CHAPTER 1

Learning Objectives

After learning the concepts in this chapter, the students will be able

- To know about Computers
- To learn about various generations of computer
- To understand the basic operations of computers
- To know the components and their functions.
- To know about booting of a computer

Father of Computer

Charles Babbage is considered to be the father of computer, for his invention and the concept of Analytical Engine in 1837. The Analytical Engine contained an Arithmetic Logic Unit (ALU), basic flow control, and integrated memory; which led to the development of first general-purpose computer concept.

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Introduction to Computers

1.1 Introduction to Computers

Computers are seen everywhere around us, in all spheres of life, in the field of education, research, travel and tourism, weather forecasting, social networking, e-commerce etc. Computers have now become an indispensable part of our lives. Computers have revolutionised our lives with their accuracy and speed of performing a job, it is truly remarkable. Today, no organisation can function without a computer. In fact, various organisations have become paperless. Computers have evolved over the years from a simple calculating device to high speed portable computers.

The growth of computer industry started with the need for performing fast calculations. The manual method of computing was slow and prone to errors. So, attempts were made to develop fast calculating devices, the journey started from the first known calculating device (Abacus) which has led us today to an extremely high speed calculating devices.

1.2 Generations of Computers

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

Based on various stages of development, computers can be categroised into different generations.

SN	Generation	Period	Main Component used	Merits/Demerits
1	**First Generation**	1940-1956	 **Vacuum tubes**	• Big in size • Consumed more power • Malfunction due to overheat • Machine Language was used

First Generation Computers - ENIAC , EDVAC , UNIVAC 1 ENIAC weighed about 27 tons, size 8 feet × 100 feet × 3 feet and consumed around 150 watts of power				
2	**Second Generation**	1956-1964	 **Transistors**	• Smaller compared to First Generation • Generated Less Heat • Consumed less power compared to first generation • Punched cards were used • First operating system was developed - Bat ch Processing and Multiprogramming Operating System • Machine language as well as Assembly language was used.
Second Generation Computers **IBM 1401, IBM 1620, UNIVAC 1108**				
3	**Third Generation**	1964 -1971	 **Integrated Circuits (IC)**	• Computers were smaller, faster and more reliable • Consumed less power • High Level Languages were used
Third Generation Computers **IBM 360 series, Honeywell 6000 series**				
4	**Fourth Generation**	1971-1980	 **Microprocessor** Very Large Scale Integrated Circuits (VLSI)	• Smaller and Faster • Microcomputer series such as IBM and APPLE were developed • Portable Computers were introduced.
5	**Fifth Generation**	1980 - till date	 **Ultra Large Scale Integration (ULSI)**	• Parallel Processing • Super conductors • Computers size was drastically reduced. • Can recognise Images and Graphics • Introduction of Artificial Intelligence and Expert Systems • Able to solve high complex problems including decision making and logical reasoning

6	**Sixth Generation**	In future		• Parallel and Distributed computing • Computers have become smarter, faster and smaller • Development of robotics • Natural Language Processing • Development of Voice Recognition Software

Table1.1 Generations of computers

The first digital computer

The ENIAC (Electronic Numerical Integrator And Calculator) was invented by J. Presper Eckert and John Mauchly at the University of Pennsylvania and began construction in 1943 and was not completed until 1946. It occupied about 1,800 square feet and used about 18,000 vacuum tubes, weighing almost 50 tons. ENIAC was the first digital computer because it was fully functional.

1.3 Sixth Generation Computing

In the Sixth Generation, computers could be defined as the era of intelligent computers, based on Artificial Neural Networks. One of the most dramatic changes in the sixth generation will be the explosive growth of Wide Area Networking. Natural Language Processing (NLP) is a component of Artificial Intelligence (AI). It provides the ability to develop the computer program to understand human language.

Optical Character Recognition (Optical Grapheme Recognition) engine for the Indus Scripts has been developed using Deep Learning Neural Networks (a sub-field of Artificial Intelligence).

Given photographs, scans, or any image feed of an Indus Valley Civilization artifact, the system will be able to recognise the inscriptions (the symbol/ grapheme sequences) from the image. There are totally 417 Symbols/ Graphemes/Characters in the Indus Scripts and just 3700+ text inscriptions of data for the machine to learn and attain expert-level status.

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1.4. Data and Information

We all know what a computer is? It is an electronic device that processes the input according to the set of instructions provided to it and gives the desired output

at a very fast rate. Computers are very versatile as they do a lot of different tasks such as storing data, weather forecasting, booking airlines, railway or movie tickets and even playing games.

Data: Data is defined as an un-processed collection of raw facts, suitable for communication, interpretation or processing.

For example, 134, 16 'Kavitha', 'C' are data. This will not give any meaningful message.

Information: Information is a collection of facts from which conclusions may be drawn. In simple words we can say that data is the raw facts that is processed to give meaningful, ordered or structured information. For example Kavitha is 16 years old. This information is about Kavitha and conveys some meaning. This conversion of data into information is called data processing.

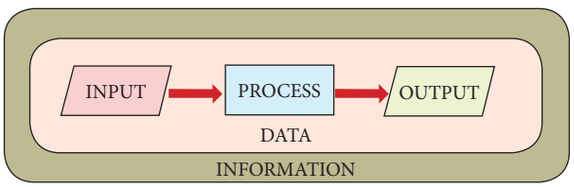

Figure 1.1 Data and Information

"A Computer is an electronic device that takes raw data (unprocessed) as an input from the user and processes it under the control of a set of instructions (called program), produces a result (output), and saves it for future use."

1.5 Components of a Computer

The computer is the combination of hardware and software. Hardware is the physical component of a computer like motherboard, memory devices, monitor, keyboard etc., while software is the set of programs or instructions. Both hardware and software together make the computer system to function.

Figure 1.2: Computer

Let us first have a look at the functional components of a computer. Every task given to a computer follows an Input- Process- Output Cycle (IPO cycle). It needs certain input, processes that input and produces the desired output. The input unit takes the input, the central processing unit does the processing of data and the output unit produces the output. The memory unit holds the data and instructions during the processing.

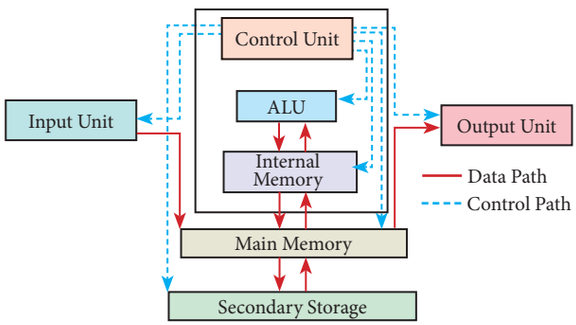

Figure 1.3 components of a computer

1.5.1 Input Unit

Input unit is used to feed any form of data to the computer, which can be stored in the memory unit for further processing. Example: Keyboard, mouse, etc.

1.5.2 Central Processing Unit

CPU is the major component which interprets and executes software instructions. It also control the operation of all other components such as memory, input and output units. It accepts binary data as input, process the data according to the instructions and provide the result as output.

The CPU has three components which are Control unit, Arithmetic and logic unit (ALU) and Memory unit.

1.5.2.1 Arithmetic and Logic Unit

The ALU is a part of the CPU where various computing functions are performed on data. The ALU performs arithmetic operations such as addition, subtraction, multiplication, division and logical operations. The result of an operation is stored in internal memory of CPU. The logical operations of ALU promote the decision-making ability of a computer.

1.5.2.2 Control Unit

The control unit controls the flow of data between the CPU, memory and I/O devices. It also controls the entire operation of a computer.

1.5.3. Output Unit

An Output Unit is any hardware component that conveys information to users in an understandable form. Example: Monitor, Printer etc.

1.5.4. Memory Unit

The Memory Unit is of two types which are primary memory and secondary memory. The primary memory is used to temporarily store the programs and data when the instructions are ready to execute. The secondary memory is used to store the data permanently.

The Primary Memory is volatile, that is, the content is lost when the power supply is switched off. The Random Access Memory (RAM) is an example of a main memory. The Secondary memory is non volatile, that is, the content is available even after the power supply is switched off. Hard disk, CD-ROM and DVD ROM are examples of secondary memory.

1.5.5. Input and Output Devices

Input Devices:

(1) Keyboard: Keyboard (wired / wireless, virtual) is the most common input device used today. The individual keys for letters, numbers and special characters are collectively known as character keys. This keyboard layout is derived from the keyboard of original typewriter. The data and instructions are given as input to the computer by typing on the keyboard. Apart from alphabet and numeric keys, it also has Function keys for performing different functions. There are different set of keys available in the keyboard such as character keys, modifier keys, system and GUI keys, enter and editing keys, function keys, navigation keys, numeric keypad and lock keys.

Figure 1.4 Keyboard

(2) Mouse: Mouse (wired/wireless) is a pointing device used to control the

movement of the cursor on the display screen. It can be used to select icons, menus, command buttons or activate something on a computer. Some mouse actions are move, click, double click, right click, drag and drop.

Different types of mouse available are: Mechanical Mouse, Optical, Laser Mouse, Air Mouse, 3D Mouse, Tactile Mouse, Ergonomic Mouse and Gaming Mouse.

Who invented Mouse?

The computer mouse as we know it today was invented and developed by Douglas Engelbart, with the assistance of Bill English, during the 1960's and was patented on November 17, 1970.

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(3) Scanner: Scanners are used to enter the information directly into the computer's memory. This device works like a Xerox machine. The scanner converts any type of printed or written information including photographs into a digital format, which can be manipulated by the computer.

Figure 1.5 Scanner

(4)Fingerprint Scanner: Finger print Scanner is a fingerprint recognition device used for computer security, equipped with the fingerprint recognition feature that uses biometric technology. Fingerprint Reader / Scanner is a very safe and convenient device for security instead of using passwords, which is vulnerable to fraud and is hard to remember.

Figure 1.6 Fingerprint Scanner

(5) Track Ball: Track ball is similar to the upside- down design of the mouse. The user moves the ball directly, while the device itself remains stationary. The user spins the ball in various directions to navigate the screen movements.

Figure 1.7 Track Ball

(6) Retinal Scanner: This performs a retinal scan which is a biometric technique that uses unique patterns on a person's retinal blood vessels.

Figure 1.8 Retinal Scanner

(7) Light Pen: A light pen is a pointing device shaped like a pen and is connected to a monitor. The tip of the light pen contains a light-sensitive element which detects the light from the screen enabling the computer to identify the location of the pen on the screen. Light pens

Figure 1.9 Light Pen

have the advantage of 'drawing' directly onto the screen, but this becomes hard to use, and is also not accurate.

(8) Optical Character Reader: It is a device which detects characters printed or written on a paper with OCR, a user can scan a page from a book. The Computer will recognise the characters in the page as letters and punctuation marks and stores. The Scanned document can be edited using a wordprocessor.

Figure 1.10 Optical Character Reader

(9) Bar Code / QR Code Reader: A Bar code is a pattern printed in lines of different thickness. The Bar code reader scans the information on the bar codes transmits to the Computer for further processing. The system gives fast and error free entry of information into the computer.

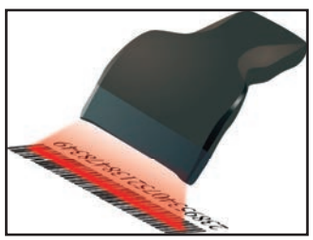

Figure 1.11 Bar code Reader

QR (Quick response) Code: The QR code is the two dimension bar code which can be read by a camera and processed to interpert the image.

(10) Voice Input Systems: Microphone serves as a voice Input device. It captures the voice data and send it to the Computer. Using the microphone along with speech recognition software can offer a completely new approach to input information into the Computer.

Figure 1.12 Voice input System

(11) Digital Camera: It captures images / videos directly in the digital form. It uses a CCD (Charge Coupled Device) electronic chip. When light falls on the chip through the lens, it converts light rays into digital format.

Figure 1.13 Digital Camera

(12) Touch Screen: A touch screen is a display device that allows the user to interact with a computer by using the finger. It can be quite useful as an alternative to a mouse or keyboard for navigating a Graphical User Interface (GUI). Touch screens are used on a wide variety of devices such as computers, laptops, monitors, smart phones, tablets, cash registers and information kiosks. Some touch screens use a grid of infrared beams to sense the presence of a finger instead of utilizing touch-sensitive input.

Figure 1.14 Touch Screen

(13) Keyer : A Keyer is a device for signaling by hand, by way of pressing one or more switches. Modern keyers have a large number of switches but not as many as a full size keyboard. Typically,

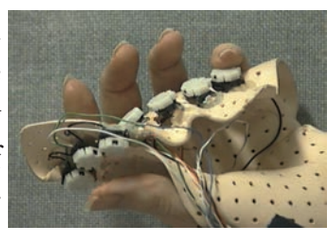

Figure 1.15 Keyer

this number is between 4 and 50. A keyer differs from a keyboard, which has "no board", but the keys are arranged in a cluster.

Output Devices:

(1) Monitor: Monitor is the most commonly used output device to display the information. It looks like a TV. Pictures on a monitor are formed with picture elements called PIXELS. Monitors may either be Monochrome which display text or images in Black and White or can be color, which display results in multiple colors. There are many types of monitors available such as CRT (Cathode Ray Tube), LCD (Liquid Crystal Display) and LED (Light Emitting Diodes). The monitor works with the VGA (Video Graphics Array) card. The video graphics card helps the keyboard to communicate with the screen. It acts as an interface between the computer and display monitor. Usually the recent motherboards incorporate built-in video card.

Figure 1.16 Monitor

The first computer monitor was part of the Xerox Alto computer system, which was released on March 1, 1973.

(2) Plotter: Plotter is an output device that is used to produce graphical output on papers. It uses single color or multi color pens to draw pictures.

Figure 1.17 Plotter

(3) Printers: Printers are used to print the information on papers. Printers are divided into two main categories:

- Impact Printers
- Non Impact printers

Impact Printers

These printers print with striking of hammers or pins on ribbon. These printers can print on multi-part (using carbon papers) by using mechanical pressure. For example, Dot Matrix printers and Line matrix printers are impact printers.

Figure 1.18 Impact Printer

A Dot matrix printer that prints using a fixed number of pins or wires. Each dot is produced by a tiny metal rod, also called a “wire” or “pin”, which works by the power of a tiny electromagnet or solenoid, either directly or through a set of small levers. It generally prints one line of text at a time. The printing speed of these printers varies from 30 to 1550 CPS (Character Per Second).

Line matrix printers use a fixed print head for printing. Basically, it prints a page-wide line of dots. But it builds up a line of text by printing lines of dots. Line

printers are capable of printing much more than 1000 Lines Per Minute, resulting in thousands of pages per hour. These printers also uses mechanical pressure to print on multi-part (using carbon papers).

Non-Impact Printers

These printers do not use striking mechanism for printing. They use electrostatic or laser technology. Quality and speed of these printers are better than Impact printers. For example, Laser printers and Inkjet printers are non-impact printers.

Laser Printers

Laser printers mostly work with similar technology used by photocopiers. It makes a laser beam scan back and forth across a drum inside the printer, building up a pattern. It can produce very good quality of graphic images. One of the chief characteristics of laser printer is their resolution – how many Dots per inch(DPI). The available resolution range around 1200 dpi. Approximately it can print 100 pages per minute(PPM)

Figure 1.19 Laser Printer

Inkjet Printers:

Inkjet Printers use colour cartridges which combined Magenta, Yellow and Cyan inks to create color tones. A black cartridge is also used for monochrome output. Inkjet printers work by spraying ionised ink at a sheet of paper. The speed of Inkjet printers generaly range from 1-20 PPM (Page Per Minute).

Figure 1.20 Inkjet Printer

They use the technology of firing ink by heating it so that it explodes towards the paper in bubbles or by using piezoelectricity in which tiny electric currents controlled by electronic circuits are used inside the printer to spread ink in jet speed. An Inkjet printer can spread millions of dots of ink at the paper every single second.

Speakers: Speakers produce voice output (audio) . Using speaker along with speech synthesise software, the computer can provide voice output. This has become very common in places like airlines, schools, banks, railway stations, etc.

Figure 1.21 Speakers

Multimedia Projectors:

Multimedia projectors are used to produce computer output on a big screen. These are used to display presentations in meeting halls or in classrooms.

Figure 1.22 Multimedia Projector

1.6 Booting of computer

An Operating system (OS) is a basic software that makes the computer to work. When a computer is switched on, there is no information in its RAM.At the same time, in ROM, the pre-written program called POST (Power on Self Test) will be executed first. This program checks if the devices like RAM, keyboard, etc., are connected properly and ready to operate. If these devices are ready, then the BIOS (Basic Input Output System) gets executed. This process is called Booting. Thereafter, a program called "Bootstrap Loader" transfers OS from hard disk into main memory. Now the OS gets loaded (Windows/Linux, etc.,) and will get executed. Booting process is of two types.

1) Cold Booting

2) Warm Booting

Cold Booting: When the system starts from initial state i.e. it is switched on, we call it cold booting or Hard Booting. When the user presses the Power button, the instructions are read from the ROM to initiate the booting process.

Warm Booting: When the system restarts or when Reset button is pressed, we call it Warm Booting or Soft Booting. The system does not start from initial state and so all diagnostic tests need not be carried out in this case. There are chances of data loss and system damage as the data might not have been stored properly.

Points to Remember:

- Computers are seen everywhere around us, in all spheres of life.
- It is an electronic device that processes the input according to the set of instructions provided to it and gives the desired output at a very fast rate.
- Based on various stages of development, computers can be divided into six different generations.
- The computer is the combination of hardware and software.
- Hardware is the physical component of a computer.
- Input unit is used to feed any form of data to the computer.
- CPU interprets and executes software instructions.
- The ALU is a part of the CPU where various computing functions are performed on data.
- The control unit controls the flow of data between the CPU, memory and I/O devices.
- An Output Unit is any hardware component that conveys information to one or more people in user understandable form.
- The Memory Unit is of two kinds which are primary memory and secondary memory.

Activity

STUDENT ACTIVITY

1. Explain the classification of computers.
2. Give the details of motherboard names, RAM capacity used in the years 1993, 1995, 2005, 2008, 2016.
3. Mention two new input and output devices that are not given in this chapter.

Evaluation

SECTION – A

Choose the correct answer

1. First generation computers used

   (a) Vacuum tubes
   (b) Transistors
   (c) Integrated circuits
   (d) Microprocessors

2. Name the volatile memory

   (a) ROM (b) PROM
   (c) RAM (d) EPROM

3. Identify the output device

   (a) Keyboard (b) Memory
   (c) Monitor (d) Mouse

4. Identify the input device

   (a) Printer (b) Mouse
   (c) Plotter (d) Projector

5. …..… Output device is used for printing building plan.

   (a) Thermal printer
   (b) Plotter
   (c) Dot matrix
   (d) inkjet printer

6. Which one of the following is used to in ATM machines

   (a) Touch Screen (b) speaker
   (c) Monitor (d) Printer

7. When a system restarts which type of booting is used.

   (a) Warm booting
   (b) Cold booting
   (c) Touch boot
   (d) Real boot.

8. Expand POST

   (a) Post on self Test
   (b) Power on Software Test
   (c) Power on Self Test
   (d) Power on Self Text

9. Which one of the following is the main memory?

   (a) ROM (b) RAM
   (c) Flash drive (d) Hard disk

10. Which generation of computer used IC's?

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

SECTION-B

Very Short Answers

1. What is a computer?
2. Distinguish between data and information.
3. What are the components of a CPU?
4. What is the function of an ALU?
5. Write the functions of control unit.
6. What is the function of memory?
7. Differentiate Input and output unit.
8. Distinguish Primary and Secondary memory.

SECTION-C

Short Answers

1. What are the characteristics of a computer?
2. Write the applications of computer.
3. What is an input device? Give two examples.
4. Name any three output devices.
5. Differentiate optical and Laser mouse
6. Write shortnote on impact printer
7. Write the characteristics of sixth generation.
8. Write the significant features of monitor.

GLOSSARY

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SECTION - D

Explain in detail

1. Explain the basic components of a computer with a neat diagram.
2. Discuss the various generations of computers.
3. Explain the following
   a. Inkjet Printer b. Multimedia projector c. Bar code / QR code Reader

References

(1) Fundamentals of Computers – V. Rajaraman – PHI Publications

(2) Computer Science text book – NCERT, New Delhi

Internet Resources

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(2) https://www.computerhope.com/jargon/c/computer.htm

CASE STUDY

Prepare a comparative study of various computers of past and present with respect to speed, memory, size, power consumption and other features

Computer	It is an electronic device that processes the input according to the set of instructions provided to it and gives the desired output at a very fast rate.
Vacuum tube	Vacuum tubes contain electrodes for controlling electron flow and were used in early computers as a switch or an amplifier.
Transistors	The transistor ("transfer resistance") is made up of semi-conductors. It is a component used to control the amount of current or voltage used for amplification/modulation of an electronic signal.
Punched cards	Punch cards also known as Hollerith cards are paper cards containing several punched or perforated holes that were punched by hand or machine to represent data.
Machine Language	Machine language is a collection of binary digits or bits that the computer reads and interprets.
Assembly language	An assembly language is a low-level programming language.

Integrated Circuits	The IC is a package containing many circuits, pathways, transistors, and other electronic components all working together to perform a particular function or a series of functions.
Microcomputer	Micro computer is used to describe a standard personal computer.
High-level languages	A high-level language is a computer programming language that isn't limited by the computer, designed for a specific job, and is easier to understand.
Natural Language Processing (NLP)	Natural Language Processing is a method used in artificial intelligence to process and derive meaning from the human language.
Robotics	Robot is a term coined by Karel Capek in the 1921 to play RUR (Rossum's Universal Robots). It is used to describe a computerized machine designed to respond to input received manually or from its surroundings.
Nanotechnology	Nanotechnology is an engineering, science, and technology that develops machines or works with one atom or one molecule that is 100 nanometers or smaller.
Bioengineering	A discipline that applies engineering principles of design and analysis to biological systems and biomedical technologies