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# UNIT 1 INTRODUCTION TO COMPUTERS

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## 1.0 OBJECTIVES

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After studying this unit, you should be able to:

- explain the basic characteristics of computers;
- list the components that make up a computer;
- differentiate between hardware and software;
- differentiate between system and applications software;
- describe the difference between bits and bytes;
- classify devices as input and output devices;
- differentiate between ROM and RAM; and
- build knowledge on the use of various secondary storage devices.

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## 1.1 INTRODUCTION

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This practical aims at introducing you to today's most commonly used electronic device - **the computer**. The study of this practical will highlight the characteristics and evolution of computers. It will also help you to understand the basic terminology associated with computers. In this practical the description of hardware versus software, system versus application software, input and output devices and secondary device has been explained. So let us study all these aspects.

## 1.2 WHY COMPUTER?

The word 'Computer' literally means to 'Compute' or to 'Calculate'. Stated simply, it is an electronic device which processes information based on the instructions provided, to generate the desired output. It, therefore, requires two types of input - raw data, and the set of instructions to process or act upon the data.

This can schematically be shown in following Fig 1.1. :

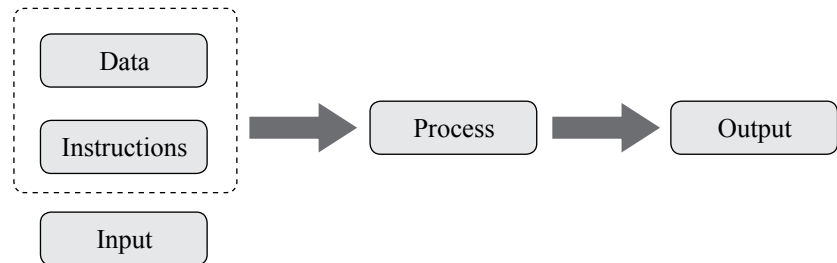


Fig 1.1: Processing Information

Data can be of any type - text, numeric, alpha-numeric, image, picture, sound, etc. The instructions that act upon this data are also called the **program** or **software** in computer terminology.

Computers have variety of **characteristics** that make them so powerful and universally useful . These are as under:

- **Speed**

Computers work at an incredible speed. The speed with which it performs is way beyond human capabilities. As a comparison, it can do in one minute, what a human being would probably take a lifetime!

When we refer to the speed of computers, we now talk in terms of milliseconds (hundredth of a second), microseconds (millionth of a second), nanoseconds (billionth of a second), and even picoseconds (trillionth of a second). A powerful computer is capable of performing about 3-4 million simple instructions per second.

- **Accuracy**

In addition to being fast, computers are also accurate. Errors that may occur can almost always be attributed to human error (inaccurate data, poorly designed system or faulty instructions or programs written by the programmer) rather than technological weaknesses. In fact, a special term GIGO (Garbage In Garbage Out) has been coined to represent a scenario where faulty results are got due to inaccurate instructions or faulty data.

- **Diligence**

Unlike human beings, computers are highly consistent. They do not suffer from human traits of boredom and tiredness resulting in lack of concentration. Computers, therefore, score high over human beings in performing voluminous and repetitive jobs.

- **Versatility**

Computers are versatile machines and are capable of performing any task as long as it can be broken down into a series of logical steps.

This means that their capability is, once again, limited only by human intelligence. As is evident, in today's fast developing technology-world, it is almost inconceivable to find an area where computers are not being used. The presence of computers can be seen in every sphere – railway/air reservation, Banks, Hotels, Weather forecasting and many more.

- **Storage Capacity**

Information is relegated to the back of the mind and forgotten as time progresses, a piece of information once recorded (or stored) in the computer, can never be forgotten and can be retrieved almost instantaneously! Information can, therefore, be retained as long as desired (using secondary storage - a type of detachable memory).

### Check Your Progress 1

List the characteristics of a computer that have contributed towards making it such a popular device.

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## 1.3 COMPONENTS OF A COMPUTER

The computer system essentially comprises three important parts - input device, central processing unit (CPU) and the output device. The CPU itself is made of three components namely, the arithmetic logic unit (ALU), memory unit, and the control unit.

In addition to these, auxiliary storage or secondary storage devices are used to store data and instructions on a long-term basis. (Fig 1.2)

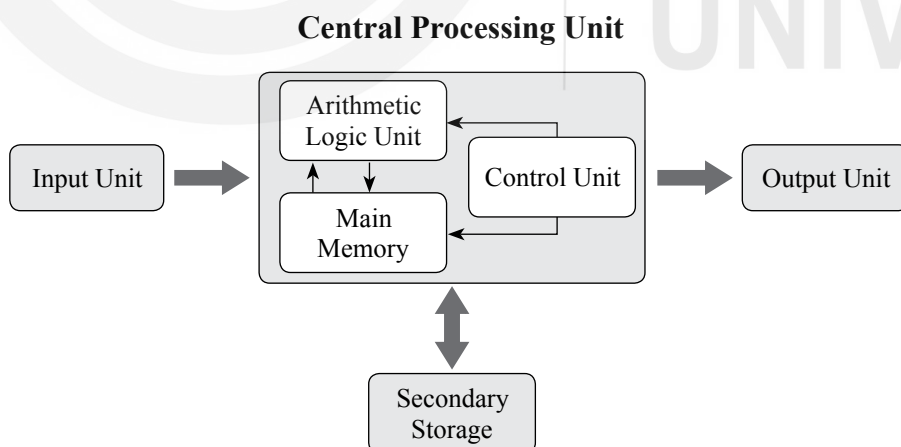


Fig 1.2: Schematic representation of a computer

These component are detailed as:

### *Input Unit*

Data and instructions must be entered into the computer system for processing, and results obtained from computations must be displayed or recorded for the user. The input device serves the purpose of receiving data and instructions in a form that can be understood by the computer.

***Central Processing Unit***

Data and instructions (programs) are stored in the computer's memory after which all the major calculations and computations are carried out within the CPU. The CPU is also responsible for controlling the operations of various units of the computer system.

***Arithmetic Logic Unit (ALU)***

All calculations and comparisons, based on the instructions provided, are carried within out the ALU. It performs arithmetic functions like addition, subtraction, multiplication, division and also logical operations like greater than, less than and equal to.

***Main Memory Unit***

The main memory holds data and instructions after input, till they are needed. It also stores operating system and application software. It also holds the processed results that are awaiting output.

***Control Unit***

The function of the control unit is to execute the instructions of a program, one-by- one, in the desired sequence. It interprets each instruction and then prompts its execution by one of the units like input, output, ALU, storage.

For example, a comparison of two numbers (a logical operation) to be performed by the ALU may require loading the two numbers into the main memory which is a function performed by the control unit. It will then pass on the execution of the 'compare' function to the ALU.

***Output Unit***

The processed data, stored in the memory of the computer is sent to the output unit, which then converts it into a form that can be understood by the user. The output is usually produced in one of the two ways - on the display device, or on paper (hard copy).

***Secondary Storage***

Also termed as 'auxiliary' or 'backup' storage, it is typically used as a supplement to main storage. It is much cheaper than the main storage and stores large amount of data and instructions permanently. Hardware devices like USB memory stick, CD, DVD, Blue ray disk, Hard disk fall under this category.

**Check Your Progress 2**

List the basic components of a computer system.

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## 1.4 HARDWARE VERSUS SOFTWARE

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The electrical, electronic, mechanical and magnetic components that make up the computer system are together termed as '**hardware**'. These include components that are responsible for user input, display and mathematical processing. The CPU, disk drives, internal chips and wiring, modem, peripheral devices like the monitor, keyboard, mouse, printer, speakers, etc., are together termed as computer hardware.

Computer hardware cannot perform any manipulation or calculation without being instructed as to what to do and how to do it. Programs (or instructions) are required to tell the computer what to do. The generic term for computer programs is '**software**'. Software comes in two main types - system software and application programs.

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## 1.5 SYSTEM VERSUS APPLICATIONS SOFTWARE

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System software consists of programs that control the operations of the computer system itself. It consists a group of programs that control the operations of a computer equipment including functions like managing memory, managing peripherals, loading, storing, and is an interface between the application programs and the computer. Mac OS, Linux, Microsoft Window are examples of system software.

Software that can perform a specific task for the user, such as word processing, accounting, budgeting or payroll, fall under the category of application software. Such programs run on top of an operating system (like Windows, UNIX, Linux, Macintosh) and are used to carry out specific functions.

Word processors, spreadsheets, database, music players, movie players are examples of application software.

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## 1.6 BITS AND BYTES

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All information in the computer is handled using electrical components like the integrated circuits, semiconductors, all of which can recognize only two states - presence or absence of an electrical signal. Two symbols to represent these two states are 0 and 1, and are known as **BITS** (an abbreviation for **BI**nary **Digi**TS). **0** represents the absence of a signal, **1** represents the presence of a signal. A BIT is, therefore, the smallest unit of data in a computer and can either store 0 or 1.

Since a single bit can store only one value, there can possibly be only four unique combinations

**00    01    10    11**

Bits are, therefore, combined together into larger units in order to hold greater range of values.

**BYTES** are typically a sequence of eight bits put together to create a single computer alphabetical numerical character. More often referred to in larger multiples, memory is measured in terms of higher units like Kilobytes, Megabytes, Gigabytes, etc. Bytes are used to quantify the amount of data

digitally stored (on storage media) or transmitted (over the internet), and are also used to measure the memory and document size.

Byte hierarchy

1 Bit	1 Bit
1 Nibble	4 Bits
1 Byte	8 Bits
1 Kilobyte	1024 Bytes
1 Megabyte	1, 024 Kilobytes
1 Gigabyte	1, 024 Megabytes
1 Terrabyte	1, 024 Gigabytes

**Check Your Progress 3**

State True or False

- a. All code or data is stored and processed in computers using two symbols – 0 and 1. (T/F)
- b. A ‘Byte’ is a group of four bits and is often used to store characters. (T/F)

**1.7 INPUT AND OUTPUT DEVICES**

The computer will be of no use unless it is able to communicate with the outside world. Input/ Output Devices are required for users to communicate with the computer. In simple terms, input devices bring information INTO the computer and output devices bring information OUT of a computer system. These devices are also known as **peripherals** since they surround the CPU and memory of a computer system. Table 1.1 outlines some of these important devices

**Table1.1: Input and output devices**

INPUT DEVICES	OUTPUT DEVICES
Keyboard	Monitor
Mouse	Printer
Joystick	Plotter
Scanner	
Light Pen	
Touch screen	

Let us discuss these in detail:

**A) Input Devices**

These are:

**i) Keyboard**

It is a text base input device that allows the user to input alphabets, numbers and other characters and consists of a set of keys mounted on a board. (Fig 1.3) The various keys are as follows:



Fig 1.3: Keyboard layout

- **Alphanumeric Keypad :** It consists of keys for English alphabets, 0 to 9 numbers, and special characters like +, -, \*, ( ) etc.
- **Function Keys:** There are twelve function keys labeled F2, F3, ... , F12. The functions assigned to these keys differ from one software package to another. These keys are also user programmable keys.
- **Special-function Keys:** These keys have special functions assigned to them and can be used only for those specific purposes. Functions of some of the important keys are also defined below.
- **Enter:** It is similar to the 'return' key of the typewriter and is used to execute a command or program.
- **Spacebar:** It is used to enter a space at the current cursor location.
- **Backspace:** This key is used to move the cursor one position to the left and also delete the character in that position.
- **Delete:** It is used to delete the character at the cursor position.
- **Insert:** Insert key is used to toggle between insert and overwrite mode during data entry.
- **Shift:** This key is used to type capital letters when pressed along with an alphabet key. It is also used to type the special characters located on the upper-side of a key that has two characters defined on the same key.
- **Caps Lock:** Caps Lock is used to toggle between the capital lock feature. When 'on', it locks the alphanumeric keypad for capital letters input only.
- **Tab:** Tab is used to move the cursor to the next tab position defined in the document. Also, it is used to insert indentation into a document.
- **Ctrl:** Control key is used in conjunction with other keys to provide additional functionality on the keyboard.
- **Alt:** Also like the control key, Alt key is always used in combination with other keys to perform specific tasks.
- **Esc:** This key is usually used to negate a command. Also used to cancel or abort executing programs.

- **Numeric Keypad:** Numeric keypad is located on the right side of the keyboard and consists of keys having numbers (0 to 9) and mathematical operators like + - \* defined on them. This keypad is provided to support quick entry for numeric data.
- **Cursor Movement Keys:** These are arrow keys and are used to move the cursor in the direction indicated by the arrow (up, down, left, right).

## ii) Mouse

The mouse is a small device used to point to a particular place on the screen and select in order to perform one or more actions. It can be used to select menu commands, size windows, start programs, etc. (Fig 1.4 )

The most conventional kind of mouse has two buttons on top: the left one being used most frequently.

### Mouse Actions

**Left Click:** Used to select an item.

**Double Click:** Used to start a program or open a file.

**Right Click:** Usually used to display a set of commands

**Drag and Drop:** It allows you to select and move an item from one location to another. To achieve this, place the cursor over an item on the screen, click the left mouse button and while holding the button down move the cursor to where you want to place the item, and then release it .



Fig 1.4: Mouse



Fig 1.5: Joy stick

## iii) Joystick

The joystick is a vertical stick which moves the graphic cursor in a direction the stick is moved. It typically has a button on top that is used to select the option pointed by the cursor. Joystick is used as an input device primarily with video games, training simulators and controlling robots. (Fig 1.5)

## iv) Scanner

Scanner is an input device used for direct data entry from the source document into the computer system. It converts the document image into digital form so that it can be fed into the computer, Capturing like this reduces the possibility of errors typically experienced during large data entry.

Hand-held scanners are commonly seen in big stores to scan codes and price information for each of the items like Barcode reader (Fig 1.6)





Fig 1.6: Scanner and Barcode scanner

v) **Light Pen**

It is a pen shaped device used to select objects on a display screen. It is quite like the mouse (in its functionality) but uses a light pen to move the pointer and select any object on the screen by pointing to the object.

Users of Computer Aided Design (CAD) applications commonly use the light pens to directly draw on screen.



Fig 1.7: Light pen

vi) **Touch Screen**

It allows the user to make selections by simply touching the display screen. Common examples of touch screen include information kiosks, and bank ATMs. (Fig 1.8)



Fig 1.8: Touch screen

vii) **Voice input**

Voice input device is a device in which speech is used to input data or system commands directly into a system. Such equipment involves the use of speech recognition processes, and can replace or supplement other input devices. (Fig 1.9)

Some voice input devices can recognize spoken words from a predefined vocabulary, some have to be trained for a particular speaker. When the operator utters a vocabulary item, the matching data input is displayed as characters on a screen and can then be verified by the operator. The speech recognition process depends on the comparison of each utterance with words appearing in a stored vocabulary table.



Fig 1.8: Providing voice input

**B) Output Devices**

The output devices include:

i) **Monitor**

A computer monitor is an output device that displays information in pictorial or text form (Fig 1.9). A good display can be very effective in the user experience. The properties of display devices have also improved a lot due to the innovation in Display Technologies. The monitor is associated with a keyboard for manual input of characters and displays the information as it

is keyed in. It also displays the program or application. The output monitors are also available in different sizes. There are many types of computer monitors available right now as follows:

1. LCD monitor
2. LED Monitor
3. OLED Monitor
4. Plasma Monitor
5. CRT Monitor



**Fig 1.9: Monitor**

### **ii) Printer**

Printers are used to produce paper (commonly known as hardcopy) output. Based on the technology used, they can be classified as **Impact** or **Non-impact** printers.

**Impact printers** use the typewriting printing mechanism wherein a hammer strikes the paper through a ribbon in order to produce output. Dot-matrix and Character printers fall under this category.

**Non-impact** printers do not touch the paper while printing. They use chemical, heat or electrical signals to fetch the symbols on paper inkjet, Laser, Thermal printers fall under this category of printers.



**Fig 1.10: Printer**

When we talk about printers we refer to two basic qualities associated with printers- resolution, and speed. **Print resolution** is measured in terms of number of dots per inch (dpi). **Print speed** is measured in terms of number of characters printed in a unit of time and is represented as characters-per-second (cps), lines-per-minute (lpm), pages per minute(ppm) (Fig 1.10)

### **iii) Plotter**

Plotters are used to print graphical output on paper. It interprets computer commands and makes line drawings on paper using multi coloured automated pens. It is capable of producing graphs, drawings, charts, maps, etc. (Fig 1.11)



Fig 1.11: Plotter

Computer Aided Engineering (CAE) applications like CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) are typical usage areas for plotters.

#### iv) Speaker

A computer speaker is an output hardware device that connects to a computer to generate sound. The signal used to produce the sound that comes from a computer speaker is created by the computer's sound card.



Fig 1.12: Speaker

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## 1.8 RAM OR ROM

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Computer's memory can be classified into two types - RAM and ROM.

**RAM or Random Access Memory** is the central storage unit in a computer system and is the place in a computer where the operating system, application programs and the data in current use are kept temporarily so that they can be accessed by the computer's processor. The more RAM a computer has, the more data a computer can manipulate.

Random access memory, also called the memory is the temporary memory of a computer. It is said to be 'volatile' since its contents are accessible only as long as the computer is on. The contents of RAM are cleared once the computer is turned off.

**ROM or Read Only Memory** is a special type of memory which can only be read and contents of which are not lost even when the computer is switched off. It typically contains manufacturer's instructions. Among other things, ROM also stores an initial program called the 'bootstrap loader' whose function is to start the computer software operating, once the power is turned on.

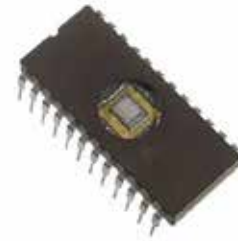
Read-only memories can be **manufacturer-programmed** or **user-programmed**. While manufacturer-programmed ROMs have data burnt into the circuitry, programmed ROMs can have the user load and then store read-only programs.

PROM or Programmable ROM is the name given to such ROM.

Information once stored on the ROM or PROM chip cannot be altered. However, another type of memory called EPROM (Erasable PROM) allows a user to erase the information stored on the chip and reprogram it with new information. EEPROM (Electrically EPROM) and UVEPROM (Ultra Violet EPROM) are two types of EPROMs. (Fig 1.13)



Fig 1.13 a): RAM



b) ROM

#### Check Your Progress 4

Differentiate between RAM and ROM.

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### 1.9 SECONDARY STORAGE DEVICES

RAM is volatile memory having a limited storage capacity. Secondary or Auxillary storage is storage other than the RAM. These include devices that are peripheral and are connected and controlled by the computer to enable permanent storage of programs and data.

Magnetic medium was found to be fairly inexpensive and long lasting medium and, therefore, became the preferred choice for auxiliary storage. Magnetic zip and hard disks fall under this category. The newer forms of storage devices are optical storage devices like Pen drive, SD card , Cloud storage, Solid storage device (SSD) etc. Let us discuss some of these in detail.

#### 1) Hard Disk

Hard disks are made up of rigid material and are usually a stack of metal disks sealed in a box. The hard disk and the hard disk drive exist together as a unit and are a permanent part of the computer where data and programs are saved. These disks have storage capacities ranging from 500GB to 87D and more. Hard disks are also rewritable and are more reliable when compared with floppies.

Depending on the way they are packaged, hard disks can be classified as **Disk packs** or **Winchester disks**. Disk packs are removable, in the sense that they can be removed and kept offline when not in use. They must be mounted on the disk drive before use. Winchester disks on the other hand, consist of disk platters sealed in a contamination-free container and form a permanent component of the computer. (Fig 1.14)



Fig 1.14: Hard disk

## 2) CD

Compact Disk (CD) is portable disk having data storage capacity between 650-700 MB. It can hold large amount of information such as music, full-motion videos, and text, etc. It contains digital information that can be read, but cannot be rewritten. Separate drives exist for reading and writing CDs.

Since it is a very reliable storage media, it is very often used as a medium for distributing large amount of information to large number of users. In fact most of the software is distributed through CDs.

## 3) DVD

Digital Versatile Disk (DVD) is similar to a CD but has larger storage capacity and enormous clarity. Depending upon the disk type it can store several Gigabytes of data as opposed around 650 MB of CD.



Fig 1.15: Pendrive

## 4) Pen drive

It is a portable and handy Universal Serial Bus (USB) memory device for storing and used to store and transfer/transport audio, video, and data related files from a computer. (Fig 1.15)

## 5) Cloud Storage

Cloud storage is off-site storage that's maintained by a third party. Cloud storage safely and securely saves your data to a remote database so you don't have to store your data and files to your computer hard drive or other storage device. Cloud storage has many advantages over hard drive storage.

### Benefits of using Cloud storage

- Usability and accessibility.
- Security.
- Cost-efficient.
- Convenient sharing of files.
- Automation.
- Multiple users.
- Synchronization.
- Convenience (Fig. 1.16)

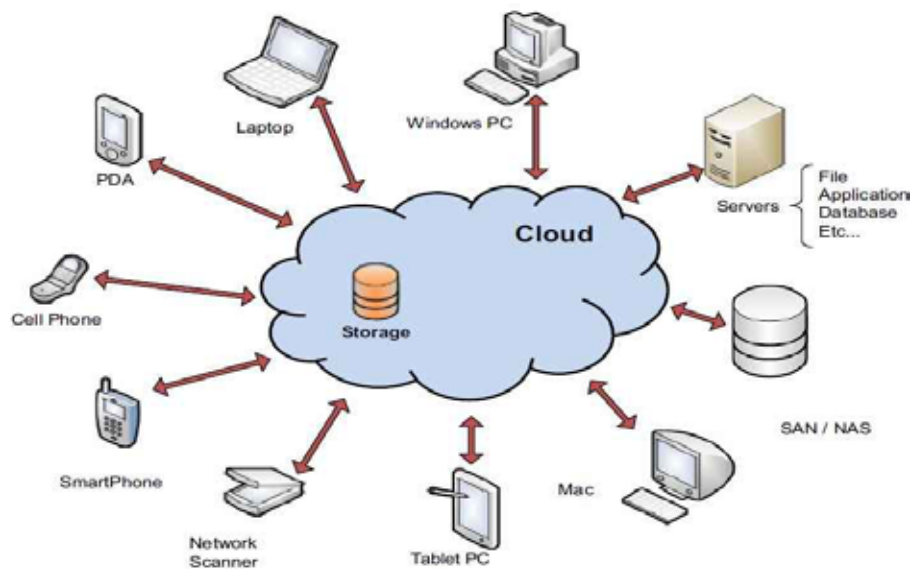


Fig 1.16: Cloud storage

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## 1.10 LET US SUM UP

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In this practical, you have studied that computer and its characteristics (speed, accuracy, diligence, versatility and storage capacity) that have contributed towards making it such a popular device. The differences between concepts like hardware/software, system/application software, bits/bytes, RAM/ROM are also explained. Various types of input, output and secondary storage devices along with their usages, are discussed. This introductory practical must have helped you to know details about computer.

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## 1.11 ANSWERS TO CHECK YOUR PROGRESS

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### Check Your Progress 1

Computer characteristics:

- Speed
- Accuracy
- Diligence
- Versatility
- Storage capacity

### Check Your Progress 2

The basic components of the computer system include:

- **Input Unit** : Input unit receives data and instructions in a form that can be understood by the computer.
- **Output Unit** : Output unit presents processed information in a form that can be understood by the user.
- **Main Memory**: Main memory holds data and instructs after input, till needed. Also holds information awaiting output.
- **Arithmetic Logic unit**: Arithmetic logic unit performs calculations and comparisons based on the instructions.

- **Control Unit** :Control unit interprets each instruction and prompts the execution by one of the units -'input, output, ALU, storage.
- **Secondary Storage**: Secondary storage supplements main storage, and stores data and instructions permanently.

### Check Your Progress 3

- a. True
- b. False

### Check Your Progress 4

The main memory in the computer system is referred to as RAM (Random Access Memory). It is fast access memory and is used to store data and instructions during computer operations. The main feature of RAM is that it can be accessed randomly (hence the name RAM). The contents of RAM are available as long as the computer is on and are lost once it switched off. It is, therefore, also called 'volatile' memory. Secondary storage can be used to store data and instructions permanently.

ROM or Read Only Memory holds data or instructions permanently and as the name suggest, can be read from but cannot be changed by the users. It is non-volatile in nature, which means the contents of ROM are not lost even if the power is switched off. It, therefore, usually contains instructions that are required to get the computer started once it is powered on. The contents of ROM are built into it at the time of manufacturing itself.

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## 1.12 ACTIVITY

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Try to use the computer for getting familiar to the Monitor, Keyboard and Printer.