Unit I
Introduction to Computer and History

Definition of Computer:-

A Computer is an Electronic device which accepts data from input device (Keyboard, Mouse), process it and gives result output to display Screen/Monitor.
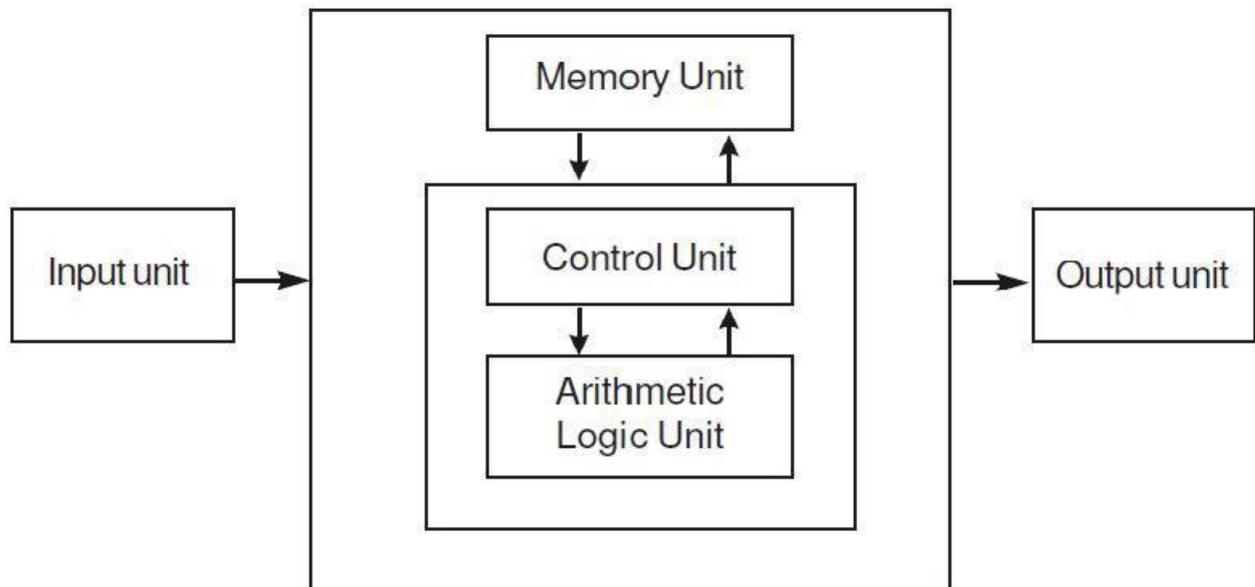
Basic Computer Organization:-

Fig. 1.1 Block diagram of Computer Organisation

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Basic Computer Organization are as follows:
1. Input Unit:

The process of sending the data and Instructions for the processing through some suitable devices such as Keyboard, Mouse etc. is called Input. The devices translate the data from human understandable form into electronic impulses which are understood by the computer.

2. Central Processing Unit (CPU):-
This unit of the computer is the brain of computer system, which does all the processing, calculations, problem solving and controls all other functions of all other elements of the computer. The CPU consists of the following three distinct units namely. 1. Memory Unit 2. Control Unit 3. Arithmetic and Logic Unit 1.

i) Memory Unit: This holds the data in in terms of Program and files. This memory unit is usually referred as primary storage section. The units in which memory unit is measured are known as BYTES. BYTE is the space required to store 8 characters or alphabet or digits to any other special character.

ii) Control Unit: This unit which coordinates all the activities of each and every element of computer. It decodes the instructions given by various users and it sends commands and signals that determine the sequence of various instructions. It also controls the flow of data from the main storage.

iii) Arithmetic and Logic Units:-
This unit performs arithmetic operations such as addition, subtraction, multiplication and division. It also does Logical Operations such as comparison of numbers etc. Thus this unit helps by processing data and taking logical decisions.

3) Output:-
The processing of extracting the data from CPU through some suitable devices is called Output. The common used output devices are VDU, Printers, Plotter, magnetic media like floppy Disks etc.

Characteristics of Computer:-
1) High Speed

Computer is a very fast device.

It is capable of performing calculation of very large amount of data.

2) Accuracy

In addition to being very fast, computers are very accurate.

The calculations are 100% error free.

Computers perform all jobs with 100% accuracy provided that correct input has been given.

3) Storage Capability

Memory is a very important characteristic of computers.

A computer has much more storage capacity than human beings.

It can store large amount of data.

It can store any type of data such as images, videos, text, audio and many others.

4) Diligence

It can work continuously without any error .

It can do repeated work with same speed and accuracy.

5) Versatility

A computer is a very versatile machine.

A computer is very flexible in performing the jobs to be done.

6) Reliability

A computer is a reliable machine.

Modern electronic components have long lives.

Computers are designed to make maintenance easy.

7) Automation

Computer is an automatic machine.

Automation means ability to perform the given task automatically.
Once a program is given to computer i.e. stored in computer memory, the program and instruction can control the program execution without human interaction.

Generations of Computer:-
First Generation

The period of first generation was 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit).

The main features of first generation are:

1) Vacuum tube technology

2) Unreliable

3) Supported machine language only

4) Very costly

5) Generated lot of heat

6) Slow input and output devices

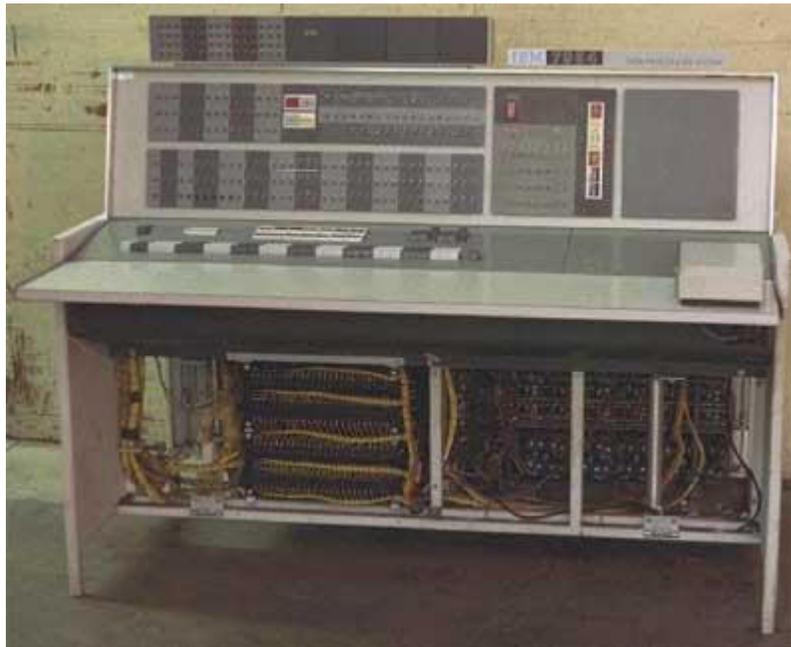7) Huge size

8) Need of A.C.

9) Non-portable

Examples

IBM-701

IBM-650

Second Generation

The period of second generation was 1959-1965. In this generation transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes.

The main features of second generation are:

    1) Use of transistors

    2) Reliable in comparison to first generation computers

    3) Smaller size as compared to first generation computers

    4) Generated less heat as compared to first generation computers

5) Consumed less electricity as compared to first generation computers

6) Faster than first generation computers

7) Still very costly

8) A.C. needed

Examples

IBM 1620

IBM 7094

Third Generation

The period of third generation was 1965-1971. The computers of third generation used integrated circuits (IC's) in place of transistors.

The main features of third generation are:
IC used

1) More reliable in comparison to previous two generations

2) Smaller size

3) Generated less heat

4) Faster

5) Lesser maintenance

6) Still costly

7) A.C needed

8) Consumed lesser electricity

9) Supported high-level language Some

Examples

IBM-360 series

Honeywell-6000 series

PDP(Personal Data Processor)

Fourth Generation

The period of fourth generation was 1971-1980. The computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors.

The main features of fourth generation are:
VLSI technology used

1) Very cheap

2) Portable and reliable

3) Use of PC's

4) Very small size

5) Pipeline processing

6) No A.C. needed

7) Concept of internet was introduced

8) Great developments in the fields of networks

9) Computers became easily available

Some computers of this generation were: Examples :

DEC 10

STAR 1000

Fifth Generation

The period of fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components.

AI includes:

Robotics

Neural networks

Game Playing

Natural language understanding and generation.

The main features of fifth generation are:
Development of true artificial intelligence

1) Development of Natural language processing

2) Advancement in Parallel Processing

3) More user friendly interfaces with multimedia features

Availability of very powerful and compact computers at cheaper rates Some computer types of this generation are(Examples):

Desktop

Laptop

NoteBook

Types of Computer:-

Microcomputer (Personal Computer)

A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is playing games and surfing Internet.

Although personal computers are designed as single-user systems. In terms of power, now-a-days High-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.

Minicomputer

A minicomputer is a class of smaller computers that developed in the mid-1960s and sold for much less than mainframe and mid-size computers from IBM and its direct competitors. A Minicomputer *is a computer* which has all the features of a large size computer, but its size is smaller than those. A minicomputer lies between the mainframe and the microcomputer because its size is smaller than the former one and larger than the latter one. A minicomputer is also called as a mid-range computer. Minicomputer are mainly multi-users systems where more than one user can work simultaneously.

Minicomputer can support multi-users at a time or you can say that minicomputer is a multiprocessing system. Also, the power of processing of minicomputers is not larger than the power of mainframe and supercomputers. These minicomputers can do time-sharing and online processing. The size of minicomputers can range from 12 inches in width to less than 7. This small size is especially attractive to students because they can use it anywhere they want.

Examples: IBM's AS/400e, Honeywell200.

Mainframe Computer

Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports many simultaneous execution of programs. A data processing system employed mainly in large organizations for various applications, including data processing, process control, industry and consumer statistics, enterprise resource planning, and financial transaction processing.

Mainframes use proprietary operating systems, most of which are based on Unix, and a growing number on Linux. Over the years they have evolved from being room-sized to networked configurations of workstations and servers that are an extremely competitive and cost effective platforms for e-commerce development and hosting. Mainframes are so called because the earliest ones were housed in Large Metal Frames.

Workstation

Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities.

Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive.

Common operating systems for workstations are UNIX and Windows NT. Like PC, Workstations are also single-user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.

Client and Server

The **client–server model** is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients.[1] Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests. Examples of computer applications that use the client–server model are Email, network printing, and the World Wide Web.
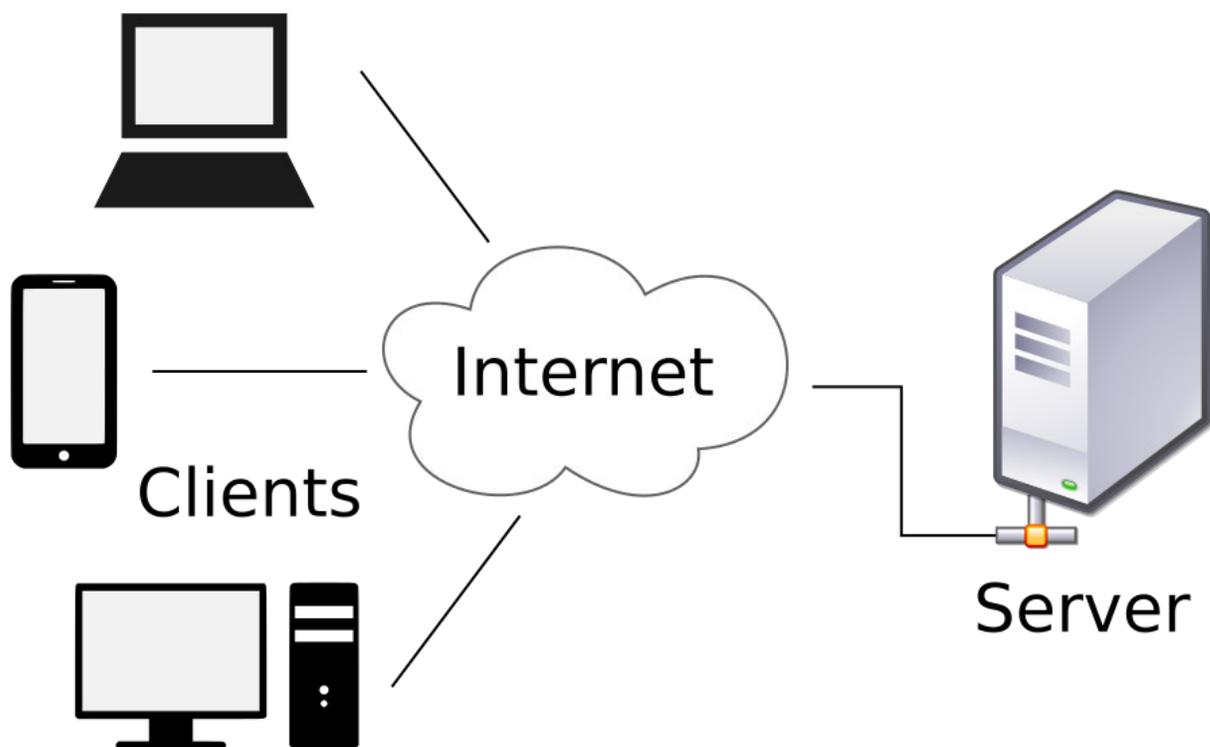
Unit II
Computer Peripherals & Memory
Input Devices:-
Following are the Input Devices Such as,

Keyboard

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet. Following are the Keys available on Keyboard:

1) Typing Keys :- These keys includes Letters keys (A-Z) & Digits (0-9)
2) Numeric Keys: - It is used to Insert Numeric Data. It Consist of 17 Keys.
3) Function Keys: -The Twelve keys present in the Keyboard. Which are arranged in a row at the top of the Keyboard.
4) Control Keys: - These Keys Provide Cursor and Screen Control. It includes End, Insert,
   Delete, Page-Up,Page-Down,Control,Alternate(Alt),Escape(Esc) .
5) Special Purpose Keys :- It consist of different Keys such as, Enter,Shift, Caps Lock,num Lock,
   Print Screen,etc.

Mouse

Mouse is most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages:-

1) Clicking

2) Double Clicking

3) Dragging

4) Easy to use

5) Not very expensive

Moves the cursor faster than the arrow keys of keyboard.

ComputerHope.com

Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved. Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

A trackball is a computer cursor control device used in many notebook and laptop computers. The trackball is usually located in front of the keyboard toward the user. Essentially, the trackball is an upside-down mouse that rotates in place within a socket.

Joystick

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.
The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. A joystick, also known as the control column .Joysticks are often used to control video games, and usually have one or more push-buttons whose state can also be read by the computer. A popular variation of the joystick used on modern video game consoles is the analog stick.

Light Pen

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

A light pen is a light-sensitive pointing input device commonly used to select or otherwise modify text or data on a screen. Used with a CRT monitor, these devices were an early form of manipulating and highlighting data on the screen. In the picture is an example using a light pen to highlight text on the screen.

Light pens were originally developed around 1955 and in the 1960s, they became more commonly used with graphics terminals, like the IBM 2250. In the 1980s, light pen usage expanded to home computers, like the BBC Microcomputer. Some graphics cards also included a connection for a light pen.

Today, light pens are no longer used due to the invention of touch screens.

A light pen may also be used to describe the pen (stylus) used with a graphics tablet.

Output Devices:-

Following are the some Output Devices Such as,

Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

☐ Cathode-Ray Tube (CRT)

☐ Flat- Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution.

Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically. There are some disadvantages of CRT

☐ Large in Size

☐ High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, videogames, monitors, laptop computer, graphics display.

The flat-panel display is divided into two categories

☐ **Emissive Displays** - The emissive displays are devices that convert electrical energy into light. Example are plasma panel and LED(Light-Emitting Diodes).
☐ **Non-Emissive Displays** - The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD(Liquid-Crystal Device)

Printers

Printer is an output device, which is used to print information on paper.

Dot Matrix Printer

In the market one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character that is why it is called Dot Matrix Printer.

Advantages

☐ Inexpensive

☐ Widely Used

☐ Other language characters can be printed

Disadvantages

☐ Slow Speed

☐ Poor Quality

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Advantages

☐ Very high speed

☐ Very high quality output

☐ Give good graphics quality

☐ Support many fonts and different character size

Disadvantages

☐ Expensive.

☐ Cannot be used to produce multiple copies of a document in a single printing.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

☐ High quality printing

☐ More reliable

Disadvantages

☐ Expensive as cost per page is high

☐ Slow as compared to laser printer

Projector

A **projector** or **image projector** is an optical device that projects an image (or moving images) onto a surface, commonly a projection screen. Most projectors create an image by shining a light through a small transparent lens, but some newer types of projectors can project the image directly, by using lasers. A virtual retinal display, or retinal projector, is a projector that projects an image directly on the retina instead of using an external projection screen.

The most common type of projector used today is called a video projector. Video projectors are digital replacements for earlier types of projectors such as slide projectors and overhead projectors. These earlier types of projectors were mostly replaced with digital video projectors throughout the 1990s and early 2000s (decade), but old analog projectors are still used at some places. The newest types of projectors are handheld projectors that use lasers or LEDs to project images. Their projections are hard to see if there is too much ambient light.

Movie theaters use a type of projector called a movie projector. Another type of projector is the enlarger, a device used to produce photographic prints from negatives.

Biometric Device

A **Biometric device** is a security identification and authentication device. Such devices use automated methods of verifying or recognizing the identity of a living person based on a physiological or behavioral characteristic. These characteristics include fingerprints, facial images, Iris prints and voice recognition.

Biometrics is being used to establish better and accessible records of the hour's employee's work. With the increase in "Buddy Punching (a case where employees clocked out coworkers and fraudulently inflated their work hours) employers have looked towards new technology like fingerprint recognition to reduce such fraud. Additionally, employers are also faced with the task of proper collection of data such as entry and exit times. Biometric devices make for largely foul proof and reliable ways of enabling to collect data as employees have to be present to enter biometric details which are unique to them.

Computer Memory

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells.

RAM

RAM(Random Access Memory) is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence a backup uninterruptible power system (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types such as,

1) Static RAM (SRAM)

2) Dynamic RAM (DRAM)

Static RAM (SRAM)

The word static indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature.

SRAM uses more chips than DRAM for the same amount of storage space, thus making the manufacturing costs higher. So SRAM is used as cache memory and has very fast access.

Characteristic of the Static RAM

i) It has long life

ii) There is no need to refresh

iii) Faster

iv) Used as cache memory

v) Large size

vi) Expensive

vii) High power consumption

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually refreshed in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells which are composed of one capacitor and one transistor.

Characteristics of the Dynamic RAM

    i)   It has short data lifetime

    ii)   Need to be refreshed continuously

    iii)   Slower as compared to SRAM

    iv)   Used as RAM

    v)   Lesser in size

    vi)   Less expensive

    vii) Less power consumption

ROM

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM, stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.
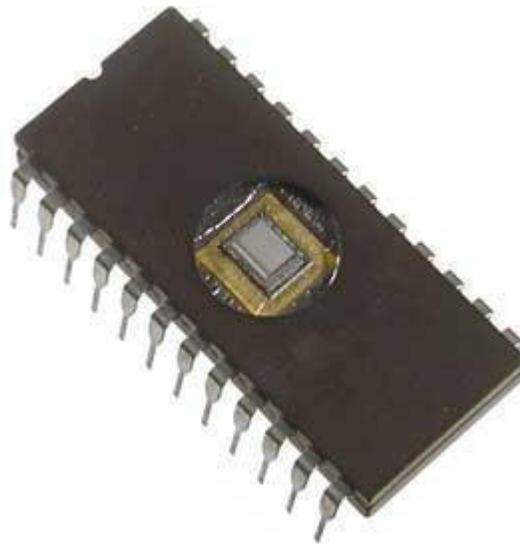
The Advantages of ROM are as follows:

    i)   Non-volatile in nature

    ii)   These cannot be accidentally changed

    iii)   Cheaper than RAMs

    iv)   Easy to test

v)   More reliable than RAMs

vi)   These are static and do not require refreshing

Following are the various Types of ROM

PROM (Programmable Read only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM(Erasable and Programmable Read Only Memory)
The EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than ten years because the charge has no leakage path.

EEPROM(Electrically Erasable and Programmable Read Only Memory)

The EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (milli second).

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

Advantages
The advantages of cache memory are as follows
   i)   Cache memory is faster than main memory.
   ii)   It consumes less access time as compared to main memory.
   iii)   It stores the program that can be executed within a short period of time.
   iv)   It stores data for temporary use.

Disadvantages

   i)   The disadvantages of cache memory are as follows

   ii)   Cache memory has limited capacity.

   iii)   It is very expensive.