

UNIT:- 2

Input/ Output Devices and Storage Devices

Topic Covered :-

- ✚ Input Devices: Key board, mouse, and touch panel.
- ✚ Display Devices: LCD and LED Monitors, Touch Screens.
- ✚ Printer and Scanner: Dot matrix, Line, Drum, Ink Jet, Laser, scanner.
- ✚ Magnetic storage & Hard Disk, Optical storage technology, CDs, DVDs. Flash memory, Memory stick (pen drive)

Que:1) Explain Input Devices ?

- ✓ Input devices accept data and instructions from the user. Following are the examples of various input devices, which are connected to the computer for this purpose.

1. Keyboard

2. Mouse

3. Touch Screen

4. Touch panel

5. Joy stick

6. Scanner

1) KeyBoard :

- ✓ It is most common input unit.
- ✓ It is used for manual data entry.
- ✓ Among the IBM-compatible computers, the most common keyboard layout is the IBM enhanced keyboard.
- ✓ Most popular keyboard used today is the 110 –keys QWERTY keyboard.
- ✓ The six groups are alphanumeric keys, modifier keys, numeric keypad, function keys, cursor movement keys and special-purpose keys.
- ✓ It consists following major categories of keys:
 - a) **Alphanumeric Key :-** This part of the keyboard is similar to a typewriter. The letters are arranged as in a typewriter and the arrangement is called QWERTY layout because the first six keys on the top row of letters are Q, W, E, R, T and Y.

- In addition to the letters the alphanumeric key group consists of numbers (0-9), punctuation keys and other characters
- (like ~, @, #, \$, %, ^, A, &, *, etc.) and a few additional keys with special functions like Tab, Caps Lock, Backspace, Enter and Spacebar.

b) Modifier Keys :- The keyboard's modifier keys are used to modify the input of other keys. You press another key while you hold down the modifier key.

- The modifier keys are Shift, Ctrl, and Alt. The Shift Key when pressed in conjunction with an alpha numeric key forces the computer to output a capital letter or symbol.
 - This function is the same as in typewriters.
 - Shift key also acts as a modifier key on some programs.
- Ctrl (Control key)
Key produces different results depending on the program.
- Ctrl+C, Ctrl+V, Ctrl+X are the universally accepted keyboard shortcuts for Copy, Cut and Paste.
 - The Alt key combinations enable you to navigate menus and dialog boxes without using a mouse.

c) Numeric Keypad :- The numeric keypad, usually located at the right side of the keyboard looks like a calculator. It contains 10 digits and the four mathematical operators.

- The numeric keypad also has a Num lock key which forces the keys in the numeric keypad to output numbers.
- When the Num Lock is Off, the key on the numeric keypad performs other functions like PgDn, PgUp, Home, End, Del, etc.

d) Function Keys :- The function keys (F1 to F12) are usually arranged at the top of the keyboard in a single row.

- They allow you to input commands without typing the commands.
- The commands vary according to the application that you are using.

e) Cursor Movement Keys :- The cursor movement keys are used to navigate around the screen. The cursor is the blinking mark that you can see on the screen when you open the different programs.

- The cursor movement keys are the arrow keys (that allow you to move left, right, up and down one character at a time) Home and End keys (keys that enable you to move to the very beginning or end of the line) Page Up (PgUp) and Page Down (PgDn) keys (keys that enable you to move through a document screen by screen in upward and downward directions).

f) Special-Purpose Keys :- The Special-Purpose keys are used to perform special functions. The special purpose keys in an IBM-compatible keyboard are Insert (Ins), Delete (Del), Esc Print Screen (PrtScr), Scroll Lock and Pause.

2) Mouse :

- ✓ It is GUI (Graphical User Interface) based user interface.
- ✓ It is a small device used to point to a particular place on the screen and select in order to perform one or more action.
- ✓ It is also called point and draw devices.
- ✓ There are Three buttons on mouse and perform some action.

1. Left click : It is used to select an item.

2. Double click : It is used to start a program or open a file.

3. Right click : It is used to display set of commands.

4. Drag and Drop: It is used 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.

✓ There are Three kinds of Mouse.

1. Mechanical :

- It requires a ball to move the cursor on the screen.
- It has two rubber wheels in bottom surface which are perpendicular to one another.
- When mouse was moved parallel to its main axis, one wheel turned.

2. Optical :

- It has no wheel or balls.
- It has an LED (Light Emitting Diode) & Photo detector on bottom.
- It is used on special plastic pad containing a rectangular grid of closely spaced lines.
- It uses a laser, precisely an optical sensor to help detecting the moving of the mouse.
- As mouse moves over the grid, LED generates light & photo detector sense this LED light.

3. Opto-Mechanical :

- There are two shafts which are connected to the ball at 90 angles.
- Shafts are connected with encoder. It emits an electrical pulse for every incremental Rotation of the wheel.
- When mouse is moved on surface area the ball & shafts also move.

3. TouchScreen :

- ✓ A touch screen enable to user to choose to available option by simply touching With their fingers.
- ✓ The desire icon or menu item display on the computer screen.

- ✓ Touch screen are most preferred human computer interface device.
- ✓ It is a display which can detect the location of touches within the display area.
- ✓ This allows the display to be used as an input device.
- ✓ For exp : At the airport or railway station to provide it information to arriving Passengers, about Hotels, restaurant and in tourist and it also use in mobile, All type of ATM.
- ✓ It has three basic components :
 - A touch sensor.
 - A controller
 - A software driver

a) Touch Sensor :-

- ✓ A touch sensor is a type of equipment that captures and records physical touch or embrace on a device and/or object.
- ✓ It enables a device or object to detect touch, typically by a human user or operator.
- ✓ A touch sensor may also be called a touch detector.

b) Controller :-

- ✓ A resistive touch screen panel is coated with a metallic electrically resistive and conductive layer that can cause a change in the electrical current which is registered when touched and sent to the controller for processing.

c) A Software Driver :-

- ✓ The driver is a software update for the PC system that allows the touch screen and computer.
- ✓ Computer operating system to interpret the touch event information that is sent from the controller.
- ✓ This make touching the screen the same as clicking your mouse at the same location on the screen.
- ✓ This allows the touch screen to work with existing software and allows new applications to be developed without the need for touch screen specific programming.

4.Touch panel

- ✓ In Input device that utilize a light sensetevi detector to select object on a display screen.
- ✓ A light pen is similar to a mouse accepts with a light pen you can move the pointer and select object on the screen by directly pointing the object with the pen.
- ✓ A light pen can also be used for graphics work and drow picture or select menu option.
- ✓ A user can directly drow on the CRT screen with the light pen.

5.Joy stick

- ✓ The joystick is a vertical which moves the graphics cursor in a direction the stick is moved.
- ✓ In typically has a button on top that is used to select the option by the cursor.
- ✓ Joystick is used as an input device primarily used with video games, training controlling robots.
- ✓ Joy stick the pointer continues moving in the direction the joystick is pointing.
- ✓ To stop the pointer you must return the joystick to its upright position.
- ✓ Joysticks include two buttons called triggers.
- ✓ In order to communicate a full range of motion to the computer a joystick needs to measure the stick position on two axes the x-axes(left to right) and the y-axis(up and down).
- ✓ Two main types are available in the market they are wired and wireless joysticks.

6.scanner

- ✓ Scanner is an input device that converts hardcopy into softcopy.
- ✓ Scanner can read text or graphics, printed on paper and translate the information in the format that computer can use.

- ✓ A scanner works by digitizing an image means dividing each box with either 0 or 1 depending on if the box is filled in or not.
- ✓ For color and gray scaling some principle apply but at that time each box is represented by 20 up to 24 bits.
- ✓ The resulting matrix of bits is known as a bitmap that can be stored as a file, displayed on the screen or manipulated by the program.
- ✓ Optical scanner do not differentiate text or graphics but it represents all the images, text scanned by the scanner.
- ✓ To edit the text read by an optical scanner you should have OCR system to translate the image into ASCII characters. Most optical scanners are available with Ocr packages.
- ✓ There are following types of scanner..

1) Hand Held Scanner

- ✓ Some scanners are small hand held devices that you can move across the paper.
- ✓ It is also known as half page scanner because it can scan 2 to 5 inches at a time.
- ✓ It is a good choice when you want to scan small pictures or photographs but it is difficult to use when you want to scan the whole page of the document.

2) Sheet Fed Scanner

- ✓ It is a large scanner into which user can feed sheet of paper.
- ✓ It is very good scanner for loose paper but it can not scan bound books or documents.

3) Flat bed Scanner

- ✓ It is also a large scanner that looks like a Xerox machine.
- ✓ It is having a board on which you can put books, magazines or other documents you want to scan.

4) Drum Scanner

- ✓ It is also called rotary Scanner.

- ✓ Drum Scanners are used by the publishing industry to capture incredibly detailed images.

- **Characteristics of Scanner**

- 1) Scanning Technology**

- ✓ Most scanners use CCD (Charged Coupled Device) arrays which are having tightly packed rows of light receptors that can detect variation in light intensity & frequency.
 - ✓ The quality of CCD array is the most important factor affecting the quality of scanner.
 - ✓ Another technology is PMT (Photo Multiplier Tube). It is the most expensive scanner but it is also very much accurate.

- 2) Resolution**

- ✓ The denser the bitmap, the higher the resolution. Typically scanner supports resolution from 72 to 600 dots per inch.

- 3) Bit Depth**

- ✓ It means the number of bits used to represent each pixel.
 - ✓ The greater the bit depth more colors or gray scales can be represented.
 - ✓ For e.g. a 24 bits color scanner can represent 2^{24} or 16.7 million colors.
 - ✓ A large color range is useless, if CCD array is capable of detecting small number of colors.
 - ✓ Size and Shape.

Que: 2) Explain Display/Output Devices ?

➤ **Monitor**

Classification of computer – based on colors

- There are many ways to classify monitors. The most basic is in terms of colors capabilities, which separates monitors into three classes.
1. **Monochrome:-** Monochrome monitors actually display two colors, one for the background and one for the foreground. The colors can be black and white, green and black or amber and black.
 2. **Gray-scale:-** A gray – scale monitor is a special type of monochrome monitor capable of displaying different shades of gray.
 3. **Color:-** Color monitors can display anywhere from 16 to over 1 million different colors.
 - Color monitors are sometimes called RGB monitors because they accept three separate signals – red, green and blue.
 - An RGB monitor consists of a vacuum tube with three electron guns – one each for red, green and blue at one end and the screen at the other end.
 - The three electron guns fire electrons at the screen, which contains a phosphorous coating.
 - When the electron beams should converge for each point on the screen so that each pixel is a combination of the three colors.

Classification of monitors – based on signals

- Another common way of classifying monitors is in terms of the type of signals they accept: analog or digital.

1. Digital monitor:-

- A digital monitor accepts digital signals
- The term digital refers only to the type of input received from the video adapter.

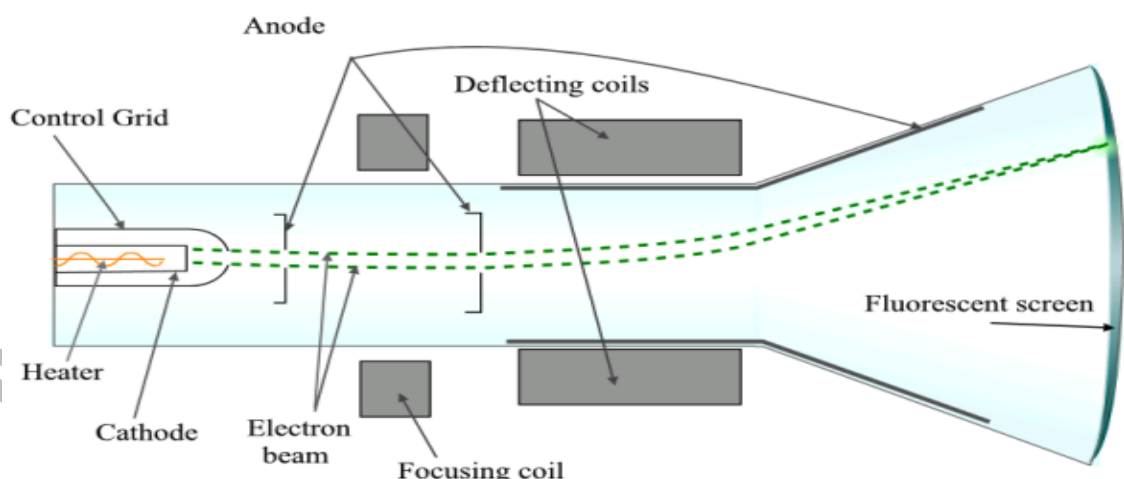
- A digital monitor then translates the digital signals into analog signals that control the actual display.
- Although digital monitors are fast and produce clear images, they cannot display variable colors continuously.

2. Analog monitor:-

- This is the traditional type of color display screen that has been used for years in television.
- In really, all monitors (*accepts flat – panel display*) based on CRT technology are analog.

1) CRT :

- ✓ CRT stands for cathode ray tube.
- ✓ VDU consists a display screen similar to television.
- ✓ CRT monitors looks like a television & they are used with non-portable computer system.
- ✓ Figure show internal structure of CRT.



- ✓ Through connector pins pass the +Ve voltages & -Ve voltage.

- ✓ When passes the +Ve voltages, a beam of electrons generated by electron gun.
- ✓ But when passes the -ve voltages, a beam of electrons not generated by electron gun.
- ✓ This beam of electrons passes from focusing system, horizontal plates & vertical plates.
- ✓ Due to this the beam split into 3 electron beams-red, green & blue.
- ✓ This three beams reflect on the phosphorus coated screen(fluorescent screen) where they are absorbed.
- ✓ Due to combination of 3 beams more than 70 million colors are generated on the screen.
- ✓ There are two types of display techniques.

1. Raster Scan Display Technique :

- In this technique, the reflected electron beam will start from top left position & it Goes to right.
- Second line also start with top left position & it will go right position till bottom Right position are not arrived.

2. Random Scan Display Technique :

- In this technique, electron beam will not start with top-left position to generate the Image , but it will start randomly to generate the image.

2) LCD :-

- ✓ It stands for Liquid Crystal Display.
- ✓ The LCD technology is the same as that used in calculators and digital watches.

- ✓ The LCD monitor creates images with a special liquid Crystal that is normally transparent but becomes opaque when charged with electricity.
- ✓ There are two main types of LCDs.
 1. Active Matrix
 2. Passive Matrix

1. Active Matrix :-

- ✓ Active Matrix LCD technology assigns a transistor for each pixel and each pixel is turned on and off individually.
- ✓ This enhancement allows the pixels to be refreshed much more rapidly.
- ✓ In addition the active matrix LCD monitor have wider viewing angle than passive matrix LCDs.
- ✓ Active Matrix displays are often called **thin-film-transistor** (TFT) displays because many active matrix monitors are based on the TFT technology.
 - **Advantage :**
 - ✓ Large viewing area, lesser desktop space, lesser weight, low power consumption etc.
 - **Disadvantage :**
 - ✓ Narrow viewing angle, high cost and inability to handle applications that need very high refresh rate like video games, CAD designing, 3D rendering etc.

2. Passive Matrix :-

- ✓ It relies on transistors for each row and each column of pixel, thus creating a grid that defines the location of each pixel.
- ✓ There is another newer version of passive matrix display called dual-scan LCD.
- ✓ In dual-scan LCD the problem of slower refresh rates is reduced by scanning through the pixels twice as often.
 - **Advantage :-**
 - ✓ They are less expensive than active matrix.

- ✓ They have narrow viewing angle.

- **Disadvantage :-**

- ✓ They do not have refreshed the pixels very often.

3) LED

- ✓ The amazing new VAIO TX3 is the smallest and lightest fully featured notebook around. Developed for ultimate mobility using advanced carbon-fibre materials, TX3 includes a range of brilliant design innovations including a super-thin LED display panel and postcard-sized motherboard.
- ✓ a light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it.
- ✓ Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.
- ✓ LED Display (light-emitting diode display) is a screen display technology that uses a panel of LEDs as the light source.
- ✓ a large number of electronic devices, both small and large, use LED display as a screen and as an interaction medium between the user and the system. Modern electronic devices such as mobile phones, TVs, tablets, computer monitors, laptops screens, etc., use a LED display to display their output.

Characteristics of computer

1. Size:-

- The most important aspect of monitor is its screen size. Size is measured in diagonal inches.
- Monitors that are 16 or more inches diagonally are often called full-page monitors.
- In addition to their size, monitors can be either portrait (height greater than width) or landscape (Width greater height).

- Large landscape monitors can display two pages, side by side.

2. Resolution:-

- Pixel is picture element. A pixel is a single point in a graphics image. Graphics monitors display pictures by dividing the display the display screen into thousands (*or millions*) of pixels, arranged in rows and columns.
- The pixels are so close together that they appear connected.
- The number of bits used to represent each pixel determines how many colors or shades of gray can be displayed.
- For example, an 8-bit color monitor uses 8 bits for each pixel, making it possible to display 2 to the 8th power (256) different colors or shades of gray.
- The quality of a display monitors largely depends on its resolution, how many pixels it can display, and how many bits are used to represent each pixel.

3. Bandwidth:-

- The amount of data can be transmitted in a fixed amount of time.
- For digital devices, the bandwidth is usually expressed, in bits or bytes per second (*bps*).
- For analog devices, the bandwidth is expressed in cycles per second, or hertz (*HZ*).

4. Refresh rate:-

- Display monitors must be refreshed many times per second.
- The refresh rate determines how many times per second the screen is to be refreshed (redrawn).
- The refresh rate for a monitor is measured in hertz (*HZ*) and it is also called the vertical frequency or vertical refresh rate.
- The faster the refresh rate, the monitor flickers.

5. Interlaced or Non-Interlaced:-

- Interlacing is a display technique that enables a monitor to provide more resolution inexpensively.
- With interlacing monitors, the electron guns draw only half the horizontal lines with each pass (*for example, all odd lines on one pass and all even lines on the next pass*).
- Because an interlacing monitor refreshes only half the lines at one time, it can display twice as many lines per refresh cycle, giving it greater resolution.
- Another way of looking at it is that interlacing provides the same resolution as non-interlacing, but less expensively.

6. Dot – pitch:-

- A measure that indicates the vertical distance between each pixel on a display screen.
- Measure in millimeters, the dot pitch is one of the principal characteristics that determines the quality of display monitors.
- The lower the number, the crisper the image.
- The dot pitch of color monitors for personal computers ranges from about 0.15 mm to 0.30 mm. Another term for pitch is phosphor pitch.

7. Convergence:-

- Convergence refers to how many sharply an individual color pixel on a monitor appears.
- Each pixel is composed of three dots –red, green and blue. If the dots are badly misgoverned, the pixel will appear blurry.
- All monitors have some convergence errors, but they differ in degree.
- **Plasma Display :**
 - ✓ These monitor have wide screen, comparable to the largest CRT sets, but they are thick.
 - ✓ In most systems, there are three pixel colors – red, green and blue.

- ✓ By combining these colors in different proportions, the monitor can produce the entire Color spectrum.
- ✓ The basic idea is to light up tiny, colored fluorescent lights to form an image.
- ✓ Each pixel is made up of three fluorescent lights – a red, a green and a blue light.
- ✓ The central element in a fluorescent light is called plasma.

✚ Advantages of Plasma :

- ✓ It can produce wide screen using extremely thin materials.

✚ Disadvantage of Plasma :

- ✓ It is very expensive.

➤ Plotter

- ✓ Plotters are the output devices that produce good quality drawings and graphs. There are Two types of plotters.

- 1) Drum Plotter
- 2) Flat-bed Plotter

1) Drum Plotter :-

- ✓ In a drum plotter, the paper on which the graph is to drawn is mounted on a rotating Drum.
- ✓ A pen which can move linearly is mounted on carriage.
- ✓ The drum can rotate in either clockwise or anticlockwise direction under the control Of plotting instructions sent by the computer.
- ✓ The pen can move left to right or right to left. The pen can also move up or down.

- ✓ The movement of pen and drum are controlled by the graph plotting program.
- ✓ The program can thus draw various graphs and also explain them by using the Pen to draw characters.

2) Flat-bed Plotter :-

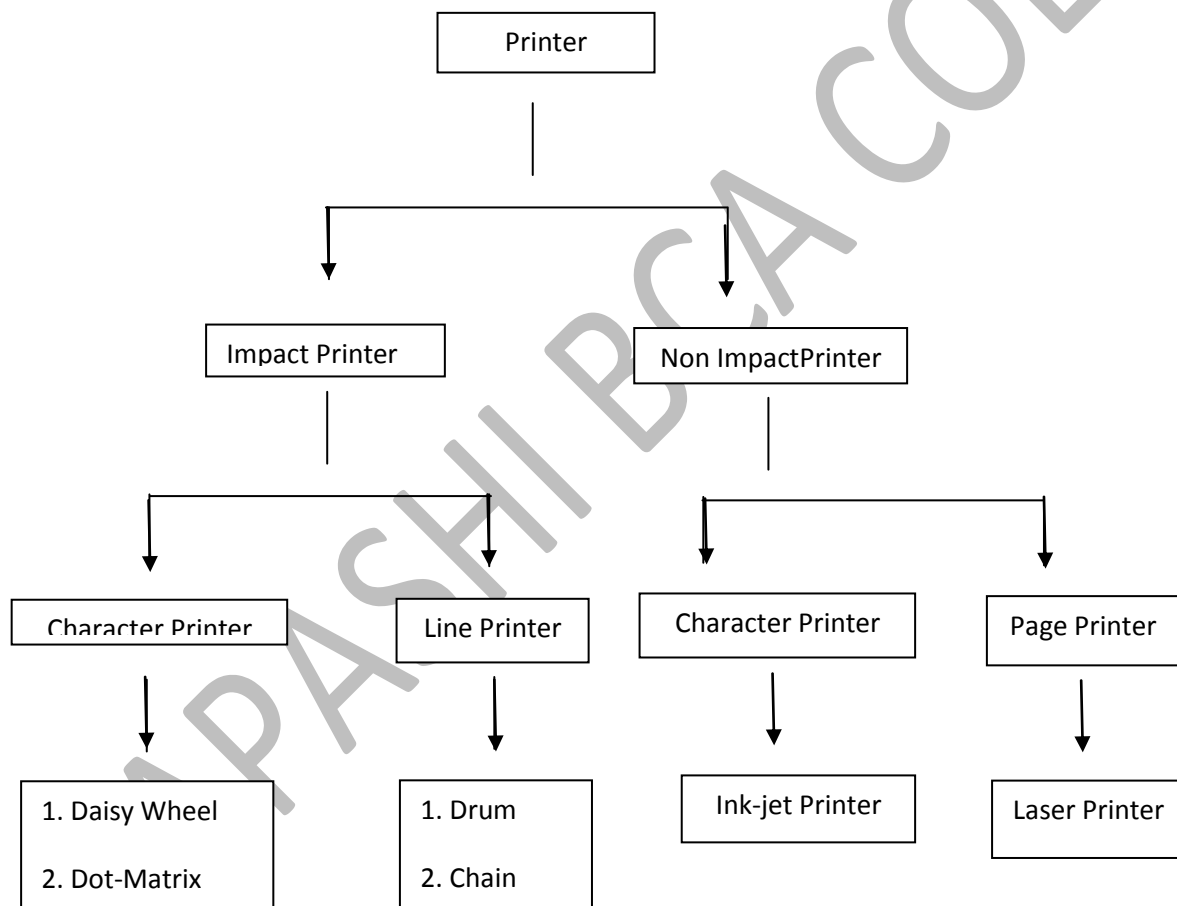
- ✓ A flat-bed plotter has a stationary horizontal plotting surface on which paper is fixed.
- ✓ The pen is mounted on a carriage which can move in either X or Y directions.
- ✓ The pen can also be moved up or down.
- ✓ A graph plotting computer program is used to move the pen to trace the desired graph.

➤ Speakers :

- ✓ When we need the sound as an output at that time we need to use the speakers.
- ✓ For sound based output firstly we need sound cards : an expansion board that enables computer to manipulate and output the sounds.
- ✓ Then we need to install the drivers for the audio : software using which computer can generate the sound.
- ✓ And the Software that converts the stored file into the format that can be output through the Speakers. Ex : Window Media Player.
- ✓ Using speakers we can listen the music that is a voice based output

➤ Printer

- ✓ Printer And Scanner is a device that prints text or illustration on paper and in many cases on transparencies and other media.
- ✓ Printers are used to produce paper (hardcopy) output.
- ✓ Printers are available in market with different size, speed and cost.
- ✓ Based on printing technology speed, they are categorized as....



[Fig: Types of Printer]

1) Impact Printer

- ✓ In this kind of printer, printing is made on the paper by impact of character Or pin hammer on paper.

- ✓ It is used the typewriting printing mechanism wherein a hammer strikes the paper Through a ribbon in order to produced output.
- ✓ These printers have a mechanism that touches the paper in order to create an image Through striking hammer.
- ✓ This printer produce much noise when printing and called noisy printer.
- ✓ For exp :- line printer and character printer.

1.Character Printer:- It is able to print single character at a time For exp :- Daisy wheel, Dot matrix And example of non-impact character printer is ink-jet printer.

2.Line Printer :- It can print whole line print at a time. For ex:-Drum printer and Chain printer.

2) Non- Impact Printer

- ✓ It is the printer creates no effect on the paper except character on the paper.

1.Page Printer:- It is able to printer the whole page at a time. the example of non-impact page printer is Laser printer.

Daisy Wheel

- ✓ A daisy-wheel printer works like a Manual typewriter.
- ✓ It has upper/lower case letters and punctuation-symbol keys in a raised stamp form on Plastic wheels.
- ✓ The wheels turn until the correct character lines up and strike the ink on the printer ribbon, Forming words on page.
- ✓ It has having fix character set and it is noisy printer.

Dot Matrix

- ✓ Dot matrix means no of rows dots and no of columns dots are collected together to print a single character on paper.
- ✓ As name suggest, a printer can printing all the matter using small DOTS together.
- ✓ To print a character the printer activates the appropriate set of pins, as the print head moves horizontally.
- ✓ Dot matrix printer produce printed output as patterns of dots, they can print any shift of character which is programmer decide. This also allow to print many special character different size of print and ability to print graphics such as charts and graphs.
- ✓ Dot matrix printer are used in multiple document printing. It is mainly used to print free printed forms.

Chain Printer

- ✓ Each link of the chain is having a character imposed on it.
- ✓ Instead of chain there may be a metal belt with the character.
- ✓ There is a print hammer located behind a paper.
- ✓ The chain rotated at the faster speed, when desired character comes it strikes the hammer along with inked ribbon.
- ✓ It also having fix character set.

Drum Printer

- ✓ It has solid cylindrical drum that has character in bands imposed on its surface.
- ✓ There are as many bands as printing positions each band is having all the possible character on it.
- ✓ Drum rotated at fast speed.
- ✓ For each possible print position, opposite to band, there are print hammers behind the paper.
- ✓ The hammer hit the paper along with the inked ribbon against the proper character on the
- ✓ Drum. In one rotation of drum, whole line printed.

Inkjet Printer

- ✓ It prints characters by spraying the small drops of ink on the paper.
- ✓ It is use a special type of link with high iron contents.
- ✓ Drops of ink are electricaly charges after leaving a nozzle.
- ✓ The drop are guided to proper position on the paper by electrically charged deflection plates.
- ✓ It does not create any type of noise as it is an non impact printer.
- ✓ It is not having fixed character set so any type of fonts as well as graphics can be printed.
- ✓ Multiple copies can't be generated at a time.
- ✓ It is available in single color as well as multicolor.
- ✓ Its speed is 40 to 300 character per second.

Lasre Printer

- ✓ It is utilizes the laser beam to produce an image on a drum.
- ✓ It is charged with about 1000 walts and with photo sensitive material.
- ✓ The light of the laser alerts the electrical charge on the drum whenever it hits , the drum isThen rolled through a tank of tonner , which is picked up by the charged portion of the drum.
- ✓ Finally, the tonner is transferred to the paper through a combination of heat and pressure.
- ✓ This is also the way copy machine works.
- ✓ The laser printer is very costly in compare with the other kind of the printers but it provides The best quality output.
- ✓ Laser printers are of 600 dpi capacity.

- ✓ It is good in quality , good in speed and its printing is low, but purchase prize is higher than Dot matrix and inject printer.



STORAGE DEVICES

Introduction

- ✓ A storage device is a device for recording (storing) information (data) until it is deleted or recorded. There are two types of storage devices used in computers.
- ✓ Primary Storage Device : A storage location that holds memory for short periods. It lost data as and when power is switched off. It is called “Volatile Memory” or “Main Memory”. RAM is an example of Primary memory.
- ✓ Secondary Storage Device : It is non volatile memory which stored data after power is switched off. Floppy Disk Drive or a Hard Disk Drive is an example of Secondary Storage
- ✓ Devices.



AUXILIARY MEMORY / SECONDARY MEMORY

- ✓ An auxiliary memory is supplement to the main memory
- ✓ It is also called “Auxiliary Storage” or “Secondary Storage”.
- ✓ It is a long term, non volatile memory means that it retains programs and data even after switching power off the computer.
- ✓ Auxiliary storage devices allows the computer to store data semi –permanently so, that the same data can be read later by the user.
- ✓ It is also useful in transferring data.
- ✓ It works as backup devices. Ex : Magnetic Tape, Magnetic Disk, Floppy Disk, Hard Disk etc.

- ✓ There are two types of auxiliary storage devices and are written in classified based on data access methods.

1. Sequential Access Method

In sequential access devices, data can be read and written in sequence, and to get a specific record or data user has to go through all the previous records. For e. Magnetic Tape.

2. Random Access Method

It is also known as direct access media because user can directly go on the record without passing the previous records. For ex. CD, Hard Disk etc.



MAGNETIC TAPE

Magnetic Tape is magnetically coated strip of plastic on which data can be stored.

- ✓ Tapes for computers are similar to the tapes for storing music.
- ✓ Storing data on tape is considerably cheaper than storing data on disk.
- ✓ Tapes have large storage capacity ranging from few 100 KB to several Giga bytes(GB).
- ✓ This is why it follows the sequential access.
- ✓ As tape are so slow, they are generally used only for long time storage and backup.
- ✓ Tapes are sometimes known as “Streamers” or “Streaming Tapes”.

Types of magnetic tape

a. Half Inch :

It is having capacity of 60 MB to 400 MB. This tape is relatively in expensive which requires expensive tape drive.

b. Quarter Inch

It is known as QIC(Quarter Inch Cartridge). It is having capacity of 40 MB to 5 GB and support fast data transfer with less price.

c. 8 mm Helical Scan

It is having the capacity of 1 GB to 5 GB. It uses same technology as VCR tape.

d. 4 mm DAT (Digital Audio Tape)

It is having capacity of 2GB to 24 GB but low data transfer rate.

HARD DISK



- ✓ A Hard Disks has to be mounted on a disk drive before it can be used for reading or writing of information. A disk drive contains all the mechanical, electrical and electronic components for holding one or more disks and for reading or writing of information on it.
- ✓ Hard Disks are smooth mettles plates coated on both sides with a thin film of magnetic material.
- ✓ A set of such magnetic plates are fixed to 'spindle' one below the other to make a disk pack.
- ✓ The disk drive consists of a motor to rotate the disk pack at a speed of about 7200 revolution per minute.
- ✓ The drive also has a set of magnetic head mounted on arms.
- ✓ The arm assembly is complete of moving in and out in radial direction.

- ✓ Data is recorded on the surface of a disk as it rotates.
- ✓ Thus it is on circular tracks on each disk surface.
- ✓ A set of corresponding tracks in all surface of a disk pack is called 'A cylinder',
- ✓ If a disk pack has 'n' plates there are '2n' surfaces
- ✓ A track is divided into sectors. Read and write operations on a disk start at sector boundaries.
- ✓ If the no. of bytes to be stored in a sector is less than the capacity of a sector, the rest of the sector is padded with last byte record.
- ✓ Assume 's' bytes per sector, 'p' sector per track, 't' tracks per surface and 'm' surfaces. the capacity of disk is $s * p * t * m$ bytes.
- ✓ A set of disk drive are connected to disk controller. The disk controller accepts the commands from the computer and positions the read – write head of the specified disk for reading or writing.

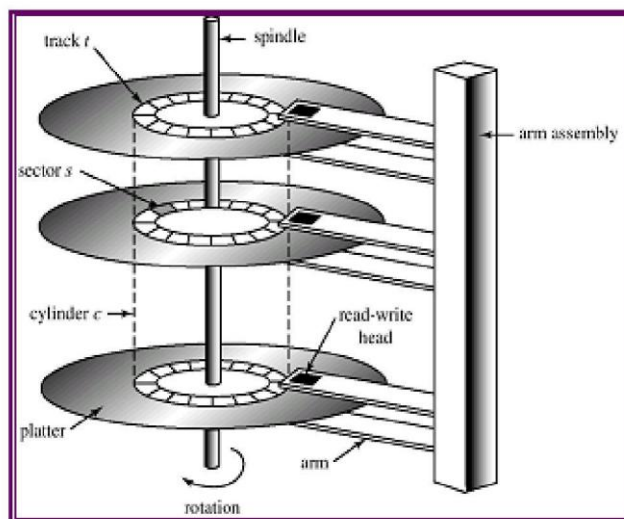


Figure : [Internal Structure of

Hard Disk]

- ✓ In order to read or write on a disk pack, the computer must specify that drive number, cylinder number, surface number and sector number.

- ✓ When a read – write command is received by the disk controller the controller first positions the arm assembly so that the read – write head reaches the specified cylinder.
- ✓ The time taken to reach the specified track is known as the “Seek Time”(TS).
- ✓ Minimum Seek Time is ‘0’. The average Seek Time is usually specified and it is in order of 10 milliseconds.
- ✓ After the head is selected, there is a further delay because the specified sector has to reach the read – write head.
- ✓ The average rotation delay equals half the time taken by the disk to rotate once. This time is known as a “Latency Time” (TL). For a disk rotating at 7200 RPM, TL is $0.5/7200 \text{ min} = 4.15$ milliseconds.
- ✓ The sum of ‘Average Latency’ ‘Seek Time’ is known as “Average Access Time”.



CD ROM (Compact Disk Read Only Memory) or

WORM (Write Once Read Only Memory) or

WORM(Write Once read Many)

- ✓ The most popular high capacity storage device is known as “Laser Disk Technology” or “CD ROM”.
- ✓ For using digital computer the disk is used same as the disk was used to store music.
- ✓ “Laser Disk” is a shining metal like disk whose diameter is 5.25 inches(12 cm).
- ✓ It can store around 650 MB equivalent or 2,50,000 pages of printed text.
- ✓ Information in CD Rom is written by creating pits on the surface by shining a laser beam.
- ✓ As the disk rotates the laser beam traces out a continuous spiral. The sharply focused beam creates a circular pit of around 0.8

micro meter diameter wherever a '1' is to be written. The no pit area is known as "Land".

- ✓ From a master disk many copies can be reproduced a process called "Stamping a disk".
- ✓ The CD Rom with pre – recorded information is read by a CD Rom reader which uses a laser beam for reading.
- ✓ It is rotated by a motor at a speed of 360 RPM.
- ✓ A laser beam moves in and out to the specified position. As a disk rotate the head sense pits and lands. This is converted to 1's and 0's by the electronic interface and sends to the computer.
- ✓ CD – ROM disk speed is measured by an integer number indicating the factor by which the original nominal speed of 150 KB per second is to be multiplied.
- ✓ Thus, a 52x CD –Rom reading speed is 52x 150 KB per second = 7800 KB per second.
- ✓ It has a 'Buffer' to keep the data temporary. The buffer size is 256 KB per block.
- ✓ All large software such as operating system and software updates are supplied on CD Rom so it has become essential to have a CD Rom drive on a PC to install software.
- ✓ Another major application of CD Rom is in distributing large text. For Ex. : E-Books.
- ✓ The current market is multimedia CD Rom in which text, audio, video, graphics and animation can be stored.

CD RW (Compact Disk Read – Write) or (Compact disk Re- Writable)

- ✓ It is same as CD ROM except that user can erase the previous data written on it.
- ✓ It is having magnetic layer.
- ✓ Laser beam changes the chemical property during writing by changing the reflectivity at desired places.

- ✓ The land and pit mechanism is same as CD –Rom so CD-Rom drive can be used to read CD-RW.
- ✓ It usually has life time 100 erase –write cycle or more.
- ✓ A disk written once can be erased by changing the chemical property again and then it can be written again.
- ✓ CD RW is a little expensive than CD –ROM but even though it is a great money saver because it can be reused many times due to its erase capability.
- ✓ Its biggest disadvantage is that accidental data loss is possible due to erase capability.



DVD ROM (Digital Versatile Disk Read Only Memory)

- ✓ DVD Rom uses the same principle as a CD Rom for reading and writing.
- ✓ However, a smaller wave length laser beam is used.
- ✓ A lens system to focus the laser beam is used which focus on two different layers on the disk.
- ✓ On each layer data is recorder hence, the capacity can be doubled.
- ✓ Additionally, the recording beam is sharper compared to the CD ROM and the distance between successive tracks on the surface is smaller. The total capacity of DVD ROM is 8.5GB.
- ✓ In double sided DVD ROM two such disk are stuck to back which allows recording on both the sides.
- ✓ This of course requires the disk to be reversed to read on the reverse side.
- ✓ With both side recording and with each side storing 8.5 GB, the total capacity is 17 GB.
- ✓ Double sided DVD ROM should be handled more carefully as both the sides have data; they are thinner and could be accidentally damaged.

- ✓ In both CD ROMs and DVD ROMs the density of data stored is constant through out the spiral track.
- ✓ In order to obtain a constant read out rate, the disk must rotate faster near the center and slower at the outer tracks to maintain Constant Liner Velocity (CLV) between the head and the disk platter.
- ✓ The speed of DVD ROM is 1.38 MB per second as opposed to 150 KB per second.



MEMORY CARD

- ✓ Flash memory cards are available as removable storage device in different types of electronic devices like mobile phones and digital camera.
- ✓ Some of the most popular memory cards are SD/MMC (Secure Digital Cards/ Multimedia Cards).
- ✓ Storage capacity of this cards can be from 8MB to 2 GB.

It gives the facility to transfer data from the device like mobile to a computer for storage or for future processing.

PEN DRIVE / FLASH DRIVE



- ✓ It is a compact device of the size of a pen, available in different shapes and design. IT may have different shapes added features like camera, music player etc.
- ✓ Using this we can transport data easily from one computer to another.
- ✓ It is plug and play device that simply plugs in to USB (Universal Serial Bus) port of a computer. The computer detects it as removable drive.
- ✓ User can read, write, copy, delete and move data from computers hard disk to pen drive or from pen drive to computer hard disk.

- ✓ After completing the work it can be plugged out of the USB port of the computer and kept in the pocket for carrying anywhere.
- ✓ It doesn't require any type of battery, cable or software and it is compatible with most computer.
- ✓ It is based on flash memory storage technology that is a non volatile EEPROM chip.
- ✓ It is available with the capacity like 8MB, 16 MB, 64 MB , 128 MB , 512 MB , 1 GB , 2 GB, 4 GB and 8 GB.
- ✓ It is having a main body and a port connector with cover. The port connector is plugged into the USB port. The main body also have read/write light indicator.