

Chapter 2

HARDWARE

Computer System is classified into two parts

- ❖ **Computer Hardware:-** All the physical component that grouped together and form a complete system known as hardware. e.g:- PC-Case, motherboard, RAM, ROM, Hard Disk, Monitor, keyboard, mouse. etc.
- ❖ **System Unit:-** A system unit includes a board called a motherboard that holds a microprocessor chip (or a CPU), memory chips, and expansion slots. Electronic circuitry is printed on the board and it connects between two main parts of a microcomputer, the microprocessor and primary storage and other parts.

*Mother Board is known as System Board.

A system unit includes the following parts:-

- Motherboard
- Microprocessor
- Memory Chips
- System Clock
- Buses
- Ports
- Expansion Slots and Cards
- ❖ **Hardware is divided into three parts:-**
 - Central Processing Unit (CPU)
 - Memory Unit
 - Peripherals Device
- ❖ **Central Processing Unit:-** Central processing unit is called the brain of computer system. It is also known as micro processor when it, is constructed on a single chip. Arithmetic logic and control unit along with registers forms a complete central processing unit and central processing unit along with input/output unit and memory unit forms a computer system.
- ❖ **Instruction Execution:-** The rogram which is to be executed is a set of instructions which are stored in memory. The CPU executed the instructions of the program to complete task The major responsibilities of the instruction execution are with the CPU. The instruction executidn takes place in the CPU with the help of registers, ALU and CU. When the processor executes instructions, data is temporarily stored in mall, local memory locations of 8, 16, 32 or 64 bits called registers. These registers are:-

- **Accumulator Register:-** Which stores the intermediate result of arithmetic and logical operations.
- **Memory Address Register (MAR):-** Which contain the address of memory location to which data is to be stored.
- **Program Counter (PC):-** Which contain the address of the next instruction to process.
- **Instruction Register (IR):-** Which contain the current instruction being processed.
- ❖ **Microprocessor:-** Microprocessors processes the instruction. The microprocessor is made of millions of transistors. These are tiny electronic devices that carry an electric charge. The first microprocessor 4004 was invented by INTEL in 1971. It was 4 bit microprocessor designed for specific application. In 1972, first general purpose microprocessor 8008 was introduced. It was 8 bit microprocessor. At present 32/64 bit processor present in the market.

Note:- All CPU's are known as microprocessor but all processors are not CPU. Because CPU control all the components of the computer system where as processor only process the instruction. Processors can't control any component.

- ❖ **Control Unit:-** Control Unit controls the flow of information within the computer system. Control units are in- charge of the computer. Control units decode machine instructions and generate control signal. Control units may also control some external devices.
- ❖ **ALU Arithmetical Logical Unit):** An arithmetic/logic unit (ALU) performs arithmetic and logic operations. It performs only four types of mathematical operations i.e. +, -, etc.

Main Memory Unit: Main Memory unit known as main memory or primary memory. Memory Unit is a internal memory. It is also known as semi conductor memory.

There are two part of memory unit:-

- ❖ **RAM-** (Random Access Memory) It is a read and write memory. It is a volatile and temporary memory. Two Types of RAM. RAM is used by Users.
- Static RAM is called static because it will continue to hold information without refreshment i.e. it does not require refreshment.
- Dynamic RAM is called dynamic because it requires refreshment. It loses information with time.
- ❖ **ROM (Read Only Memory):** It is a permanent memory, read only memory and Non-Volatile. ROM allows data and instruction to be read and does not allow user to write anything on it. The contents of ROM are written by the manufacturer at the time of manufacturing.
- **PROM (Programmable Read Only Memory):-** PROM can be custom-programmed by the user using special circuitry. A PROM can be changed/updated only once.

- EPROM (Erasable Programmable Read Only Memory):- This type of ROM can have its contents erased by ultraviolet light and then reprogrammed by a PROM programmer. This procedure can be carried out many times; however, the constant erasing and rewriting will eventually render the chip useless.
- ❖ EEPROM (Electrical Erasable Programmable Read Only Memory):- This type of ROM works in a similarway to Flash memory in that it can its contents can be ‘flushed for erasure and then written to without having to remove the chip from its environment. EEPROMs are used to store a computer system’s BIOS, and can be updated without returning the unit to the factory. In many cases, BIOS updates can be carried out by BIOS update.
- **Flash memory** - Flash memory is non-volatile memory that is an integrated circuit that does not need continuous power to retain the data, It is much more expensive than magnetic storage. However, flash memory is widely used with car radios, cell phones, digital cameras, PDAs, MP3 players, and printers.

Difference between memories

	Access Time	Storage Capacity	Cost/bit of storage
Primary Memory	Faster	Smaller	High
Secondary Memory	Slower	Higher	Low

Based on access time, storage capacity and cost/bit storage, the memory devices can be categorized into three kinds of memory system.

- Semiconductor memory such as RAM, ROM, PROM, EPROM, EEPROM and Flash Memory.
- Magnetic Memory such as Hard disk, Floppy disk and magnetic tapes.
- Optical Memory such as Compact disk, Digital Video/Versatile disk (DVD), Blu-Ray disk.

Port:- Port is a connecting socket outside the system into which different type of cables are plugged. It is place where dvice are physically connected. There are many type of ports used in computer system. These ports are:

- ❖ Serial Port
- ❖ Parallel Port
- ❖ USB Port (Universal serial bus)
- ❖ SCSI Port (Small Computer system Interface)

- **Serial Port:-** Serial port transmits one bit of a byte, one at a time as a single stream of bits. It is used for transmitting slow data over long distances. E.g Dialup modem, serial mice use serial ports.
- **Parallel Port:-** A Parallel port transmit 8 bit of byte of data in parallel. It is used for transmitting fast data over short distances. It is used to connect printer, monitor, projector etc.
- **USS Port:-** A USB port can connect up to 127 peripheral devices such as a mouse, digital camera, scanners, speakers etc. It also permit to connect plug and play device.
- **Small computer System Interface (SCSI Port):-** SCSI port allows data to be transmitted in a daisy chain to up to 7 devices at a higher speed (32 bit at a time). It is fast data transmitting device is used to connect HDD (Hard disk drive, CD-ROM drives etc with the computer.

A bus is a set (group) of parallel lines that information (data, addresses, instructions, and other information) travels on inside a computer. Information travels on buses as a series of electrical pulses, each pulse representing a one bit or a zero bit. The control unit and internal storage are linked together by sets of parallel electrical lines called bus.

An internal bus is a bus inside the processor, moving data, addresses, instructions, and other information between registers and other internal components or units.

An external bus is a bus outside of the processor (but inside the computer), moving data, addresses, and other information between major components (including cards) inside the Computer.

Peripherals Device:- Auxiliary equipment used in computer like input device, output device, storage device, communication device or other functions under the direct control of a computer.

- **Input device** — A computer hardware or device capable of accepting data or instructions, E.g keyboard, mouse, light pen, joy stick, bar code reader, scanner, microphone etc.
- **Output device** — A Computer hardware of device capable of displaying the result of the processed data. E.g monitor (VDU), printer, plotter, speaker etc.
- **Storage device-** A computer hardware devices used for storing information permanently. It is also known as secondary memory. E.g. hard disk floppy disk compact disk pen drive etc.
- **Communication device** - microphone, modem, router

Input Device:-

- **Keyboard:-** Keyboard is a most common data entry device. Using Keyboard, User can type text and execute commands.
- It is known as standard input device.
- Use keyboard in GUI and CUI.
- **No of Keys on Keyboard**
 - minimum number of keys → 101 keys (without WIN key)
 - minimum number of keys → 104 keys (with WIN key)
 - minimum number of keys → 84 keys (on Laptop)
- **Layout of keyboard:-** There are three type of layout of keyboard
 - QWERTY
 - AZERTY
 - DVORAK

Note: QWERTY is the most common and standard Layout of the keyboard

Another Keys on Keyboard:-

- **Function Key:-** There are 12 function keys available on the keyboard. F1 to F12.
- **Modifier key:-** Ctrl key, Alt key and Shift key are the modifier key.
- **Toggle Key:-** Num Lock, Caps Lock and Scri Lock are known as toggle key.
- **Mouse:-** It is known as standard pointing device. You can use mouse only in GUI. Mouse was invented by Douglas Engelbart in 1967. There are two type of mouse. These are
 - Mechanical mouse
 - Optical Mouse
- **Trackball:-** Trackball is another pointing device that is used instead of mouse. Now a days trackball is used to control cursor movement on mobile phone to access internet.
- **Light pen:-** It is also a pointing device. You can use light pen for digital signature. A light pen can work with any CRT- based monitor, but not with LCD screens, projectors or other display devices.
- **Joy Stick:-** It is also known as pointing device. Joystick are used for computer games as they provide a better control.
- **Scanner:-** A scanner allows .you to capture documents or pictures that are printed on paper andturn them into digital format to be viewed on a computer. Scanners can be of different Typest:-
 - **Handheld scanner:-** To use handheld scanner, you simply pass the scanner over the image or document you want to scan.
 - **Flatbed scanner:-** The flatbed scanner is similar to a photocopier machine. You can place an image or document on the glass scanning surface to scan.

- **Microphone:-** A microphone is a device to input sound information. It allows you to record sound and voice to place onto the computer.
 - **Barcode Reader:-** Barcodes are different groups of vertical bars that can be read by a barcode reader. Barcodes are printed on nearly every products that you can buy. A Barcode reader is also known as Point of sale scanner.
 - **Barcode:-** A bar code is the small image of lines, (bars) and spaces that is affixed to retail store items, identification cards, and postal mail to identify a particular product number, person, or location. In Barcode, there are 13 digit available which is divided into 4 section.
 - First 2 digit—(1-2) → Country code
 - Next 5 digit— (3-7) → Manufacturing code
 - Next 5 digit—(8-12) → product code
 - Last digit—(13) → Check code
 - **Optical Character Reader (OCR):-** OCR is the recognition of printed or written text characters by a computer. This involves photo scanning of the text character-by-character, analysis of the scanned-in image, and then translation of the character image into character codes. OCR is being used by libraries to digitize and preservetheir holdings.
 - **Optical Mark Reader (OMR):-** OMR is a device which can detect the presence or absence of a mark on a paper. Light is incident onto the paper and the reflected light is detected. - OMR is used in! reading answer sheet Questionnaires.
 - **Magnetic Ink Character Recognition (MICR):-** MICR use specialink which can be magnetized, to print characters that can then be read and decoded by special magnetic devices. This system is widely used by banks for piocessing cheques. The check number, the bank and branch code and the atcount number are printed with ink containing magnet particle of iron oxide.
- ❖ **Output Device:**
- **Monitor:-** Monitor is known as Standard output device: It is also known as visual display unit. The monitor displays the computer's user interface and open programs, allowing the user to interactwith the computer.

Monitors color Offerd by Various video standards:-

- **Monochrome** → Mono means single and chrome means colour i.e. black and white.
- **Color**
 - CGA (Color Graphics Adapter): 4color/resolution 320*320
 - EGA (Enhanced Graphics Adapter): 16 color/resolution 640*350
 - VGA (Video Graphics Array): 256 color/resolution 640*480
 - XGA (Extended Graphics Array): 65536 color/resolution 800*600 true color and 1024*768

- SVGA (Super Video Graphics Array): 16,777,216 color/resolution 1280*1024
- **Printer:-** Printer is output device that prints text or image on paper. The output given out by the printer on a paper is called hard copy. Printers are divided into two parts:
 - **Impact Printer:-** Impact printers are the oldest printer still in action. With this type of printer something strikes paper and ribbon together to form a character. e.g dot matrix printer, chain printer etc.
 - **Non Impact Printer:-** Non Impact printer does not involve striking the paper. Instead, they use ink sprayer toner powder.

Note:- The resolution of printer is measured in dpi (dots per inch). Laser printers are the example of page printer, and inkjet printers are the example of line printers.

Another type of printers available in the market:-

Label Printers are the smartest way to print labels one at a time. There are multi-purpose printers, that can print different types of labels. For example, label printers used in supermarkets can print bar codes as well as normal text. There are also some label printers that can print different sizes of labels on goods.

POS receipt and banking printers these printers realize innovative technology and functionality to increase productivity. and reduce costs. A receipt printer plays an integral role in any POS (Point-of-Sale) system, signaling the cash drawer to open when the transaction is completed.

Plotter:- A plotter can be used to produce high quality, accurate ad bigger drawings. They are usually used for computer aided design (CAD) and computer aided manufacture (CAM) applications such as printing out for houses or car parts. Plotters are available in two designs Flatbed and drum.

Based on the hard copy and soft copy outputs, the output devices are classified into two types:-

1. Hardcopy
2. Softcopy

Speaker:- A speaker is an output device that is used to play sound. Speakers allow you to hear sounds and music on computer.

Storage Device:-

- **Hard Disk:** A magnetic disk on which you can store computer data. Hard Disk is a computer main storage device and can hold more data and faster then other storage device. The hard drive was first introduced on September 13, 1956.
- **Floppy Disk:** A small, portable magnetic disk that is used to store and transport computer data. It is also known as a diskette. There are two type of floppy disk. 1. 3½

inch and it can hold 1.44 M.B data and 5¼ inch data and can hold 1.2 M.B data. First floppy was made by IBM

- **Compact Disk (CD):-** A CD known as optical disk. A compact disc, or CD, is an optical Storage medium with digital data recorded on it. The digital data can be in the form of audio, video, or computer information. Firstly CD was introduced as Read Only device but now technology allow user to record data on it. A newer technology, the digital versatile/video disk (DVD). A CD was invented by James T. Russell in 1960. Some variations of the CD include:

CD-ROM → WORM (Write once and read many) → CD-RW

- **Pen Drive:-** A small portable USB flash drive consists of flash merpory data storage device integrated with USB. A pen drive is a plug n play device known as USB flash drive, jump drive, thumb drive etc. The USB Flash Drive was introduced in 1996 and invented by Dov Moran

File Access pn Disk:-

- **Disk Access time:-** Disk operate in semi-random mode of operation and normally are referenced block wise. The data access time on disk consists of two main components:-
- **Seek Time:-** Time to position the head on a specific track. On a fixed head disk it is the time taken by electronic circuit to select the require head while in movable head disk it is the time required to- move the head to a particular track.
- **Latency Time:-** The time required by a sector to reach below the read/write head.
- **Disk Formatting:-** Formatting is a three-step process that deletes all of your old data and prepares your entire disk for storing new data.
 - The formatting program removes the references to your old files. This makes the files inaccessible to most programs becausethe programs won't know where the files are located on the hard drive.
 - Disk is to divided into tracks and sectors.
 - A new file called a file allocation table is created. This file will be used to store the locations of data on the disk.
- ❖ **Bootng Process:-** All computers rurfning Operating system share the same startup sequence:
- **POST (Power on Self Test):-** When power is turned on POST programme start running. Itis the diagnostic testing sequence that test a computers basic input/output system. Then BIOS (or 'starting program') runs to determine if the computer keyboard, random access memory, disk drives, and other hardware are workincorrectly and it start searching for operating system. First it search the floppy disk and then C: drive and If OS is found it start loading in the main memory.

- **Virtual memory:-** Virtual memory is the use of space on a hard disk drive (HDD) to simulate additional main memory. Virtual memory permits software to run in a memory space (i.e., a logical memory) whose size is greater than the computer's RAM. Or you can say, if your computer lacks the random access memory (RAM) needed to run a program or operation, Windows uses virtual memory to compensate.
- **Cache memory:-** Cache is the fastest memory and most expensive memory. It increases the efficiency of central processing unit. It lies between CPU and main memory. The CPU uses cache memory to store instructions that are repeatedly required to run programs, improving system speed. The advantage of cache memory is that the CPU does not have to use the motherboard's system bus for data transfer.

The cache makes any data frequently used by CPU instantly available. If the required information is not located in the cache, a fetch is made from the main memory.

Generation of Computer:- (Hardware)

1ST Generation (1940-1958)	Vacuum Tube
2nd Generation (1959- 1964)	Transistors
3rd Generation (1965-1970)	I.C. (integrated circuit)
4th Generation (1971- present)	LSI (Large Scale integration), VLSI (Very large scale integration) ULSI (Ultra large scale integration)
5th Generation (today)	Still under development phase