations in the computer. It performs addition, subtraction, multiplication, division, etc. For example, if we do 25 + 30 on a calculator app, this unit does that job. The Logic Unit is the second part of the ALU. It helps the computer make decisions using logic operations. It checks things like greater than, less than, or equal to. It helps in comparing numbers, and making yes/no (true/false) decisions.

Memory Unit

The Memory Unit is the place where the computer stores data. It can store data for a short time or a long time. It has Primary Memory and Secondary Memory. Primary Memory (like Random Access Memory-RAM) is called volatile memory because everything is lost when the power goes off. Secondary Memory (Solid State Drive –SSD, Hard Disk Drive-HDD) is called non-volatile memory because it stores data permanently. Let us discuss here storage part in detail, because it is part of memory unit.

Primary Storage (Main Memory)

Primary storage, also known as main memory, is the memory that the CPU accesses directly. It is volatile, meaning data is lost when the computer is turned off. Random Access Memory Stores data temporarily while the computer is running. Read Only Memory stores permanent instructions needed to start the computer. Figures 1.13 and 1.14 show RAM and ROM respectively, while their differences are outlined in table 1.2.
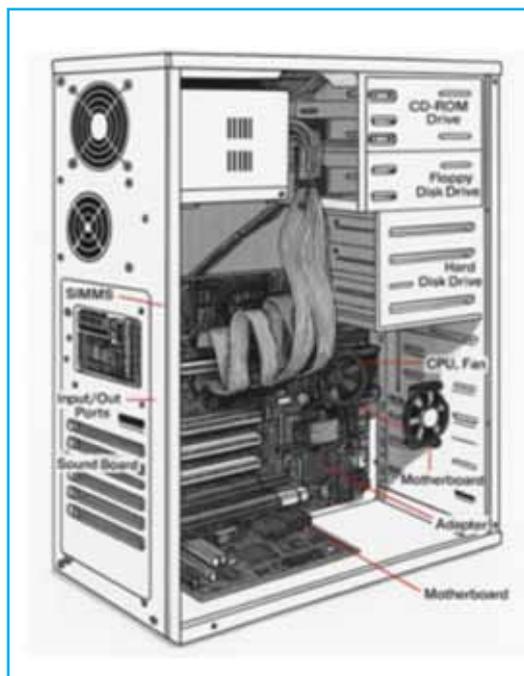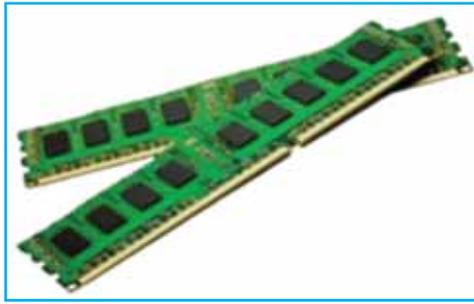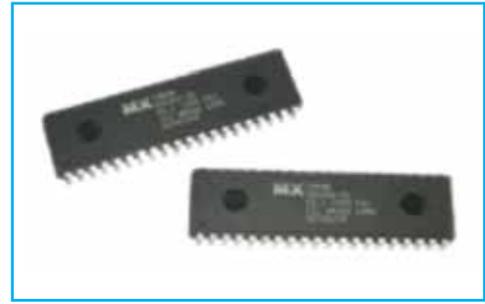
Figure1.13 : RAM

Figure1.14 : ROM

Feature	RAM (Random Access Memory)	ROM (Read-Only Memory)
Definition	Temporary memory used to store data currently in use	Permanent memory used to store firmware or boot instructions
Volatility	Volatile – data is lost when power is off	Non-volatile – data is retained even when power is off
Function	Helps in processing and multitasking	Stores essential instructions for booting and basic functions
Data Accessibility	Read and write operations allowed	Mostly read-only (cannot be modified easily)
Speed	Fast	Comparatively slower
Size	Typically larger (GBs)	Smaller in size (KBs or MBs)
Usage	Used by CPU during operation to store temporary files	Stores system firmware
Modifiability	Can be updated or changed easily	Difficult to modify or requires special tools

Table 1.2 : Memory (RAM and ROM)

Secondary Storage

Secondary storage is used to store data permanently. It retains data even when the computer is turned off. It includes devices like:

- Hard Disk Drive (HDD): A traditional storage device with large capacity.
- Solid State Drive (SSD): A modern storage device with faster speed and no moving parts.
- Optical Discs: CDs, DVDs used for media storage.
- Flash Drives: Pen drives, USB drives used for portable data storage.
- Floppy Disk: It is a type of removable magnetic storage medium, historically used for storing and transferring data on computers.
- Memory Cards: Used in cameras, mobile phones, and tablets.

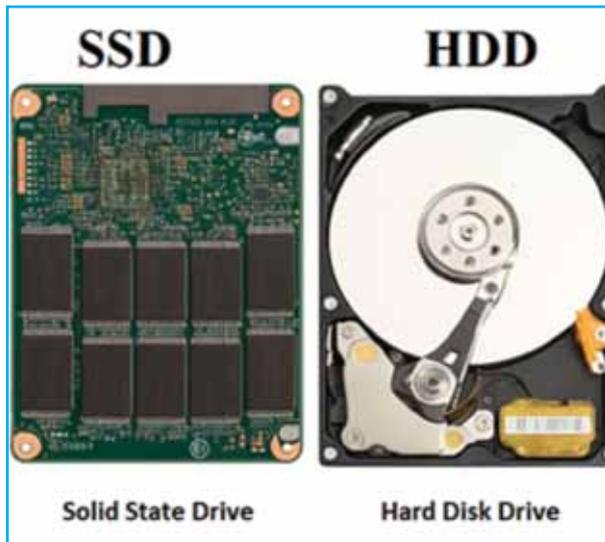Secondary storage devices are shown in figure 1.15, 1.16, 1.17 and 1.18.

Figure 1.15 : SSD / HDD

Figure 1.16 : CD / DVD Drive

Figure 1.17 : Floppy Disk

Figure 1.18 : Pen Drive / USB

Motherboard

It is the single, largest board that acts as the central hub or "backbone" of the entire PC. It holds the most crucial components, such as the CPU and the RAM, directly in dedicated sockets. Its main job is to provide the electrical connections and pathways, known as buses, that enable all hardware components to communicate and work together. Every internal part, like the hard drive, graphics card, and all external ports (USB, audio, etc.), plugs into the motherboard. It manages the distribution of power throughout the system from the power supply unit.
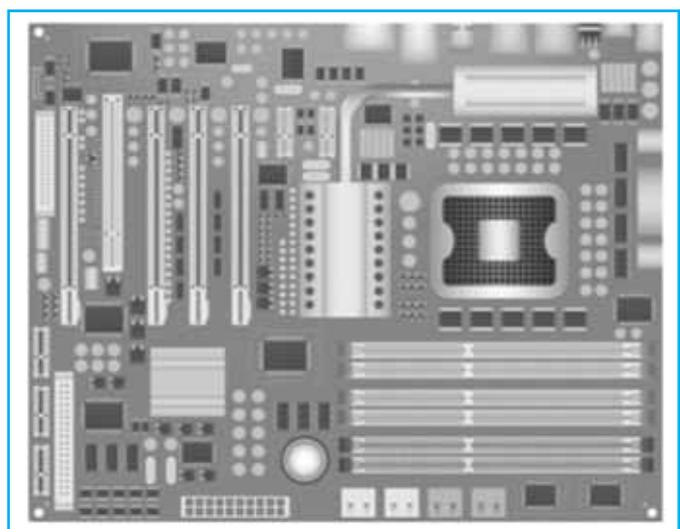

Figure 1.19 : Motherboard

Output

Output devices are hardware components that allow a computer to communicate the results of its processes to the user. These devices take information from the computer and convert it into a form that humans can understand, such as text, images, sound or video.

Figure 1.20 : Monitor

Monitor

A monitor is also called a Visual Display Unit (VDU). It displays text, pictures and videos on the screen. It is one of the most important output devices, and is used when we are working on documents, watching videos or using any software. Figure 1.20 shows a sample image of CRT, LCD and LED monitors.

Printer

A printer is used to make a hard copy (paper version) of documents or images from the computer. It is useful for printing homework, assignments, charts and pictures. Common types include inkjet, laser and dot matrix printers. It is shown in figure 1.21.

Figure 1.21 : Printer

Speakers

Speakers output sound from the computer. They let us hear music, sound effects in games, voice from videos or audio from online classes. Speakers are essential for multimedia activities like listening to music, watching movies or video conferencing. It is shown in figure 1.22.

Figure 1.22 : Speakers

Summary

This chapter provides a comprehensive overview of computers, including their definition, components and evolution. It explains key terms like hardware, software, and firmware, and distinguishes between application, system, open-source and proprietary software. The block diagram, input/output devices, CPU functions, and memory units have been also discussed. We have also discussed the historical evolution of computers through hardware and software generations.

<center>**EXERCISE**</center>

1. Define a computer in your own words.

2. What are the main components of a computer? Describe each with examples.

3. Explain the difference between hardware, software and firmware.

4. Describe the benefits of a computer in our daily life.

5. What are input and output devices? Give five examples of each.

6. Explain the function of the CPU and its components.

7. Differentiate between RAM and ROM.

8. Describe the different types of secondary storage devices.

9. Write a short note on the evolution of computers through different generations.

10. Explain secondary storage device.

11. State whether true or false.

(1) Software is a physical component of a computer.

(2) A keyboard is an input device.

(3) CPU stands for Central Program Unit.

(4) ROM stores data temporarily.

(5) Touch screen acts as both input and output device.

12. Fill-in the blanks.

(1) A _____ is an electronic device that processes data.

(2) _____ is used to store data permanently.

(3) _____ is the brain of the computer.

(4) Linux is an example of _____ software.

(5) Data is given to the computer using _____ devices.

13. Multi-choice questions. Choose the most correct answer.

(1) Which of the following is a characteristic of fifth-generation computers?

(a) Use of vacuum tubes   (b) Assembly language

(c) Artificial Intelligence   (d) Magnetic tape

(2) What is the function of the Arithmetic Logic Unit (ALU)?

(a) Stores data   (b) Controls hardware

(c) Performs calculations and logic   (c) Manages input devices

(3) Which key is used to move the cursor to the next tab stop?

(a) Enter   (b) Tab   (c) Ctrl   (d) Shift

(4) The first indigenously developed computer in India was:

(a) ENIAC   (b) PARAM   (c) TIFRAC   (d) IITAC

(5) What is the primary function of system software?

(a) Play games   (b) Create documents

(c) Manage hardware   (d) Design graphics

(6) Which memory type loses data when power is off?

(a) ROM   (b) SSD   (c) RAM   (d) HDD

(7) Which generation introduced microprocessors?

(a) First   (b) Second   (c) Third   (d) Fourth

(8) What is an example of proprietary software?

(a) Linux   (b) LibreOffice

(c) Microsoft Windows   (d) OpenOffice

(9) Which key is used to execute a command ?

(a) Escape   (b) Enter   (c) Space   (d) Tab

(10) Which input device converts physical documents into digital form?

(a) Keyboard   (b) Scanner   (c) Mouse   (d) Printer

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