Chapter I

·oduction to Computers

Computer is certainly the most versatile and indigenious developments of the modern technological age and today people use computers in almost every walk of life. Laptops is a common personal computers used in the work place and at home. It has emerged as an essential household equipment. Computer is a device made up of electronic and electromechanical component. The computer can receive, send, store, retrieve, analyse and synthesize the data according to a planned program. The basic function performed by a computer is execution of the program. The program in turn is a set of instructions by which the computer operates the data and performs certain tasks.

Classification of Computers

Computers come in various sizes and perform numerous functions. The mode of processing the data differs. The portability of the computer has drastically changed. Computers can be classified according to the size/function, data processing mode and portability.

The classification according to the size / function is as follows

(a) Micro computers
(b) Mini computers
(c) Mainframe computers and
(d) Super computers

Computers can also be classified based on the data processi mode as:

(a) Analog computers
(b) Digital computers
(c) Hybrid computers

Based on the portability, the computers can be classified a

(a) Desktop computers and
(b) Laptop computers

1. Classification based on the size / function

(a) **Micro computers** – The microcomputer originated 1970s. It is built on an 8-bit microprocessor chip. Tl CPU has a microprocessor, a semiconductor, RAM f processing the data and ROM for storing the data. Th are single user machines and can be processed by o person at a time. This computer had a word leng of 8 bits. Currently 32-bit microprocessor share be developed. Most of the popular microcomputers a developed with Intel's chip.

(b) **Mini computers** – This is a small general purpose comput computing larger capacities than micro computers. Mi computers are small and expensive with limited input output capabilities. These machines can be handled simu taneously by multiple users and have more storage capacit They have a word length of 16 bits or more. They are use for stand-alone operations or dedicated applications.

(c) **Mainframe computers** – These computers are powerful than mini computers and have a word length of 32 bits, 48 bits or 64 bits. They can support more than 100 users in timesharing mode and can have a wide variety of languages and operating systems. They can be used in libraries and others places where networking is essential.

(d) **Super computers** – This is characterised by a very large size and high processing speed. These computers are the most powerful ones and are very expensive. Super computers hold 64 bits of information. One super computer can perform the work of 40000 personal computers. Super computers are mainly used for weather forecasting, computational fluid dynamics, remote sensing, image processing, bio-medical applications and so on.

2. Classification based on the data procsssessing mode

(a) **Analog computers** – These computers work on continuous variables. Data obtained through measurement are called continuous data (Example – speedometer measures speed of an automobile). Analog systems are frequently used in places where temperature measurement is important.

(b) **Digital computers** – Discrete data, which are obtained by counting, are used in digital computers and these systems perform arithmetic and logic functions. Digital computers may be further elassified as (i) special purpose computers and (ii) general purpose computers. Special purpose computers perform only one specific task. It may not be versatile but performs the single task quickly and efficiently. A general purpose computer is one that can store different programs and can thus be used in countless applications.

) **Hybrid computers** – This device uses desirable features of both analog and digital computers.

3. Classification based on portability

(a) **Desktop computers** – Personal computers sometimes a bigger in size and are placed on a table. These perso computers are called desktop computers because they c be placed on a table or desk.

(b) **Laptop computers** – Laptop computers (also known notebook computers) are portable computers weighi around 2 kg. They use a keyboard, flat screen crystal d play and a processor. They run with batteries and are th designed to conserve energy. Many laptops can be co nected to a network and may provide wireless connectivi Miniature of laptop is palmtop, where the computer ca be placed in the palm.

Computer Generations

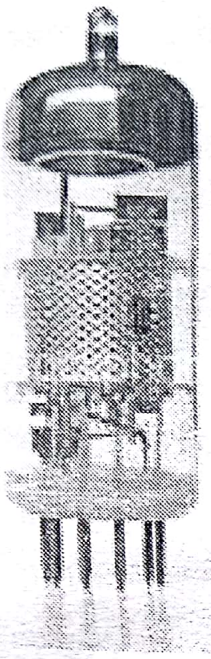
Computer generations provide a framework for the growth c the computer industry. It shows the major developments in th computer industry.

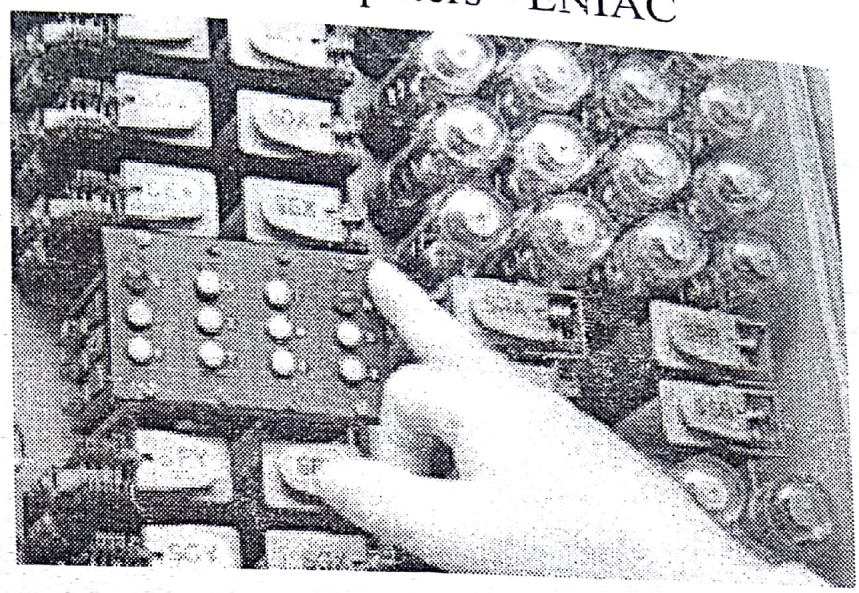
First Generation (1942 – 1955)

Vacuum tube computers like Electronic Numerical Integrato and Calculator (ENIAC), Electronic Delay Storage Automati Calculator (EDSAC), Electronic Discrete Variable Automati Computer (EDVAC) and Universal Automatic Compute (UNIVAC) are referred to as first generation computers During this period, computer programming was mainly don in machine language. Assembly language was invented in th early fifties. Initial applications were in science and enginee ing. ENIAC took about 200 microseconds to add two digits an about 2800 microseconds to multiply.

Limitations – too bulky, unreliable, emits large amount o heat, air-conditioning required, frequent hardware failures an limited commercial use.

Vacuum Tube, First Generation Computers - ENIAC





Second Generation (1955 – 1964)

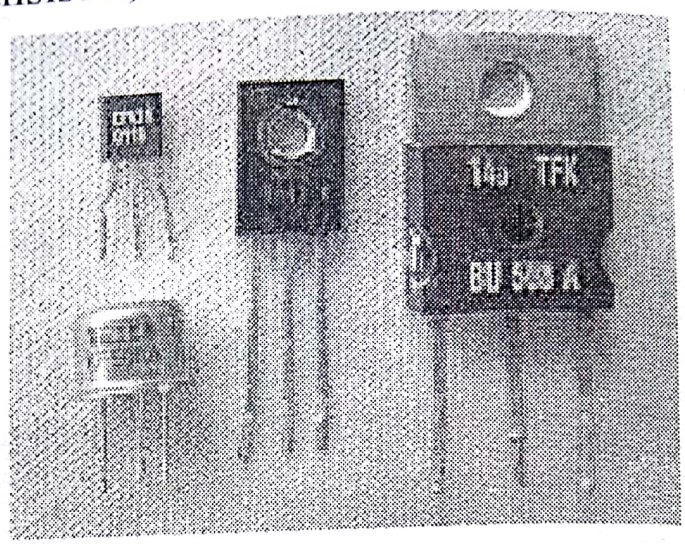
In 1947, transistors made of Germanium semiconductor material were used. This was more reliable than vacuum tube. The switching circuits were ten times faster, ten times more reliable, occupied one-tenth space and were ten times cheaper than vacuum tubes. This period witnessed the use of magnetic core for storage. High level languages like FORTRAN, COBOL, ALGOL, SNOBAL were developed in this generation.

Limitations – air-conditioning was essential, frequent maintenance was required and commercial production was difficult and costly.

Third Generation (1964 – 1975)

Germanium transistors were replaced by silicon transistors. The third generation computers were based on Integrated circuits (IC's) with thousands of transistors and other electronic components on a silicon crystal known as 'chip'. High memory (100 megabytes) along with powerful CPU and large disc memories resulted in Time Shared Operating Systems. In this generation Fortran IV

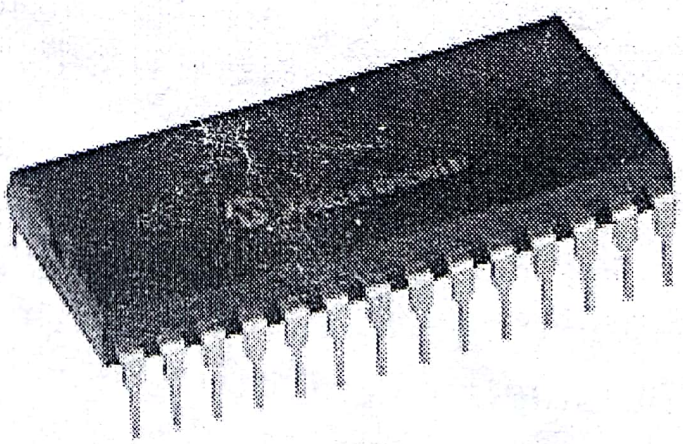
Transistor, Second Generation Computer



and optimising FORTRAN compilers were developed as in t period. Important online systems like airline reservation, dynam production control, interactive query and integrated data ba management systems were some of the significant developmen This generation developed increased miniaturisation, high spe computation and proved to be more reliable.

Limitations – Air-conditioning was required in many cases a this highly sophisticated technology required the manufactu of IC chips.

Integrated Circuits, Third Generation Computers

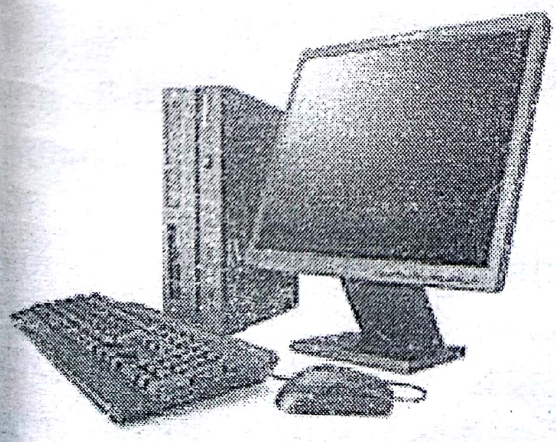


Fourth Generation (1975 – 1995)

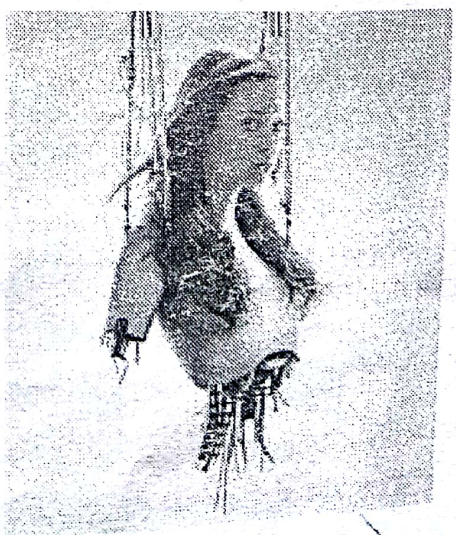
First Decade (1975 – 1985) - Large Scale Integrated Circuits (LSI's) and Very Large Scale Integrated Circuits (VLSI's) packed about 50,000 transistors in a single chip. Disc memories became very large (1000 Mbytes/drive). Memory capacity per chip has increased to 1K, 4K, 16K, 256K up to 1M bits. Computer cost was reduced and personal computers became common in offices and homes. Interactive graphic devices and language interfaces to graphic systems were developed and this paved way for computer-aided designs.

Second Decade (1986 – 1995) – The speed of microprocessors and the size of main memory and hard disk increased every year. In 1994, a single chip was packed with 9.3 million transistors and was driven by a 300 MHz clock and could carry out a billion operations per second. Apart from IBM, Apple computers, Motorola and Intel designed-powerful microprocessors. Laptops and palm held computers were developed in this decade. 1GB hard disc became common and networks became powerful. Language C and C++ was popular. Parallel processing computers were built during this period.

Fourth Generation Computers



Fifth Generation Computers



Fifth Generation (1996 onwards)

The contemporary computers are characterised as fou generation computers and the boundary between fourth g eration and fifth generation is still not clear. The concept artificial intelligence was developed. More powerful micropr essors and more storage space were added in a single chip. T computers have become very fast, reliable and inexpensive, b the basic logic structure is not changed. The basic block d gram of a CPU, memory and I/O devices remains unaltered

Computer Specifications

Computer is made of components like processor, RAM, ha drive and so on. The speciifcation of a computer refers to t list of the nature of the components and its special featur The specifications of a computer varies with the end use li office use or as in engineering designs

Processor Speed – Processing speed refers to the speed at whi the computer runs. It is expressed as Hz (hertz), MHz (meg hertz), GHz (gigahertz). The computer work fast if the proce ing speed is high. Higher the processing speed, the compu will be able to run two or more programs at the same time.

RAM (Random Access Memory) – This is one of the stora devices. It can also be defined as the memory or space availal for the running of the programs. For example, the opera can listen to music as he/she works on the spread sheet a also browse the internet to check mail or run search engines the RAM is very low, the execution of the program will be sl or the the application may stop responding to the commar in other words, it hangs or freezes. The RAM now comes in t range of 1GB, 2GB, 4GB, as per the application requiremen CAD programs may require more RAM

Hard Disc Drive – This is the main storage where all the data are stored. Data include, word files, drawing files, photos, a

movies. More number of files can be stored if the hard disc is big. The storage capacity is usually expressed in terms of bytes. Hard drives are inbuilt in the computers, but external hard drives are also available, which can be connected to the computer with the help of a USB port. Additional files can be stored in the external hard drives or it can serve as an additional copy. The capacity of the hard drive is usually over 100 GB and can go upto 1000 GB.

Optical Disc Drive – This helps to read or write CDs or DVDs. Reading refers to the ability of the computer to view or run the contents of the CD/VCD. Writing refers to the process of saving the datas from the computer to the CD/VCD. Writing is termed as 'burning'. CD/VCDs come in two formats, some are meant only read, whereas some are for read and write. Optical drives varies in its speed while reading or writing a CD/VCD. Some optical drives may write a CD in a minute, while the others may take 5 minute to write the same file.

USB (Universal Serial Bus) Port – The mouse, data cards, cellphones, cameras and external drives are connected to the computer through the USB port. The datas from the cameras, cellphones and external drives can be read/edited/saved when connected to the USB. Transfer of datas from computer to cellphone and vice versa is also possible. The monitor can be projected on an larger screen (LCD projector/Television) through USB. Internet connections are now available as data cards which are connected to the computer through USB ports.

Keyboard and Mouse – Desktop computers have a separate keyboard and a mouse, while the laptop computers have built in keyboard and touch pad. The touchpad serves as a mouse. Mouse can be plugged in additionally, if needed. The keyboard of the desktop is connected to the CPU with a cable. Mouse comes with two buttons and a scroll in the centre. Optical mouse uses a camera to detect the movement and works faster. Recent developments in the keyboard and the mouse is the

wireless keyboard and wireless mouse which can be opera without a cable. Touch screen computers work without the k board and mouse.

Network connections – Networking with other computers cellphones is possible through broad band connections bluetooth connectivity. Broadband connections are rou through a modem/router. Recent development include w less connectivity and net connections through data ca Bluetooth connections are also wireless connections wh enables the compuer to connect to the cellphones and he in transfer of data.

Audio / Video – Speakers are inbuilt in the computers. But a higher level of sound external microphones/speakers be plugged into the computer. Headphones are also anot mode of hearing music / movie. For video-conferencing, w cam is used, which is also common in the laptops. For a desk computer, a web cam can be purchased seperately and insta in the computer.

Graphics Cards – The visual clarity of images depends on graphic cards. It is now intergrated into the system. Rec developments include LCD / LED monitors. A dedica graphics card is essential for higher picture quality and to multimedia programs faster.

Chapter II

Organisation of Computer

Computer maybe defined as a device that operates upon information or data. Data come in various shapes and sizes depending upon the type of computer application. A computer can store, process and retrieve data as and when desired. The basic operations in a computer is as follows

- Input of data
- Storing the data
- Processing of data
- Output of results
- Control of operations

Input of Data – The data can be entered into the computer in the form of numerical, alphabets, lines or shapes.

Storing the Data – Once the data is entered into the system, it is saved and stored in the system. The data can be retrieved whenever required

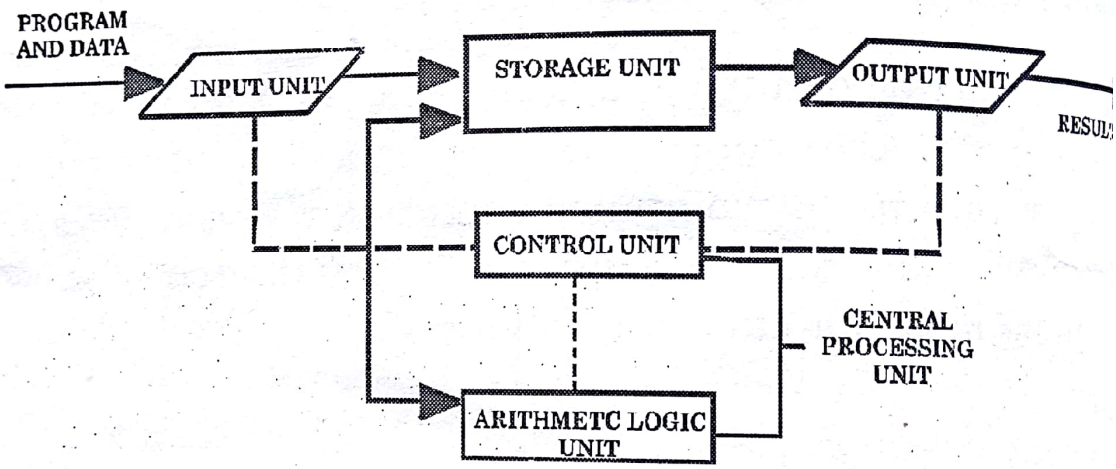
Processing of Data – The data is processed in many different ways. It can undergo mathematical calulations or logical functions.

Output of results – After processing the data, the final re is given as output. It may be in the printed format or vi display.

Controlling – Every stage invloves co-ordination of di ent operations. This sequence of operation is termed controlling.

The design and specifications of computers vary, however basic computer organisation remains the same. The flow c for the computer organisation is given below.

Organisation of Computer



The five basic operations performed by the computer done by the following units namely – Input unit, Output U Storage Unit, Arithmetic Unit, Control Unit and Cen Processing Unit

Input Unit – Instructions or details commonly termed as d is entered into the system before the operation. Data can entered from a keyboard or any other input device. The data transformed into the binary codes. This transformation is do by units called input interfaces. The functions of the input u maybe summarised as follows

1. It accepts the instructions and data from the outside
2. It converts the data into a computer acceptable format
3. It supplies the converted instructions and data to the computer system for further processing

Output Unit – The output unit has an interface which converts the machine coded output results from the processor into a human readable form. The output may be in printed form as a hard copy or visually displayed in the monitor. The functions of an output unit maybe summarised as follows

1. The output unit of the computer produces the results in the coded form, which cannot be understood by the viewer.
2. The coded results are converted by the interface into a human readable form.
3. Finally the decoded results are presented in a printed format or as a visual display.

Storage Unit – The storage or memory of the computer consists of devices that store the data both intermediate and final results as the program runs. It provides space for storing data and instructions, space for intermediate results and also space for final results. The functions of the storage unit maybe listed as follows

1. Data required for processing is received from the input units
2. Generates intermediate results
3. Releases final results to the output unit

Arithmetic Logic Unit (ALU) – This unit is the place where the actual execution of the instructions takes place. In simple terms, the computer performs addition, subtraction, division and multiplication as well as some logic operations like comparisons. The data and instructions stored in the primary storage prior to processing are transferred to the ALU, where the processing

takes place. No processing is done in the primary storage u
Intermediate results generated in the ALU are tempor
transferred back to the storage unit. Data is retrieved from
storage to the ALU for further processing. After completio
processing, the final results which are stored in the storage
are sent to the output unit.

Control Unit – The control unit tell the arithmetic and l
unit which operations to perform and ensure that the ne
sary inputs are supplied. This also ensures that only the
results are sent to the output unit. This does not perform
processing function but manages and coordinates the wor
of the entire computer system. It obtains instructions from
program stored in main memory, interprets the instruct
and issues signals that cause other units to execute them.

Central Processing Unit (CPU) – The CPU is the brain of
computer system as all the major functions / decisions are m
in this unit. The control unit and the arithmetic logic un
a computer system are jointly known as the Central Proces
Unit.

Types of Storage Devices

The Storage or memory can be grouped under the follo
heads

1. Internal Processor Memory – This consists of a small se
high speed registers which are internal to a processor m
ory and are used as temporary locations where the ac
processing is done
2. Primary Storage – It is a large memory that is fast but
faster than the internal processor memory. This memor
accessed directly by the processor. It is based mainly on
integrated circuits.

3. Secondary Storage – This is larger than primary storage but is slower than primary storage. It normally stores programs, other instructions and data files. Secondary storage can also be used as an overflow memory, in case where the capacity of the primary storag space. Secondary storage devices are not directly accessed by the processor. The information from the secondary storage is transferred to the primary storage device and then the information is accessed.
4. Cache memory – Another kind of storage is Cache memory. It is logically positioned between the internal memory (registers) and the main memory. It stores some of the contents of the main storage that is currently used by the processor.

Primary Storage Devices

Primary or internal storage unit is basic to all computers. It is an essential component as it is needed for storing the programs that are executed by the CPU. The memory that communicates directly with the CPU is called as primary storage or main memory. The primary storage section consists of devices that store the information. There are two types of storage – Read only memory (ROM) and Random Access Memory (RAM).

Read Only Memory – This is a memory chip that one can read but cannot write on it. ROM provides permanent storage for program instructions. This is often used in microprocessors that always execute the same program such as BOOT STRAP LOADER. A ROM is prepared by the manufacturer and cannot be altered once the chip is made. The ROM memory can be classified under the following heads – PROM and EPROM.

Programmable Read Only Memory (PROM) – A variation of the ROM chip is PROM. It is possible for the user to 'customise' a system by converting the programs into micro programs and

store them in the PROM chip. Once the operations are writt
they become permanent and cannot be altered.

Erasable Programmable Read Only Memory (EPROM) – Th
type of ROM can be erased and programmed with the help of sp
cial equipment. Information stored in an EPROM chip is eras
by exposing the chip to the ultra violet rays for some time.

Random Access Memory (RAM) – Primary storage is usua
referred to as RAM because it is possible to randomly select a
use any location of this memory to directly store and retrie
data and instructions. Each separate location inside the memo
is easy to access as any other location and takes the same amou
of time. The information can be read from a RAM chip and al
written into it. Hence it is also called as read/write memory.

Secondary Storage Devices

Storage capacity of the primary storage may not be sufficient
store large volumes of data; hence an additional memory call
the auxiliary memory or secondary storage is used in most
the computer systems. This is also called as backup storage
it can be partially transferred to the primary storage and wh
required for processing. Data stored in the binary codes as
the primary storage. Commonly used secondary devices are

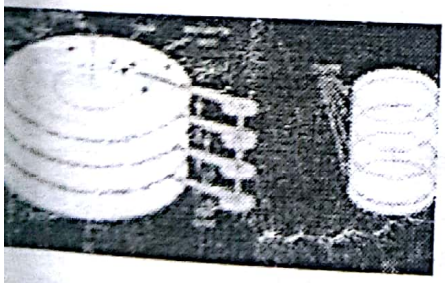
1. Magnetic Disk
2. Hard Disk
3. Floppy Disk
4. Winchester Disk
5. Magnetic Tape
6. Optical Disk Technology

Magnetic Disk – This is a thin circular metal plate coat
on both sides with a magnetic material. A conducting co
named 'Head' performs the job of reading and writing

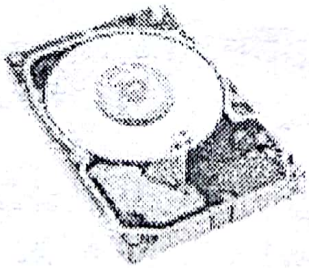
the magnetic surface. The head remains stationery while the disk rotates below it for reading and writing operation. The magnetic field causes magnetic patterns to be recorded on the magnetic surface. The capacities of the magnetic disk range from 1MB to thousands of MB. As far as the secondary memory is concerned, the magnetic disk stores the data in hard disk and floppy disk. The data is transferred from and to the disk in blocks.

Hard Disk – Hard disks are packs of rigid disks made up of light alloy and coated on both sides with a layer of magnet sable oxide. The disks rotate on a high speed (about 3600 rpm) on the drive. The hard disk is a permanent fixture containing one or more circular metallic disks that are used to store data files and software programs. Data is stored on the disk surfaces along the concentric tracks. Read / write heads do not come n contact with the disk surface but float above it with a gap f about 20 millions of an inch. Thus hard disks do not suffer rom so much wear as floppy disks and are therefore suitable or long term usage.

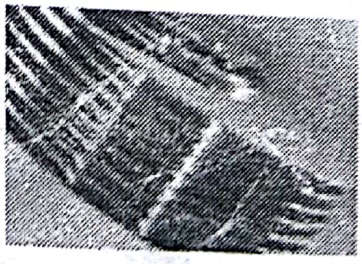
Magnetic Disk



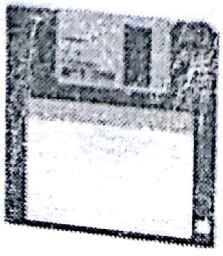
Hard Disk



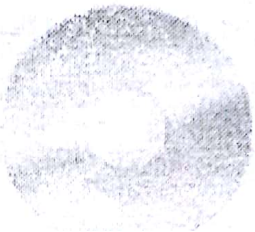
Hard Disk Platter



Floppy Disk



CD-ROM



Floppy Disk – A floppy disk is made of flexible plastic whi coated with magnetic oxide. The flexible disk is enclosed wi a square plastic jacket, often referred to as cartridge. The ja gives handling protection to the disk surface. Floppy disks typically 3, 5.25 or 8 inches in diameter. Floppy disks are cheap compared to the other storage device. They enh online and offline storage medium for small system users.

Winchester Disk – In this unit disks are permanently ho in sealed, contamination free containers. The disks are co with a special lubricant which reduces the friction when read/write heads land on the surface. High-capacity syst using these sealed housings are said to employ Winche technology. This disk is fast and reliable yet low priced. T are normally 5.25, 8 or 14 inches in diameter and sto capacities of 10, 20 and 40 megabytes are typical.

Magnetic Tape – Magnetic tape memories are similar to commonly used audio tape recorders. A magnetic tape c consists of a spool on which a magnetic tape is wound. The is transported across a set of magnetic heads and is taker on another spool on another spool. Between the two spoo set of nine heads are mounted to write and read informa on tape. Each head operates independently and stores infor tion on the tape. This is a sequential access device and he data recorded on tape cannot be addressed directly. If an i is at the end of the tape, all the earlier parts have to be r before accessing the required information.

Optical Disk Technology (CD-ROM Disks): CD-ROM st for compact Disk Read Only Memory. A CD is 5.25 inche diameter and has a larger storage capacity. Mass replicatio CD is inexpensive and fast. A CD-ROM disk is created usin laser beam, which alters the surface of the disk, creating and bumpy areas called pits at the bottom of the disk. Th areas represent data. CD is written over during the proces

manufacture by a high power laser beam and the information is retrieved using low power laser.

Input Devices

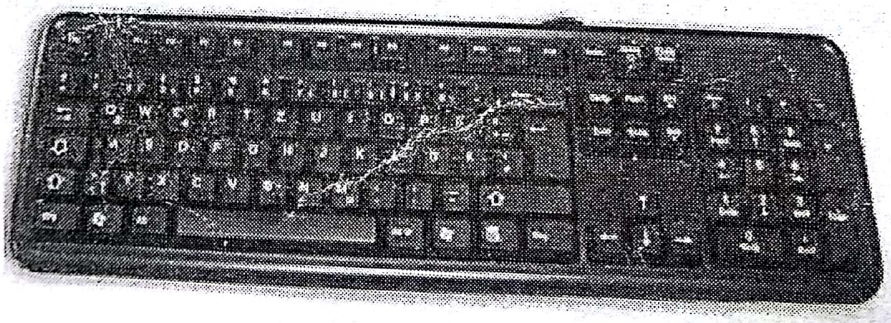
Input devices feed the necessary data into the computer. The data has to be converted to a form which can be read by an input unit of the computer. This form is known as machine readable form. The data in machine readable form is read by the input unit, transformed to appropriate internal code and stored in the computer memory. The processed data stored in the memory is sent to an output unit when commanded by a program. The input devices may be listed as follows.

I. Keyboard
II. Pointing Devices
    1. Mouse
    2. Light Pen
    3. Joystick
III. Scanners
    1. Optical Scanners
        a. Optical Mark Readers
        b. Optical Character Readers
        c. Bar Code Readers
    2. Magnetic Ink Character Recognition
IV. Voice / Speech Recognition Devices
V. Smart Cards
VI. Digitiser

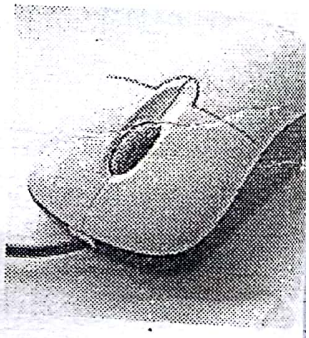
As mentioned earlier, the input devices take data and programs and put them in the form of programs and put them into the form the computer can process. The most common input devices are keyboard, mouse, punched cards, magnetic-tape readers etc.

I. Keyboard – The keyboard is the most common and i
device. It allows you to communicate with the comput
consists of four main areas – the function keys, the typew
keys, the numeric keypad and the special-purpose keys.
standard keys consist of letters, numbers and special c
acters such as semicolon and the commas. The outpu
the key switches are fed to electronic circuit known as
keyboards encoder which converts them into binary-co
values. The values are then fed into the computer w
interprets the key which are pressed. Thus the functio
the keys change with the type of work we are doing.
function keys are used to issue commands. Function
are also programmable keys. This also has special pur
keys such as Ctrl (Control), Del (Delete), INS (Insert)
Alt (Alternate). Cursor movement keys have directi
arrows. Numerical keys are used to enter numbers for m
ematical manipulation.

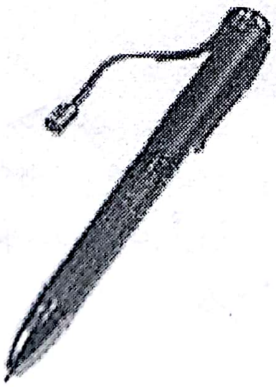
Keyboard



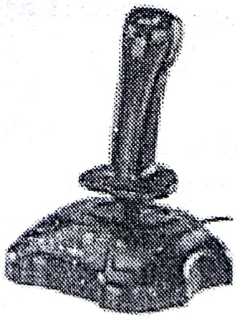
Mouse



Light Pen



Joysticks



II. Pointing Devices – These devices are displayed as pointers on the monitor. The pointer moves as per the direction of the device. Few examples of the pointing devices are mouse, light pen and joystick.

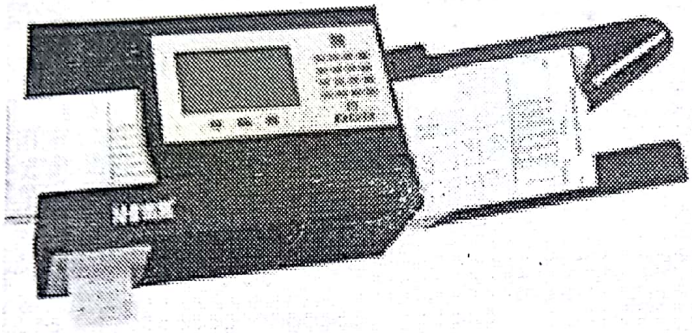
1. Mouse – This is used in addition to the keyboard. It is a hand-held device that controls a pointer on the screen. When the mouse is moved, the ball on the base of the mouse moves. This is translated into signals that tells the computer how to move the screen pointer. Mouse is more useful for creating graphical designs. It can be used like a pen and thereby can be used to draw patterns and figures. The mouse cannot do all the functions; it requires the keyboard for certain functions (like typing words).
2. Light Pen – A person can point and draw a line or curve on the screen. It may be noted that the light pen does not emit light. The light sensitive dioxide at the tip of the pen would sense the light. The light pen is also useful for graphics work. For example, a CAD designer can draw designs directly on the screen with the pen.
3. Joystick – With the joystick, the movements are determined by the manner in which the user pushes a single vertical stick. It is commonly used in playing video games

III. Scanners – They are used for direct data entry into the computer system. The two major types of scanners are – Optical scanners and Magnetic Ink character recognition devices.

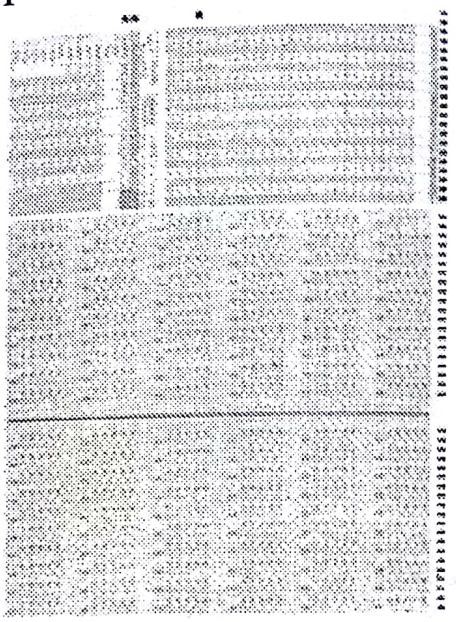
1. Optical Scanners – These devices recognises marks/characters involves a light source and light sensors. The common optical scanner devices are optical mark readers (OMR), optical character readers (OCR) and bar-code readers.
   a. Optical Mark Readers are scanners capable of recognising a pre-specified type of mark made by pen or pencil. The application forms are filled by darkening a square or cir-

cular space by a pencil. These sheets are directly fed i
the computer and OMR reads the data and records
same. The recognition of marks involves focussing a li
on the page being scanned and detecting the reflec
light pattern from the marks. Pencil marks made wit
soft lead pencil will reflect the light

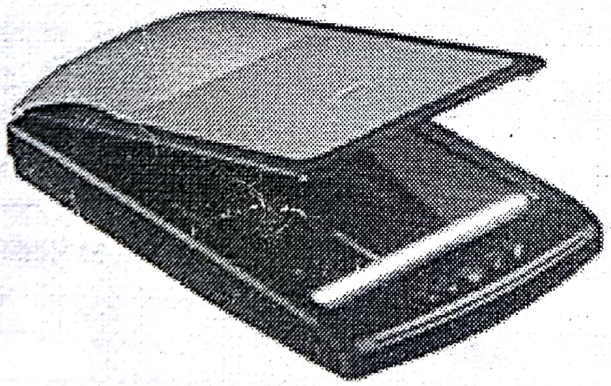
Optical Mark Reader



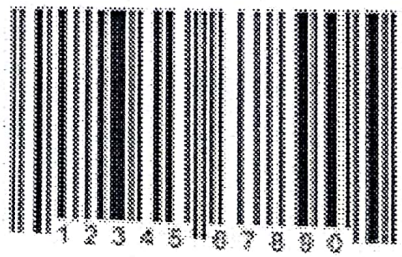
Optical Mark Sheet



Optical Character Reader



Bar Code



Bar Code Re

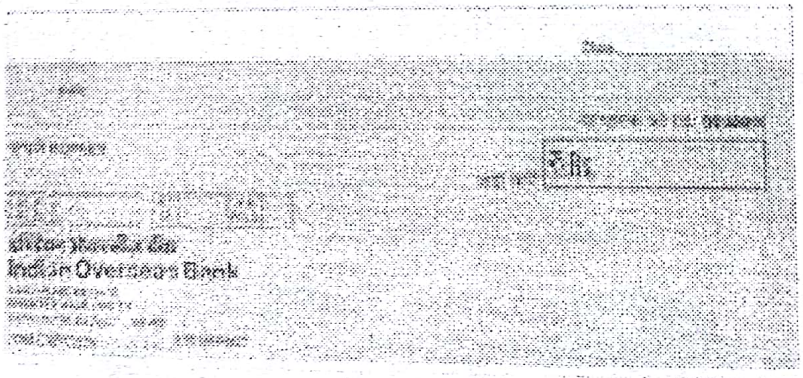
b. Optical Character Readers are capable of detecting alp
betic and numeric characters printed on paper. The c
acters may be handwritten or typed or a printed docum
or a picture form. OCR devices examine each charac
for minute spots. Once the whole character is scanned,
compared with the characters (standard fonts) the mach

has been programmed to recognise. If the pattern matches or nearly matches, it is considered to be character read. If the scanned character does not match satisfactorily with any of the fonts, it is rejected.

c. Bar-code Readers – Data coded in the form of light and dark lines or bars are known as bar codes. Bar-codes are used particularly by the retail trade for labelling shelves and in stock control. They are also used for numbering books in libraries. The date of borrowing and returning of the book is entered into the system by scanning the barcodes in the books with a laser beam. The laser beam strikes across the pattern of bits and records them as input data.

MICR

Magnetic Ink Character



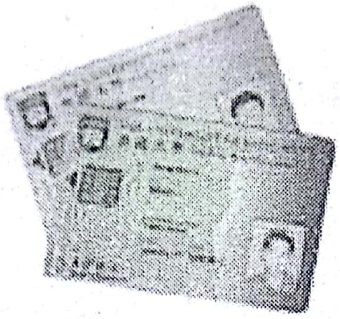
2. Magnetic-ink Character Recognition (MICR) – This system uses a special ink to print characters. These characters can be decoded by special magnetic devices. This system is widely used by banks for processing cheques. Cheque numbers are printed with ink containing magnetic particles of iron oxide. There is a special font used to represent the characters. In this font each character is basically composed

of vertical bars. The characters are printed in a specia
that contains a magnetic material. This method is prim
used in the banking industry and most cheques are
processed under the MICR.

IV. Voice / Speech Recognition and Response devices
voice recognition system consists of a microphone
telephone that converts the human speech into ele
cal signals. A signal pattern obtained in this mann
transmitted to the computer where it is matched aga
pre-stored patterns. When a close match is found, a w
is recognised by the vocabulary of the system. To b
up this vocabulary, the system has been trained to re
nise the words and phrases that are to be present in
vocabulary. Hence the system is initially operated in
'training mode' when the user speaks the words sev
times to train the system to recognise his/her patt
Just as the voice recognition system allows the use
talk to computer, similarly, a voice response enabl
computer to talk to the user. Audio response is an ou
media that produces verbal responses from the comp
system. In a voice response system, all the sounds nee
to process the possible enquiries are pre-recorded
a storage medium. Each sound is given a code. W
enquiries are received, the computer follows a set of r
to create a reply message in a coded form. This co
message is then transmitted to an audio-response dev
which assembles the sounds in a proper sequence
transmits the audio message back to the station requ
ing the information. This is widely used in the bank
is also used in the elevators, by insurance companie
television and by telephone companies. "Touch and
toys also use this mechanism in teaching basic vocabu
and English.

Voice Recognition Device

Smart Card



Smart Card Reader

V. **Smart Cards** – Smart cards are used as credit cards for making transactions. To use it the cardholder inserts the card into a special terminal and enters the password on the keyboard. The card has microchips that can keep a permanent record which are updated each time the card is used. This is commonly termed as 'ATM' cards or 'credit' cards. Smart cards also is used for identity cards.

V. **Digitiser** – This is used for making maps and inputting the manual patterns. Digitiser also called as digitising tablet come in different sizes and working surfaces. The surface is covered with a grid of many tiny wires which are connected to the computer. Drawings placed over the grid can be traced and entered into the computer by the usage of a special pen or mouse-like device which identifies the x, y co-ordinates. As it progresses the drawing is displayed on the screen; it can be stored on the system or printed on a paper.

Output Devices

The output unit transforms the internal representation of data into a form which can be read by people. These are also known as peripherals devices as they surround the CPU. Output units are instruments of interpretation and communication between the humans and the computers. These devices take machine-coded results from the processor and convert them into the form that can

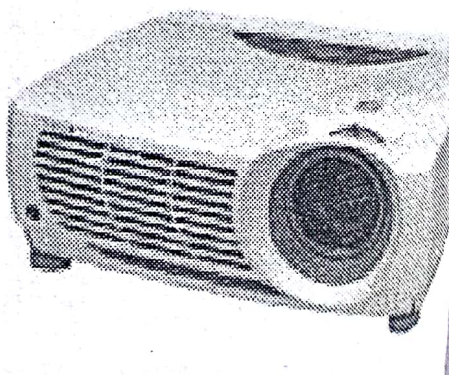
be used by people. The most common output devices are the
itor and the printers. The output devices can be listed as follo

I. Monitor
II. Projection Displays
III. Printers
    1. Character Printer
        a. Letter Quality Printer
        b. Dot-matrix Printer
        c. Ink-jet Printer
    2. Line Printer
        a. Drum Printer
        b. Chain Printer
    3. Page Printer
IV. Plotters
V. Speech / Voice Output Unit
VI. Microfilm and Microfiche

I. Monitor – The monitor is the computer screen and
bles a television screen. The monitor displays instru
sent to the computer. The information and the
processed can also be viewed in the monitor. The
tor can be a monochrome or a colour screen displa
monochrome uses only white, green or black to d

Monitor

Projection Displa



text on a contrasting background. Colour screen display a minimum of 256 colours of over a 4 Trillion colours.

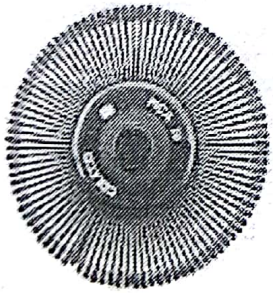
II. Projection Displays – The output of the CPU is projected on a large screen using projectors termed as LCD/LED projector. Thanks to the projector, the image is enlarged and projected on a large screen. These are popularly used for seminars, classrooms and marketing presentations.

III. Printers – Printers are the primary output devices used to prepare permanent documents. The printer generates a permanent hard copy of the files on paper. The printer can be classified as follows – Character Printer, Line Printer and Page Printer

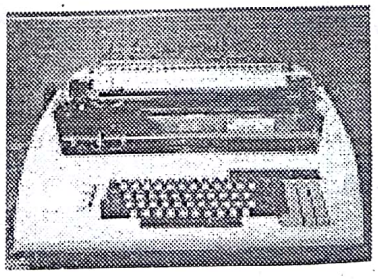
1. Character printer – Character printer print only one character at a time. Commonly used character printer are – letter quality printer, dot-matrix printer and ink-jet printer.

a. Letter quality printer popularly known as daisy wheel printer is a low speed printer and is used when high quality is demanded. This is an impact printer where the hammer strikes on the ribbon to produce character. This printer is fitted with unchangeable print heads called daisy

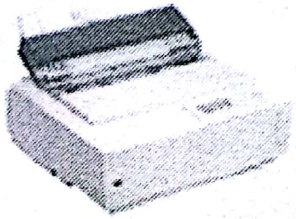
Daisy Wheel



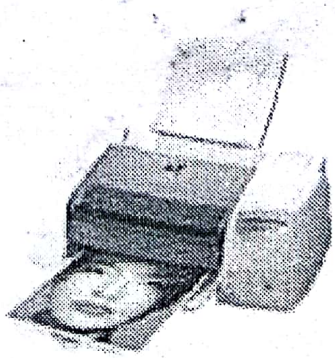
Daisy Wheel Printer



Dot-matrix Printer



Ink jet Printer



wheels. To print each character, the wheel is rotated
the appropriate spike strikes against an inked ribbon.

b. Dot-matrix printer is also a slow speed impact prin
This printer prints character as pattern of dots.
printer head consists of tiny needles, typically se
rows with nine characters each. The print produce
a small 'Print head' which moves to and fro across
page, stopping momentarily in each character posi
to strike a print ribbon against the paper. Multiple p
copies maybe produced by the usage of a carbon pa
The print quality is inferior to the daisy wheel, but
the advantage of changing the font style and size wh
is not possible with daisy wheel.

c. Ink-jet printer – This is a low speed non-impact prin
They print characters by spraying small drops of
onto paper. Special type of ink having high conte
used. Droplets of ink are electrically charged after
ing a nozzle. The droplets are then guided to the pro
position on the paper by electrically charged de
tion plates. Ink-jet printer produce high quality ou
because the characters are formed by dozens of tiny
dots. Ink-jet printer also produce colour print outs.

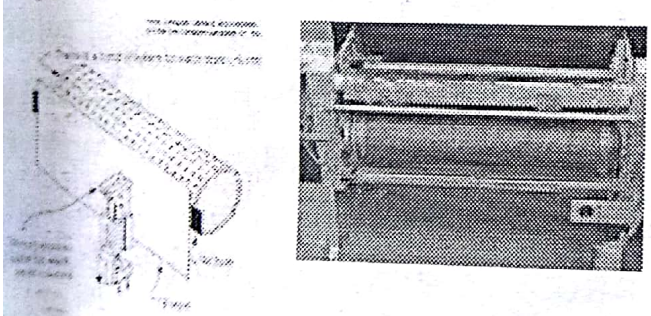
2. Line Printers – They are high speed printers havin
speed of 300 to 2500 lines per minute. Their print
speed is such that to an observer they appear to be pri
ing a line at a time and hence the name 'line printe
Drum printer and chain printer are commonly used i
printers.

a. Drum printer consists of a cylindrical drum with ch
acters embossed on its surface. On complete set
characters is embossed for each and every possible p
position on a line. Thus a printer with 132 characters
line and a 96 character set will have on its surface

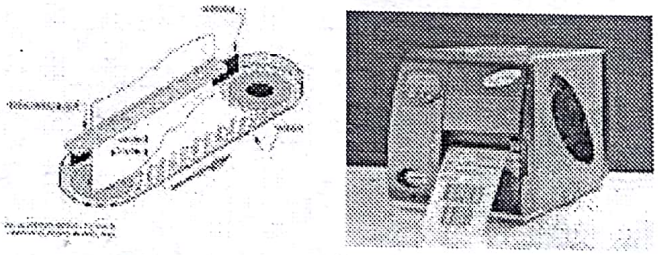
x 96 = 12672 characters embossed. The printer drum is rotated at a high speed. A character is printed by striking a hammer against the embossed character on its surface. Printer drums are expensive and cannot be changed often. Printer drums have a fixed font type and size.

b. Chain printer has a steel band on which character sets are embossed. The band is rotated at high speed. As the band rotates, a hammer is activated. When a desired character as specified in the buffer register comes in front of it. For a printer with 132 characters per line, 132 hammers will be positioned to strike the carbon ribbon which is placed between the chain, paper and the hammer. The hammer movement and the chain movement should be accurately synchronised. Bad synchronisation leads to blurred lines. The main advantage of chain or band printer is the ease with which chains can be changed. Thus different fonts and different scripts maybe used with the same printer.

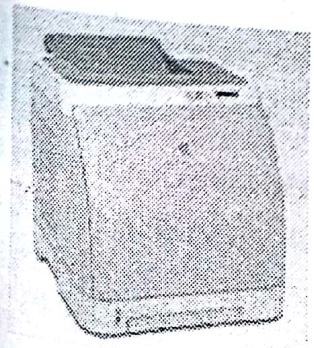
Drum Printer



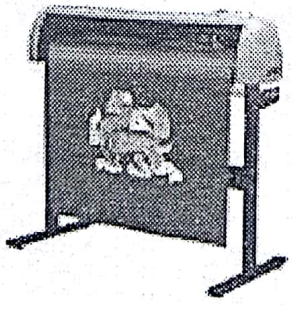
Chain Printer



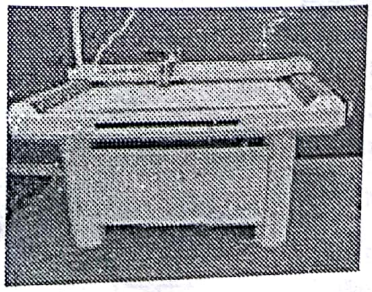
Laser Printer



Drum Plotter



Flat bed Plotter



3. Page Printer – This printer print an image of a whole p at a time. The image may consist of conventional pr diagrams, pictures or combination of these. Accordin the technical features, these printers are also know optical printer, laser printer or xerographic printer. electronically controlled laser beam marks out an elec static image on the rotating surface of a photoconduc drum. Ink toner is attracted onto the electrostatic patt on the surface of the drum. The toner is then transfer onto the paper as it comes into contact with the drum typically high-speed laser printer would print 146 pa per minute and the quality of the output is very h indeed.

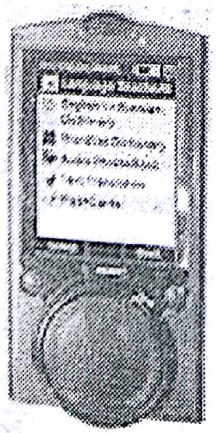
IV. Plotters – Plotter is a specialised output device desig to produce high-quality graphics in a variety of colours is also termed as large scale printer. There are two ty of plotters – drum plotter and flat bed plotter. In a dr plotter, the paper on which the graph is drawn is moun on a rotating drum. A pen which can move linearly, t is perpendicular to the direction of drum rotation mounted on a carriage. The drum can rotate in clockw or anti-clockwise direction under the control of plott instructions sent by the computer. The pen can move lef right or right to left. The pen can also move up and do The movement of the pen and the drum is controlled the graph plotting program. The programs can thus d various graphs and also annotate them by using the pen draw characters. A flat bed plotter has a stationery plott surface on which a paper is fixed. The pen is mounted the carriage which can move in either X or Y directi The pen can also be moved up and down. A graph plott computer program is used to move the pen to trace desired graph.

V.

V. Speech / Voice output unit – A speech output unit is one which reads strings of characters stored in a computer's memory and converts them into a spoken sentence. These speech units for English have been greatly refined and a near natural speech emerges. They are used to give voice commands to operators of plants based on results of computations. They are used as parts of a machine which can read out printed matter to blind persons. This enables the blind persons to read books as soon as they are printed rather than wait for the book to appear in Braille.

VI. Microfilm and Microfiche – The output from the computer is displayed on a high resolution cathode ray tube. This is photographed on a 35mm film. A camera is controlled to film successive output pages on the screen of the cathode ray tube. A special microfilm reader is used to read the output. Some microfilm readers also produce a hard copy using Xerographic process. In some systems, the microfilm is converted to a 'microfiche' form. A microfiche is a 4" x 6" sheet of film that holds 98 frames of 8" x 11" page images reduced to 24 times. It is easier to read a microfiche with a microfiche reader than to read with a microfilm. Besides this, microfiche is easier to mail between locations and hence it is popular.

Voice output



Microfilm