BCA 1ST Semester

BCA - 101: COMPUTER FUNDAMENTALS AND PROGRAMMING

UNIT: 1

COMPUTER

1. A computer is an electronic device which processes raw data according to the programmed instruction to produce the O/P in useful form.

2. Computer is an electronic devices which is capable of solving any problems (simple or complex) by (a) accepting input in the from of data , (b) performing prescribed operation in this data in a specified sequence and finally (c) supplying result (or information) after these operation, in the form of an output.

History of Computers

The first counting device was used by the primitive people. They used sticks, stones and bones as counting tools. As human mind and technology improved with time more computing devices were developed. Some of the popular computing devices starting with the first to recent ones are described below;

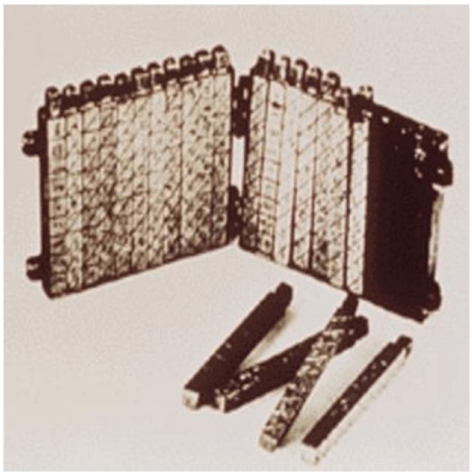
1. Abacus

The history of computer begins with the birth of abacus which is believed to be the first computer. It is said that Chinese invented Abacus around 4,000 years ago.

It was a wooden rack which has metal rods with beads mounted on them. The beads were moved by the abacus operator according to some rules to perform arithmetic calculations. Abacus is still used in some countries like China, Russia and Japan. An image of this tool is shown below;

2. Napier's Bones

It was a manually-operated calculating device which was invented by John Napier (1550-1617) of Merchiston. In this calculating tool, he used 9 different ivory strips or bones marked with numbers to multiply and divide. So, the tool became known as "Napier's Bones. It was also the first machine to use the decimal point.



3. Pascaline

Pascaline is also known as Arithmetic Machine or Adding Machine. It was invented between 1642 and 1644 by a French mathematician-philosopher Biaise Pascal. It is believed that it was the first mechanical and automatic calculator.

Pascal invented this machine to help his father, a tax accountant. It could only perform addition and subtraction. It was a wooden box with a series of gears and wheels. When a wheel is rotated one revolution, it rotates the neighboring wheel. A series of windows is given on the top of the wheels to read the totals. An image of this tool is shown below;

4. Stepped Reckoner or Leibnitz wheel

It was developed by a German mathematician-philosopher Gottfried Wilhelm Leibnitz in 1673. He improved Pascal's invention to develop this machine. It was a digital mechanical calculator which was called the stepped reckoner as instead of gears it was made of fluted drums. See the following image;

5. Difference Engine

In the early 1820s, it was designed by Charles Babbage who is known as "Father of Modern Computer". It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables.

Classification of Computers-

There are four classifications of digital computer systems:

super-computer, mainframe computer, minicomputer, and microcomputer.

1. **Super computers :** The super computers are the most high performing system. A supercomputer is a computer with a high level of performance compared to a general-purpose computer. The actual Performance of a supercomputer is measured in FLOPS instead of MIPS. All of the world's fastest 500 supercomputers run Linux-based operating systems. Additional research is being conducted in China, the US, the EU, Taiwan and Japan to build even faster, more high performing and more technologically superior supercomputers. Supercomputers actually play an important role in the field of computation, and are used for intensive computation tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modeling, and physical simulations. and also Throughout the history, supercomputers have been essential in the field of the cryptanalysis.
   eg: PARAM, jaguar, roadrunner.

2. **Mainframe computers :** These are commonly called as big iron, they are usually used by big organisations for bulk data processing such as statics, census data processing, transaction processing and are widely used as the servers as these systems has a higher processing capability as compared to the other classes of computers, most of these mainframe architectures were established in 1960s, the research and development worked continuously over the years and the mainframes of today are far more better than the earlier ones, in size, capacity and efficiency.
   Eg: IBM z Series, System z9 and System z10 servers.

3. **Mini computers :** These computers came into the market in mid 1960s and were sold at a much cheaper price than the main frames, they were actually designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping, later they became very popular for personal uses with evolution.
   In the 60s to describe the smaller computers that became possible with the use of transistors and core memory technologies, minimal instructions sets and less expensive peripherals such as the ubiquitous Teletype Model 33 ASR. They usually took up one or a few inch rack cabinets, compared with the large mainframes that could fill a room, there was a new term "MINICOMPUTERS" coined.
   Eg: Personal Laptop, PC etc.

4. **Micro computers :** A microcomputer is a small, relatively inexpensive computer with a microprocessor as its CPU. It includes a microprocessor, memory, and minimal I/O circuitry mounted on a single printed circuit board. The previous to these computers, mainframes and minicomputers, were comparatively much larger, hard to maintain and more expensive. They actually formed the foundation for present day microcomputers and smart gadgets that we use in day to day life.
   Eg: Tablets, Smartwatches.

GENERATIONS OF COMPUTERS →

First generation 1942-1954 : The first generation marked the beginning of commercial computing. The first generation was characterized by high-speed vacuum tube as the active component technology. Operation continued without the benefit of an operating system for a time. The mode was called "closed shop" and was characterized by the appearance of hired operators who would select the

job to be run, initial program load the system, run the user‘s program, and then select another job, and so forth. Programs began to be written in higher level, procedure-oriented languages, and thus the operator‘s routine expanded.

Advantages : 1. Computer in this generation use of vacuum tubes or values as their basic electronic component.

2. There were faster than earlier mechanical devices.

3. These computers were very enlarging in size and very costly.

Disadvantages :

1. They consumed too much power and generated too much heat, when used for even short duration of time.

2. They were very unreliable and broke down frequently.

3. They require regular maintenance their components had assembled manually.

4. Big air condition was required.

Second generation 1954-1964 : The second generation of computer hardware was most notably characterized by transistors replacing vacuum tubes as the hardware component technology. In addition, some very important changes in hardware and software architectures occurred during this period. For the most part, computer systems remained card and tape-oriented systems. Significant use of random access devices, that is, disks, did not appear until towards the end of the second generation. Program processing was, for the most part, provided by large centralized computers operated under mono-programmed batch processing operating systems.

Advantages : 1. Transistors used instead of vacuum tubes.

2. Comparatively smaller in size and generated less heat.

3. Better than the earlier comp.

4. Transistors were made from pieces of silicon, so they were more compact than vacuum tubes.

Disadvantages :

1. Limited storage capacity.

2. Consumed more power.

3. Relatively slow in performance.

4. Required regular maintenance and their components are very expensive.

5. Commercial production was difficult and costly.

Third generation 1964-1978 : The third generation officially began in April 1964 with IBM‘s announcement of its System/360 family of computers. Hardware technology began to use integrated circuits (ICs) which yielded significant advantages in both speed and economy. Operating System

development continued with the introduction and widespread adoption of multiprogramming. This marked first by the appearance of more sophisticated I/O buffering in the form of spooling operating systems. These systems worked by introducing two new systems programs, a system reader to move input jobs from cards to disk, and a system writer to move job output from disk to printer, tape, or cards.

Advantages : 1. Based on IC is (Integrated chips) technology.

2. Mainframe computers were developed in this generation.

3. Smaller in size and were cost effective with increased memory capacity.

4. IC's were more compact than transistors.

5. Very less heat generated.

6. Required very less power.

7. Reduce computational times from microseconds to nanoseconds.

8. More reliable.

9. Maintenance cost is low because h/w failure is rare, easily portable and totally general purpose.

Disadvantages : 1. They still had less storage capacity,

2. Relatively slower performance.

3. Air conditioning is required in many cases.

4. Highly sophisticated technology required for the manufacture of IC chips.

Fourth generation 1978-1995 : The fourth generation is characterized by the appearance of the personal computer and the workstation. Miniaturization of electronic circuits and components continued and Large Scale Integration (LSI), the component technology of the third generation, was replaced by Very Large Scale Integration (VLSI), which characterizes the fourth generation. However, improvements in hardware miniaturization and technology have evolved so fast that we now have inexpensive workstation-class computer capable of supporting multiprogramming and time-sharing. Hence the operating systems that supports today's personal computers and workstations look much like those which were available for the minicomputers of the third generation.

Advantages: 1. Used micro technology .

2. Use of large scale integrated (LSI) is place of ICS.

3. VLSI is the latest technology of comp introduced

4. Development of the popular PCS, also called as microcomputer.

5. Having a high memory and a fast processing speed.

6. Today's PCS are more powerful than mainframe computer,

7. Smallest in size because of high component density.

8. Very reliable. Heat generated is negligible.

9. No air conditioning was required.

Disadvantages : 1. Highly sophisticated technology is required for the manufactured of LSI chips.

2. No intelligence on their own.

Fifth generation 1995- present :

1. The AI was introduced. The comp of this generation has the capability to think on their own.

2. Use ULSI (Ultra Large Scale Integration) chips in place of VLSI chips.

3. One ULSI chips contains millions of component on a single IC.

4. Use intelligent software.

5. The programmers or users would not require giving each and every instruction to the comp for solving a problem.

6. Comp can accept spoken word instructions (voice recognition) and reproduce human reasoning.

7. Fifth generation computers the ability to translate a foreign language.

Input and Output Devices :

Before a computer can process your data, you need some method to input the data into the machine. The device you use will depend on what form this data takes (be it text, sound, artwork, etc.). Similarly, after the computer has processed your data, you often need to produce output of the results. This output could be a display on the computer screen, hardcopy on printed pages, or even the audio playback of music you composed on the computer. The terms "input" and "output" are used both as verbs to describe the process of entering or displaying the data, and as nouns referring to the data itself entered into or displayed by the computer.

Input Devices

1. **Keyboard :**
   Most keyboards attach to the PC via a PS/2 connector or USB port (newer). Older Macintosh computers used an ABD connector, but for several years now all Mac keyboards have connected using USB. It is a text base input device that allows the user to input alphabets, numbers and other characters. It consists of a set of keys mounted on a board.

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 F1, 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 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. 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 :
Cap Lock is used to toggle between the capital lock features. 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.

Pointing Devices:

The graphical user interfaces (GUIs) in use today require some kind of device for positioning the on-screen cursor. Typical pointing devices are: mouse, trackball, touch pad, track point, graphics tablet, joystick, and touch screen. Pointing devices, such as a mouse, connected to the PC via a serial ports (old), PS/2 mouse port (newer), or USB port (newest). Older Macs used ADB to connect their mice, but all recent Macs use USB (usually to a USB port right on the USB keyboard).

2. Joysticks :

Joysticks and other game controllers can also be connected to a computer as pointing devices. They are generally used for playing games, and not for controlling the on-screen cursor in productivity software.

3. Mouse :

PC Keyboard (you have one in front of you that you can see for a closer look) . The mouse pointing device sits on your work surface and is moved with your hand. In older mice, a ball in the bottom of the mouse rolls on the surface as you move the mouse and internal rollers sense the ball movement and transmit the information to the computer via the cord of the mouse.

The newer optical mouse does not use a rolling ball, but instead uses a light and a small optical sensor to detect the motion of the mouse by tracking a tiny image of the desk surface. Optical mice avoid the problem of a dirty mouse ball, which causes regular mice to roll unsmooth if the mouse ball and internal rollers are not cleaned frequently.

A mouse also includes one or more buttons (and possibly a scroll wheel) to allow users to interact with the GUI. The traditional PC mouse has two buttons, while the traditional Macintosh mouse has one button. On either type of computer you can also use mice with three or more buttons and a small scroll wheel (which can also usually be clicked like a button.

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.

4. Touch pad:

Most laptop computers today have a touch pad pointing device. You move the on-screen cursor by sliding your finger along the surface of the touch pad. The buttons are located below the pad, but most touch pads allow you to perform “mouse clicks” by tapping on the pad itself. Touch pads have the advantage over mice that they take up much less room to use. They have the advantage over trackballs (which were used on early laptops) that there are no moving parts to get dirty and result in jumpy cursor control.

5. Track point :

Some sub-notebook computers (such as the IBM ThinkPad), which lack room for even a touch pad, incorporate a track point, a small rubber projection embedded between the keys of the keyboard. The track point acts like a little joystick that can be used to control the position of the on-screen cursor.

6. Microphone :

A microphone can be attached to a computer to record sound (usually through a sound card input or circuitry built into the motherboard). The sound is digitized—turned into numbers that represent the original analog sound waves—and stored in the computer to later processing and playback.

Output Devices:

1. Printer :

A **printer** is an electromechanical device which converts the text and graphical documents from electronic form to the physical form. They are the external peripheral devices which are connected with the computers or laptops through a cable or wirelessly to receive input data and print them on the papers.

Quality of printers is identified by its features like color quality, speed of printing, resolution etc. 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 (plum), or pages-per-minute (pap). 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 touch the symbols on paper. Inkjet, DeskJet, Laser, Thermal printers fall under this category of printers. They are faster and quieter than impact printers because they have fewer moving parts. Nonimpact printers form characters and images without direct physical contact between the printing mechanism and the paper.

2. Sound Output :

Computers also produce sound output, ranging from simple beeps alerting the user, to impressive game sound effects, to concert quality music. The circuitry to produce sound may be included on the motherboard, but high quality audio output from a PC usually requires a sound card in one of the expansion slots, connected to a set of good quality external speakers or headphones. Multimedia is a term describing computer output that includes sound, text, graphics, movies, and animation. A sound card is an example of a multimedia output device (as is a monitor that can display graphics).

Audio Output: Sound Cards and Speakers: The Audio output is the ability of the computer to output sound. Two components are needed: Sound card – Plays contents of digitized recordings, Speakers – Attached to sound card.

3. Computer Output Microfilm :

Comp is a system that converts stored data directly to microfilm or microfiche. It was used in 1960s still used today mostly organization who need to store payroll accounting, insurance, inventory or employee data. Computerized system that converts online or stored data directly into microfilm as images for archiving. Computer output microfilm or "COM" is a process for copying and printing data onto microfilm from electronic media found on personal, mini, or mainframe computers.

4. Projectors :

It is a hardware device with which an image and text is projected onto a flat screen. Image data is sent to the video card by the computer which is then translated into a video image and sent to the projector. A projector is often used in meetings or to make presentations as it allows the display to be visible to a larger audience.

Types of projector:

1. Cathode Ray Tube (CRT) projector
2. Liquid Crystal Display (LCD) projector
3. Digital Light Processing (DLP) projector

Primary and Secondary memories:

Memory means →

Based on a Layman: - Memory is the mental faculty of retaining and recalling past experience based on the mental processors of learning, retention, recall and recognition.

Based on IT: - The term memory identifies data storage that comes in the form of chips, and the word storages used for memory that exists on tapes or disks. Memory is an electronic device.

The memory of a computer is a place where data and instruction are stored. The capacity of the computer depends upon the parts.

1. The storage capacity
2. The processing speed of the processor.

Memory usually refers to a form of solid state storage known as RAM & sometimes other form of last but temporary storage.

Types of memory:

Volatile memory: it requires constant power to maintain the stored information .volatile **memory** is typically used only for primary storage.

Non-volatile memory: it will retain the stored information even if it is not constantly supplied with electric power. It is suitable for long term storage for information & therefore used for secondary tertiary & off-line storage.

Dynamic memory: dynamic memory is volatile memory which also requires that stored Information is periodically refreshed or read & rewritten without modification.

Advantage of storage device:

It is economical as it takes up far less space than paper document.

It is secured as by using the storage controls. We can save our data from unauthorized user.

It is almost unlimited as there is virtually no limit to the amount of data to be stored.

Storage devices are divided into 2 parts:-

Primary Storage Device

Secondary Storage Device

1**. Primary storage device:** it also called main memory. It works with the C.P.U. to hold instructions' and data in order to be processed. Primary storage is considered as volatile form of storage means, it hold data temporarily because it requires a continuous flow of electrical current. If current is interrupted, data is lost. They are two types:-

1) RAM 2) ROM

Primary storage may include several types of storage such as main storage, cache memory and special registers, all of which can be accessed randomly, that is, accessing any location in storage at any moment takes the same amount of time.

RAM

RAM can be erased and written over it by the user. RAM refers to storage formats and equipment that allow the stored data to be accessed in any order- that is, random not in sequence. Some RAM chips maintain data indefinitely without electrical power. RAM devices are not limited to memory chips, as a storage format is not limited to use as working memory. Most RAM can be both written to and read from, so often used interchangeably with "read write memory".

RAM manufacturers: - Corsair memory, crucial technology, GEIL, Gaskell, Nynex , Infineon technologies, micron technology, mush kin, OCZ Technology, Samsung, simple technology, Kingston technology.

RAM features

1. It can receive and use much larger programs.
2. It can hold copies of more than one program in the main memory to supports the computer by more than one user at a time.
3. It can operate faster and more efficiently.
4. It will be able to use new sophisticated S/W.
5. It can hold image for creating graphics and animation.
6. Can work with and manipulate more data,
7. Very expensive.
8. RAM comes in very small capacity as compared to secondary storage media.
9. RAM is volatile, so data on RAM should be saved on secondary storage.
10. The CPU uses it to hold the O.S., active application and many open files.
11. Major support of RAM is swiftness, when you open an S/W program or enter data into your computer; you are placing this information on RAM. CPU constantly up dates the RAM with new information.

There are two types of RAM

1**. Static RAM (SRAM) :-** (More expensive consume more power than the RAM .use 6 transistors per bit 6 times larger than the RAM) This RAM will maintain its data as long as power is provided to the memory Chips. It does not need to be re-written periodically. In

fact, the only time the data on the memory is refreshed or changed is when an actual write command is executed. SRAM is very fast, but is much more expensive than the RAM. SRAM is often used as cache memory due to its speed. SRAM store bits (1's or 0's) in memory cells that are basically flip- flops- a SRAM is a type of semiconductor memory. SRAM is stores its data in capacitors. It does not require constant recharging to retain their data, this type of Ram is faster than DRAM. Speed is approx 8ns to 30ns as opposed to 60 ns to 80 ns from DRAM.

There are few types of SRAM

a. Asynchronous SRAM: - An older type of SRAM used in many pc's outdated for L2 cache. It is asynchronous, meaning that it works independently of the system clocks. This means that the CPU found itself waiting for information from the L2 cache.

b. Synchronous SRAM: - Synchronous means it is synchronized with the system clocks. While this speeds it up, it makes it rather expensive at the same time.

c. Pipeline burst SRAM: - commonly used. SRAM requests are pipelined meaning larger packets of data resent to the memory at once, and acted on very quickly. This breed of SRAM can operate at bus speeds higher than 66 MHz so is often used.

2**. Dynamic RAM (DRAM)** - DRAM, unlike SRAM, must be continually re-written in order for it to maintain its data. This is done by placing the data several hundred times per second. DRAM is used for most system memory. Because it is cheap and small. The now of electrically charged points in which a computer stores quickly accessible data in the form of 0 and 1.

There are few types of DRAM

a. FPM: - Fast page mode DRAM introduced in 1987. FPM DRAM is only slightly faster than regular DRAM FPM RAM was the main type used in pc: it was slow to work on the 66 MHz system bus.

For this reason, FPM RAM was replaced by EDO DRAM. FPM RAM is not much used today due to its slow speed, but is almost universally supported.

b. EDO DRAM: - Extended data out DRAM. EDO is similar to FPM; with it have the additional feature that a new access cycle can be started while keeping the data O/P of the previous cycle active. This allows a certain amount of overlap in operation (pipelining), allowing somewhat improved speed. EDO must be supported by the chipset. EDO comes on a SIMM. EDO cannot operate on a bus speed faster than 66 MHz so with the increasing use of higher bus speeds, EDO has taken the path of FPM.

C. **BEDO DRAM: -** (Burst EDO) Bursting was the method devised. Each "Block" of data carried the memory address. BEDO RAM was an effort to make ED DRAM complete with SDRAM.

d. Synchronous DRAM (SDRAM):- it synchronizes itself with the microprocessor clock speed allowing faster access to memory. These chips are mounted on DIMM and are classified according to the CPU speed they are designed to support.

SDRAM was introduced in 1996, and by 2000 had replaced all other types of DRAM in modern.

Computer because of its greater speed and much lower latency. It could operate at up to 100 MHz.

e. RD RAMS (RAM BUS DRAM):- successor to SDRAM.
f. DDR-SDRAM (Double Data Rate):- DDR shuffles data over the bus over both the rise and fall of the clocks cycle, effectively doubling the speed over that of standard SDRAM. DDR-DRAM is now the new standard in pc memory, with ever increasing speed support coming out, even so that it can complete quite well up against RAM BUS.
DDR2-SDRAM Short for Double Data Rate Synchronous DRAM 2 is a type of DDR that supports higher speeds than its predecessor DDR SDRAM.
DDR3-SDRAM Short for Double Data Rate Synchronous DRAM 3 is the newest type of DDR that supports the fastest speed of all the SDRAM memory

1. 184-pin-DIMMs, used for DDR SDRAM
2. 240-pin-DIMMs, used for DDR2 SDRAM

g. ESDRAM – Enhanced SDRAM
H. SLDRAM – Synchronous Link DRAM

Ram Advantages

1. Silent – There are no moving parts. RAM operation is completely silent.
2. Power-Efficient – RAM uses much less power than Disk Drives. Reduce your CO2 emissions (release) and extend battery life.
3. Fast – RAM is the fastest storage medium outside of the CPU.

ROM

ROM stands for read only memory. It is present on mother board in the form of a chip, is also called a firm ware. It retains instruction in permanently accessible, non-volatile form. While the power computer is turned off, the instruction stored in ROM are not lost. Non-volatile chips always hold the same data. The data in them cannot be changed expect through a special process that over write the data. Putting data permanently into this Kind of memory is called “Burning in the data”, and it is usually done at the manufacturing. (During normal use, the data in these chips is only read and used not changed, so the memory is called Read-only-memory.) One important reasons a computer needs ROM is that it must know what to do when the power is turned on. ROM contains a set of start-up instruction, which ensure that the rest of memory is functioning properly, checks for H/W devices and check for OS and computer disk drives.

Features of ROM

1. ROM is non-volatile; its contents are not lost when power to the computer is turned off.
2. ROM chips contain data, instruction or information that is recorded permanently.
3. The data, instruction or information stored on ROM chips is recorded when the chips are manufactured.
4. Firm ware is ROM chips that contain permanently written data, instruction or information.
5. ROM chips are found almost every where in a computer system, from the BIOS to peripheral devices

like printers and scanners. Each ROM chips contains exact instruction important to the operation of that particular part of the system.

There are different types of ROM:-

1. Programmable ROM (PROM): - this is basically a blank ROM chips that can be written to, but only once. It is much like a CD-R drive that burns the data into the CD. Some companies use special machinery to write PROMs for special. In this memory user can prepare a microcode program with the help of a facility known as PROM programmer, the user can store some special programs, once the information is recorded on PROM chips it cannot be changed.

2. EPROM (Erasable PROM):- this is just like PROM, except that we can erase the ROM by shining a special ultra-violet light through a sensor the ROM chip for a certain amount of time. Doing this wipes the data out allowing it to be rewritten. (Non volatile, can be programmed and reprogrammed by user, invariably byte organized) in this memory the information written can be erased using "ultra-violet rays". After erasing the old programs, new programs can be written. The user cannot erase a particular part. The whole information present in the chips is lost when erased. The data which is of permanent Nature and does not require frequent updating are stored in the EPROM chip. It is cheaper than PROM because it is reusable.

3. Electrically EPROM (EEPROM): - it also called flash BIOS. This ROM can be rewritten through the use of a special software program. Flash BIOS operates this way, allowing user to upgrade their BIOS. This is the earliest way of storing information in ROM. it does not require ultra violet rays to erase the information as in EPROM. It is most flexible ROM. So its information can be erased by using a high voltage current. (Versatile in nature) electrically erased and rewritten electrically.

4. Electronically Alterable PROM (EAPROM):- in this information can alter later. (In many sizes- up to 16 GB. Memory card). In which the contents of selected memory locations can be changed by applying suitable electric signals. EEPROM/EAPROM is more versatile. Individual cells can be reprogrammed by reversing the voltage used to create a zero. There are some timing constraints that cause the part to need more time for erasure or programming than is needed to read data from that part. Some EAPROM/EEPROM has a word or byte erase mode.

Advantages of ROM

1. They are non-volatile in nature.
2. ROM is easier to interface than RAM
3. ROM cannot be accidentally changed.
4. ROM is cheaper than RAM
5. ROM is easy to test.
6. These are more reliable than RAM due to their reduced complexity.
7. These are static and do not require refreshing.
8. It contents are always known and can be verified.

Applications of ROM:-

1. Code converter: - A ROM with N-bit MAR and M-bit MBR can realize any N-input and M output combination circuit.
2. Character generator: - character display in dot matrix form use ROM for decoding and activating the display.
3. Function generator: - tables for commonly used functions such as cosine, sine and tangent etc. may be stored in ROMs
4. Control units design: - ROMs are used in the design of control units of present day computer.

Different between RAM and ROM:

	RAM	**ROM**
Type	This is volatile by nature	This is non-volatile by nature.
Price	It is more costly	It is less costly
Size	RAM is small as compare to ROM	ROM is large as compare to ROM
Reliability	RAM is not more reliable	More Reliable as compare to RAM.
Lead Time	Lead time is not require	Lead time is requiring.
	Ram is temporary store of data	Rom is permanent store of data.
	Ram is primary storage of data. Ram has small capacity of store data	Rom is secondary storage of data. Rom has high capacity of store data

Secondary Storage:

1. Storage – is defined as all various media on which a computer can store programs and Information.
2. Secondary Storage – is also called Auxiliary, backing or mass storage. It contains data, Instructions and information for future use. It is permanent and non – volatile.

The Criteria for rating Secondary Storage Devices are:

1. Storage Capacity – This is determined by the type of program or amount of data to be stored. It is a representative of the size of the memory. The capacity of internal memory and main memory can be expressed in terms of number of words or bytes.
2. Access Speed – This refers to the average time taken to locate data on a sec. storage device.
3. Transfer Rate – this refers to the speed and time taken for data to be transferred from a secondary device to main memory in order for the data to be executed (processed). The access time depends on the physical characteristics and access mode used for that device.
4. Size - this is determined by the expected amount of data to be stored.
5. Cost – this is directly related to the other 4 factors. E.g. '' floppy disk is cheaper than CD Which is cheaper than a memory stick.''
6. Technology used to store data
7. Portability of storage device.

Secondary Storage devices classified by Sequential and Random (Direct). Access Method

1. Sequential Access Storage - Sequential access also known as serial access is a type of method of retrieving data from a storage device. With sequential access, the device must read or move through all information up to the point it is attempting to read or write. A tape drive is an example of a sequential access drive, where the drive must move the tape forward or backwards until it reaches its destination. (Refers to the way in which the data is retrieved i.e. sequentially)

Magnetic Tape- this storage medium that consists of a plastic ribbon that has been coated With material that can be magnetized to represent data. It is no longer widely used, expects for archival purposes, and was it keeps a backup of important data. A tape is divided into vertices columns called frames and horizontal rows called channels on tracks. Tapes had 7 bit tracks 6 bit BCD code format for data recording and one bit for parity.

Advantages:

1. Provides archival or backup storage
2. They are reusable, light, compact and easy to store on tracks
3. They are inexpensive
4. They can be used for large files or copying from disk files.

Disadvantages:

1. Allows only sequential data access
2. Stored data cannot be easily updated
3. They must be stored in a suitable environment, vulnerable humidity and dust.

2. Direct Access Storage (Random) – Means data can be located immediately without having to search consecutively through the storage medium. A direct access storage device is one in which any location in the device may be selected at random, access the information stored is direct i.e. no need of scanning a series of records and approximately equal access time is required for each location. Hard disk, optical disk are the examples of direct access storage device. (Used to retrieve the data i.e. magnetically or optically).

A. Magnetic Media –reads data from the storage medium by magnetizing the iron particles on the medium. It is also cheap.

B. Optical Media – uses high – powered laser beams to burn microscopic sports represented in a disk's surface. It is expensive.

C. Memory Storage Devices.

Magnetic Media - Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile memory. A magnetic media consists of plastic or metal circular plate or platter. These platters are coated with magnetic oxide layer. Data is represented as magnetized spots on a disk. The information is accessed using one or more read/write heads. It stores data files that can be accessed later.

The surface of a platter is organized as a number of concentric tracks. Each track is divided into sectors. The information held in one sector, a block, is the unit of transfer between the

disk and primary memory. The operating system determines where the blocks for each file are placed. The time taken to access a particular block consists of:

1. Seek time-Time to move the heads to the right track.
2. The latency-Time waiting for the sector to come round to the head.
3. The block transfer time-Time to actually transfer the data

Floppy Disk- It introduced by IBM in 1972. The diskette is a flexible magnetic disk on which data is recorded magnetically. The device is used to read data from a disk or record data on a disk is called a floppy device. A floppy disk is a flat, circular piece of flexible plastic coated with magnetic oxide. It is encased in a square plastic or vinyl jacket cover. A computer can have more than one floppy drive. The first floppy drive is labeled A, and if a second drive is present it is labeled B. The label C is reserved for the hard disk drive. These are slower to access than hard disks and have less storage capacity, but they are much less expensive. The disks are removable and reusable.

1. Single sided single density
2. Double sided double density

Floppies come in two basic sizes:

1. 5¼-inch: This type of floppy is generally capable of storing between 100K and 1.2MB (Megabytes) of data.

3. **3½-inch:** The most common sizes for PCs are 720K (double-density) and 1.44MB (high□density).

Advantages:

1. They allow copying files from one computer to another
2. They are quite cheap
3. Widely used
4. Light/ weight portable
5. Provides random data access

Disadvantages

1. They have a limited capacity (graphics files often don't fit on a disk
2. They are less care should be taken to prevent loss data
3. Vulnerable to dirt
4. Susceptible to viruses
5. Data access relatively slow
6. Data is easily damaged/corrupted

Central Processing Unit →

CPU: - CPU is the Brain of a computer. It is the part of computer which controls the interpretation and execution of instruction. It also controls the operation of computer

and performs processing functions. Every program to be executed consists of a set of instructions stored in memory of CPU sequentially executes instructions specified in a program. CPU is responsible for activation and controlling the operation of other units of computer system. CU and ALU are together known as CPU. It is a brain of a computer system which takes before all major calculation and comparison that take place inside the CPU.

Functions of CPU are:-

a. It coordinates entire computer system.
b. Internal data movement (moving data between various parts of storage.)
c. Data manipulation (Accept, sort, process then generating the required information)
d. Arithmetic and Logical operations.
e. It obtains instruction from program stored in main memory, interpret (to compile line by line) instruction and issues signals that causes other units of system to executes them.

Components of CPU:-

a. Control units (CU)
b. Arithmetic Logical units (ALU)
c. Registers/ Memory Unit

Control units: - It acts as a central nervous system for other components of computer system manages and coordinates the entire computer system. It obtain and stored in main memory interprets the issue signals causing other units of the system to execute them.

It maintains order and directly the operation of entire system it coordinates the operations of H/W. it also coordinates the flow of data and instruction that are fed into the main via CPU.

Function of control units are:-

1. to access and store relevant data and instruction during processing
2. To control the sequence of operations.
3. Ti gives commands to all parts of computer
4. to coordinates actions of all parts of computer
5. To carry out processing.
6. It also control signals between the CPU and the Input devices.
7. It determines the movements of electronic signals between the main and the ALU.
8. Instruction can be converted by a Lang processor into a low level form of instruction
9. The computer can work with machine lang. Data and instruction are represented in binary form (0 and 1)
10. It fetches the instruction and data from the main unit, decodes them and sends them to the ALU. The O/P from the ALU is fetched by the control units and sent to various parts.

a. ALU: - This unit is responsible for execution of all instructions taking place. Data and information are stored in primary storage and accessed or transferred to ALU when

required. Intermediate results generated in ALU are transferred to storage device and retrieved when needed. ALU perform +,-, %,*, <,> and logic operations (AND, OR, NOT). Its functioning is based on fetch-execution cycle. Load, store, Move is the most commonly use commands.
When entire CPU (CU and ALU) is contained on a single tiny silicon chip, it is called a microprocessor.