Subject: Foundation of Information Technology

80% plus attendance

2 Class Tests

Internal Marks

Assigments of each chapter

Project Work or Lab Work

Class behaviour

Mid Term and Pre-board

CHAPTER 1

INRODUCTION TO COMPUTER SYSTEM

1.1 INTRODUCTION TO COMPUTER

- The term computer is derived from the Latin word **"Compute"** which means to calculate and to calculate means to perform arithmetic and logical evaluations.

- Computer is an electronic, digital, programmable and automatic machine which takes raw fact as input from the user and gives meaningful information as output to the user.

- A computer is a fast and accurate electronic data manipulating system that is designed to automatically accept and store input data, process them and produce output under the direction of stored program instruction.
- A computer is a programmable machine capable of:
a) Accept data
b) Input, store and execute instruction
c) Perform mathematical and logical operation on data
d) Output results.

Characteristics of Computer

Computer is the powerful electronic device. It can use to process large amount of data and information. The characteristics of computer are given below:

a) **Word Length:**

A digital computer operates on binary digit 0 and 1. A binary digit is called a bit. The number of bits that a computer can process at a time in parallel is called its word length. Word length of the computer varies such as 8, 16, 32 , 64 bits etc. It is the measurement of the computing power of a computer i.e. the longer the word length, the more powerful the computer is. When we talk of a 32 bit computer, its means the word length is 32.

b) Speed:

The time taken to perform any task by computer is called speed of computer. A microcomputer can process millions of instructions per second over and over again without any mistake. A modern computer can execute millions of instructions in one second. The speed of computer is affected by various factors such as processor speed, clock cycle, size of RAM, etc.

The fractions of seconds are given below:

Unit of time	Part of second	
Milliseconds (ms)	One thousands	1/1000
Microseconds (µs)	One millionth	1/1000000
Nanoseconds (ns)	One billionth	1/1000000000
Picoseconds (ps)	One trillionth	1/1000000000000

c) Storage:

The physical space inside the computer where we can store huge amount of data is called storage. Computers have ability to store the results. Computer storage can be divided as primary storage and secondary storage. Primary storage is where CPU can directly interact. The data can be stored in large volume using secondary storage devices like magnetic disks, tape storage, etc. The storage in computer is measured in terms of Nibble, Byte, Kilo Byte (KB), Mega Byte (MB), Giga Byte (GB) and Tera Byte (TB).

d) Accuracy:

Computer's physical circuits rarely make errors, if the data and instructions are correctly fed. Most of the errors occurring in computers are either hardware errors or human errors. In addition of being fast, computers are very accurate. The accuracy of computer is very high. Error in computer is due to the user rather than technological weakness. For instance, if the data we entered is wrong or the instructions we have given are not proper, computer is not going to give desired output. Computer error caused due to incorrect input data or improper instructions are often called **Garbage in, garbage out (GIGO).**

e) Diligence:

It is the capability of performing the same task over and over again with the same speed, accuracy as in the first time for a long period of time without feeling it tired and bored. It can work for hours without creating any error. If millions of calculations are to be performed, a computer will perform every calculation with the same accuracy.

f) Versatility:

The feature of computer to perform more than one task having different characteristics is called versatility of computer. It can carry out processes ranging from simple mathematical calculations to highly complex and logical evaluations for any extended period of time. Computers are being used in different areas for different purposes like in office, banks, etc.

Components of Computer

The major components of computer are:

a. Hardware:

The physical component that makes up the computer are called hardware. Eg: monitor, keyboard, mouse, etc.

b. Software:

Software is a set of instructions that make the computer to perform tasks. [i.e. it tells the computer what to do.]

c. Data:

Data is the raw fact and figures often used to produce the information as per the demand of the user. Data can be letters, numbers, sound, images or videos.
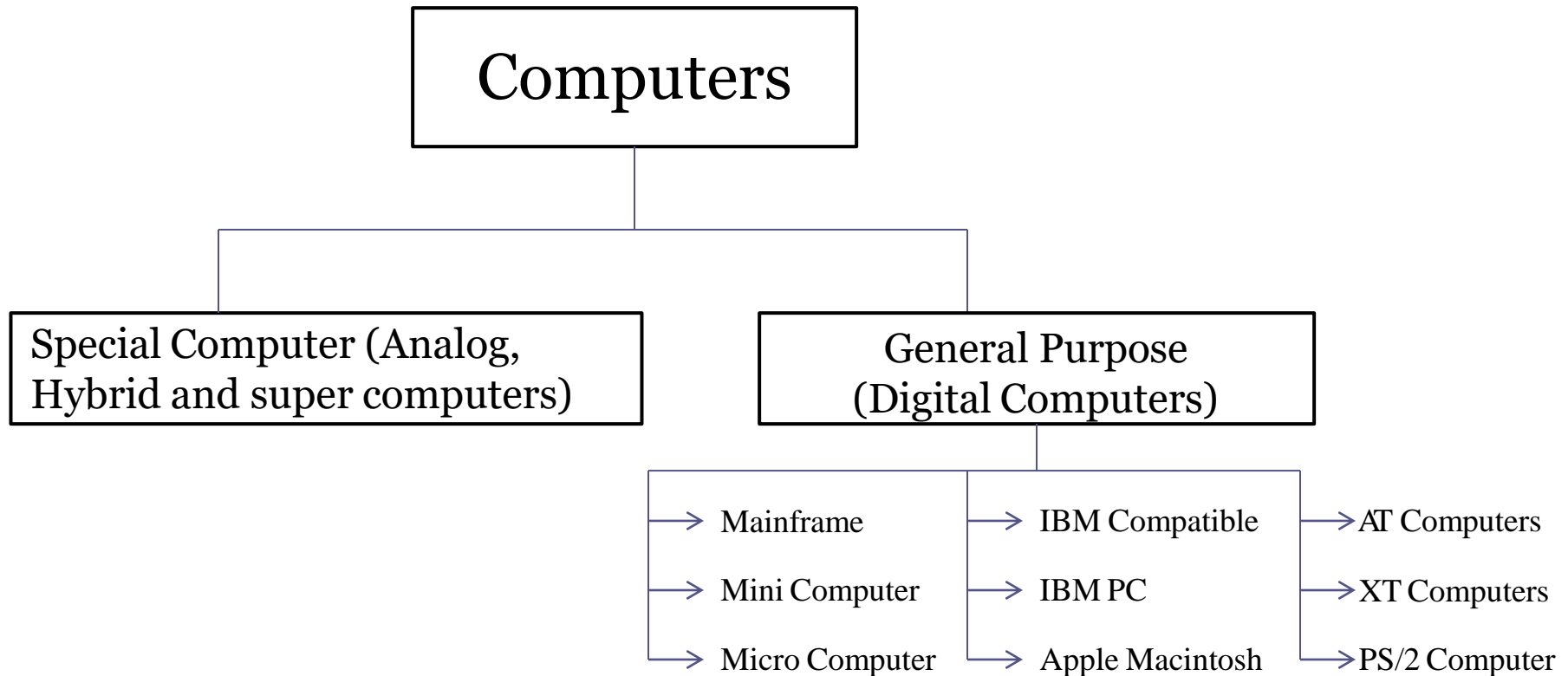
d. People:

People are users of the computer system and are responsible for designing, building programs and repairing computer system.

e. Procedure:

It us simply the way of doing thing. Computer always performs the task based on the specific procedure based on the nature of the task to be carried on.

1.3 Types of Computer

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                    ┌─────────────────┐
                    │    Computers    │
                    └─────────────────┘
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Special Computer (Analog, Hybrid and super computers)	General Purpose (Digital Computers)

→ Mainframe → IBM Compatible → AT Computers

→ Mini Computer → IBM PC → XT Computers

→ Micro Computer → Apple Macintosh → PS/2 Computer

On the Basis of Work

a) **Analog computer:**

The word "Analog" means continuously varying in quantity. The analog computers accept data in continuous form and output is obtained in the form of graphs. The voltage, current, sound, speed, temperature, pressure, etc. values are examples of analog data. These values continuously increase and decrease. The thermometer is an example of analog device because it measures continuously the length of mercury column.

The analog computers have low memory size and have fewer functions. These are used in industrial units to control various processes and also used in different fields of engineering.

b) **Digital computer:**

The word Digital means discrete. It refers to binary system, which consist of only two digits 0 and 1. Digital data consists of binary digits represented by OFF (low) and ON (high) electrical pulses.

In digital computers, quantities are counted rather than measured. A digital computer represents the data in digital signals and then processes it using arithmetic and logical operations. Eg: calculators, personal computers, etc.

c) Hybrid computer:

The hybrid computer have best features of both analog and digital computers. These computers contain both the digital and analog components. In this, the user can process both the continuous and discrete data. These are used in scientific fields, hospitals to see the status of health condition of patients, spaceships, etc.

On the basis of size

Computers are classified according to their data processing speed, amount of data that they can hold and price.

1. **Supercomputer:**

It is the most powerful and fastest, and also very expensive. It was developed in 1980s. It is used to process large amount of data and to solve the complicated scientific problems. It can perform more than one trillion calculations per second. It has large number of processors connected parallel. In a single supercomputer, thousands of users can be connected at the same time and it can handle the work of each user separately.

They are mainly used for:
- Weather forecasting
- Nuclear energy research
- Aircraft design
- Study of DNA structure
  Examples of supercomputers are: CRAY-1, CRAY-2, Control Data CYBER 205 and ETA A-10, etc

2. Mainframe Computer:

Mainframe computers are also large, fast and expensive computers, but they are smaller, slower and less expensive than the super computers.

Mainframe the name itself describe that it is a cabinet containing the central processing unit which controls a large number of I/O hardware. The mainframe computers support large database, vast I/O hardware, and multiprogramming simultaneously. The mainframe computer acts as a server and serves several users simultaneously.

The mainframe computers are specially used as servers on the World Wide Web. These type of computers are used in large organizations such as Banks, Airlines, and Universities, etc. where many users need frequent access of same data, which is usually organized into one or more human databases.

Examples: IBM S/390, Control Data CYBER 176 and Amdahl 580, etc.

Difference between supercomputer and mainframe

A supercomputer is a powerful computer which is used for processing data at fastest possible speed. A mainframe is a large computer which is used for calculations dealing with a huge amount of data. Thus, the primary focus of a supercomputer is speed, whereas for a mainframe it is to deal with extensive amount of data. Mainframe computers are not as powerful as supercomputers.

ASSIGNMENT 1:

1. WRITE THE DIFFERENCES BETWEEN ANALOG AND DIGITAL COMPUTER.

2. WRITE THE DIFFERENCES BETWEEN SUPERCOMPUTER AND MAINFRAME COMPUTER.

3. Minicomputer:

Mini computers are very popular among medium sized computers. Mini computers offer facilities for faster processing of voluminous information. Mini computers, of course, are bigger than microcomputers but smaller than most of their elders called mainframes.

They are smaller in size, have low processing speed and also have lower cost than mainframe. These computers are known as microcomputers because of their small size compared to other computers at that time. The capabilities of minicomputer are between mainframe and personal computer.

The minicomputers are used in business, education and many other government departments. It is also multi-user computer and supports more than dozens of people at a time. They are commonly used as servers in network environment and hundred of personal computers can be connected to the network with a microcomputer acting as servers like mainframes, they are used as web servers.

Example: PDP-11, VAX, etc.

4. Microcomputer:

The microcomputers are also known as personal computers or simply PC because it is a single user computer. It supports many higher level languages, multimedia, graphics and games. It is popular among students and professionals due to its small size, low price and low maintenance cost and easy in operation.

In 1981, IBM announced its first IBM PC and in 1982 it lunched in the market for the first time.

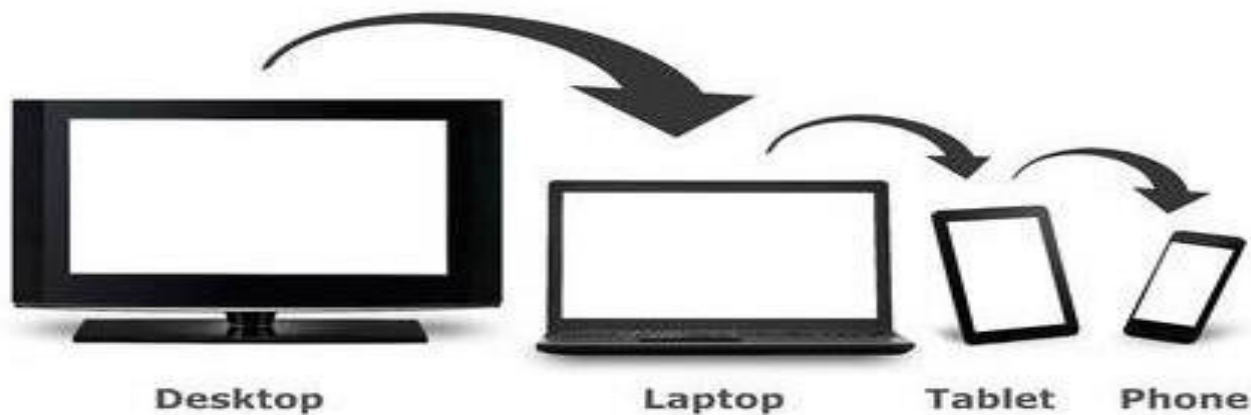The first IBM PC was equipped with following components:

- Intel 8088 processor of 4.77 Mhz
- 64 KB RAM (expandable to 256 KB)
- 40 MB ROM
- 5.25" floppy drive (160 KB)
- PC-DOS 1.0 (MS DOS)

Example: IBM PC's, Apple MAC, IBM PS/2,etc.

Types of Microcomputer

1. Desktop
2. Laptop
3. Palmtop

1. Desktop

Desktop computers are full size computers that are small enough to be used at a desk but too big to carry around. These are the computers you see in schools, homes and offices. In this, motherboard, hard disk, video card and other components are assembled into a large case. The monitor, keyboard and other peripherals connect wirelessly or with wires.

In order to use printer , scanner, driver software of those devices need to be installed.

Present desktop computers are very powerful as they can be used even as a server. It has very good display quality. But the major problems with the desktop computers are:

- It occupies ample of space.
- It is not portable.
- It consumes more electricity and it makes noise in comparison to laptop.

2. Laptop

Laptops are portable, and they use less power and make less noise than desktop models. Overall laptop and desktop computers are similar. They have the same basic hardware, software and operating systems. The primary difference is how their components fit together. A laptop, however, is much smaller and lighter than even the most compact PC tower. Its screen and keyboard are integral parts of the unit. A laptop uses a small, flat design in which all the pieces it together.

Because of the laptop's internet portability, components of the laptop have to:

- Fit into a compact space
- Conserve power
- Product less than desktop components.

3. Palmtop

A small computer that literally fits in your palm. Compared to full-size computers, palmtops are severely limited, but they are practical for certain functions such as phone books and calendars. Palmtops that use a pen rather than a keyboard for input are often called *hand-held computers* or *PDAs*. A **palmtop computer** is a personal computer or other electronic device that has many of the same features as a computer and fits in the palm of your hand.

The term "palmtop computer" was an early term used when computers were big and cumbersome and small cell phones and even smartphones were not yet invented. Today, this term is rarely used to describe a computer that fits in your hand because of the invention of the Smartphone.

1.4 Uses of Computer

In the last few decades, computer technology has revolutionized the businesses and other aspects of human life all over the world. Some of the areas where computers are being used are:

1. **Science:**

Scientists have been using computers to develop theories, to analyze and to test the data. The fast speed and accuracy of the computer allow different scientific analyses to be carried out. Satellite based applications couldn't have been possible without the use of computers.

2. Education:

Computers have also revolutionized the whole process of education. Currently, the classrooms, libraries, and museums are utilizing computers to make the education much more interesting. Computer-aided education and computer based training packages are making learning process much more interactive.

3. Medicine and Health care:

There has been an increasing use of computers in the field of medicine. Doctors are using computers right from diagnosing the illness to monitoring patient's status during complex surgery. By using automated imaging techniques, doctors are able to look inside a person's body and can study each organ in detail.

4. Engineering/Architecture/Manufacturing:

The architects and engineers are extensively using computers in designing and drawings. By using techniques like virtual reality, architects can explore house that have been designed. The manufacturing factories are using computerized robotic arms in order to perform hazardous jobs.

5. Entertainment:

Computers are finding greater use in the entertainment industry. They are used to control the images and sounds. The special effects, which mesmerize the audience would not have been possible without the computers. In addition., computerized animation and colorful graphics have modernized the film industry.

6. Communication:

E-mail is one of the communication media in which computers are used. The advantage of this service is that while transferring the messages it saves time. Moreover, the person who is receiving the messages can read the messages whenever he/she is free and can save it, reply it, forward it or delete it from the computer.

7. Business Application:

Computers are mainly used for real-time applications that require immediate response from the computer. There are various concerns for which computers are used such as in business forecasting, to prepare bills and personal records, and as an aid to management. Use of an e-mail and internet has changed the ways of doing business.

8. Weather Forecasting:

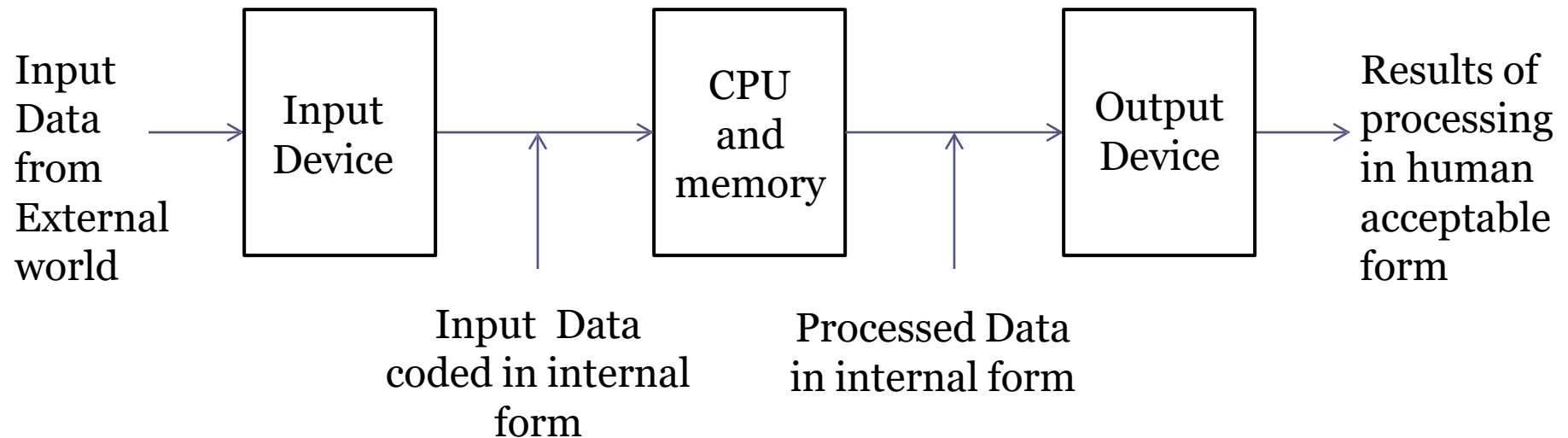Computer programs are used for weather forecasting. The past and present data help to predict the climate.

9. Banking:

In the field of banking and finance, computers are extensively used. When the different branches of the bank are connected through the computer networks, the inter-branch transactions, such as drawing cheques and making drafts, can be performed by the computers without any deal.

1.5 Input Output device

The input/output (I/O) devices provide the means of communication between the computer and the outer world. They are also known as peripheral devices because they surround the CPU and memory of a computer system. Input devices are used to enter data into primary storage and output devices accept results from the primary storage. The computer system consists of many I/O devices to feed data into the computer and to see the result of processing done by the system.

Role of I/O Devices

Input Data from External world → Input Device → Input Data coded in internal form → CPU and memory → Processed Data in internal form → Output Device → Results of processing in human acceptable form

Input Device

- By the use of input device user can present the data to the processing unit of computer. An input device may read the data in the form of text, numbers, images, audio or video, but the data given in any format is converted to machine-readable form i.e. binary format then only forwarded for processing.
- Examples: keyboard, mouse, microphone, scanner, joystick, lightpen etc.

Keyboard and its uses.

Keyboard is an input device with various keys that enable you to enter alphanumeric data into a computer. It is similar to electronic typewriter but contains additional keys. It has been an effective device for inputting non-graphical data. Nowadays, a keyboard has also been provided with different features to facilitate menu selection or graphical functions.

The layout of the keyboard is like that of traditional QWERTY.

A standard keyboard contains different types of keys:
a) Alphanumeric keys (A-Z, 0-9)
b)Function keys (Ctrl, Alt, Caps lock, Enter, Tab, Shift)
c)Special function keys (F1, F2, F3,……..,F12)
d)Cursor movement keys (page up, page down, arrows, etc)
e) Punctuation keys (,, "", ", ?, !)
f) Numeric pad
g) Multimedia keys

How the computer accepts input from the keyboard?

When we press a key on a keyboard we might think that the keyboard simply sends the letter to the computer after all, that is what appears to happen. Actually it is more complex than that :-

- Suppose a key is pressed on the keyboard. A tiny computer chip, called the **keyboard controller** , notes that the key has been pressed. The **k**eyboard **c**ontroller places a code into a part of its memory called the **keyboard buffer**, indicating which key was pressed. This code is called the **k**ey's **s**can **c**ode.

- The keyboard controller then signals the computers system software **(Operating system)** that something has happened at the keyboard. It does not specify what has occurred , just that something has. The signal that keyboard sends to the computer is a special kind of message called an interrupt request.

- The keyboard controller sends an interrupt request to the system software, when it receives a complete keystroke. When the system software receives an interrupt request , it evaluates the request to determine the appropriate response. When a key press has occurred, the system reads the memory location in the keyboard buffer that contains the scan code of the key that was pressed. System software then passes the key's scan code to CPU. This is the way by which computer accepts Input from Keyboard.

(1) Key is pressed on the Keyboard

(2) The keyboard controller sends the Scan code for the key to the keyboard Buffer.

Keyboard Controller

(3) The keyboard controller sends an Interrupt request to the system software

Keyboard buffer

(4) The system software read the scan Code from the keyboard buffer.

System software

(5) The system software process the scan code to CPU.

CPU (Central processing unit)

Mouse and its uses

Mouse is a handheld device which can be moved on a smooth surface to simulate the movement of the cursor on the display screen. A mouse is a small object you can roll along a hard, flat surface usually on a desk or keyboard tray and controls the pointer.

The pointer is an on-screen object, usually an arrow that is used to select text, access menus, and interact with programs, files, or data that appear on the screen.

Types of Mice

Three types of mice are:

- **Mechanical Mouse**: Mechanical has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors with the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

- **Opto-mechanical Mouse:** It is same as mechanical mouse but uses optical sensors (LEDs) to detect motion of the ball. There is horizontal and vertical roller inside the mouse.

- **Optical Mouse:** It uses a laser to detect the mouse's movement. They respond more quickly and precisely than mechanical and opto-mechanical mice, but they are also more expensive.

- **Microphone:** A microphone is a device that translates sound vibrations in the air into electronic signals or scribes them to a recording medium. Microphones enable many types of audio recording devices for purposes including communications of many kinds, as well as music and speech recording.

  For example, when a microphone is used to record a voice or music, the information it records can be stored on the computer and played back later. Another great example of how a microphone is an input device is with voice recognition, which uses your voice to command the computer at what task to perform.

- **Track ball**
  Trackball is the modification of mechanical mouse. It contains rubber ball on its top. User can move the cursor by rotating the ball with finger. It also contains two buttons on the either sides similar to mouse. It was used in older laptops.
- **Track pad/Touch pad**
  Track pad is the modification of optical mouse, and touch pad is further modification making it touch sensitive. It contains a window with two buttons on the either sides. User can also provide left click option by tapping the window with the finger. It is mainly used in portable devices like laptops, notebook, palmtop, etc.

- **Joystick**
  Joystick is a hand held pointing device which is mainly used for playing games. It is used for controlling objects, their movement, direction and speed of movement. Modern joysticks handle can move in any direction. When the handle is moved, the electronic circuit in the base detects the movement and sends corresponding binary signals to CPU.
- **Light   pen**
  Light pen is used for creating drawings, designs by directly touching the screen. It is mainly used by designers, architects, engineers, etc. it is used in monitor not having touch screen facility. It is a pen shaped structure containing photo sensitive tip which can capture light emitted from the monitor and mark the position on the monitor.

- **Touch screen**
Touch screen is none of the common input device at present mainly for portable computers. User can provide inputs by directly touching the screen with the metallic pen (stylus), finger or any pointed object. Touch screen is developed by using either of the following technologies:
a) Pressure sensitive
b) Capacitive
c) Infrared

- **Scanner**
Scanner digitizes hard copy or printed images which can be used in digital computers. Scanner copies the image and draws a new digital image in its memory similar to hard copy image.

- **OCR (Optical Character Reader)**
  OCR reads printed characters directly and converts them into appropriate codes and stores them in a computer. When light source is passed over a document the written or typed characters reflect less light than the background area. Thus the shape of the character may be determined. Each character is scanned several times and an electronic picture of it is built-up
- **MICR**
  It stands for Magnetic Ink Character Reader. MICR is an OCR that can digitize text written or printed by using magnetic ink like iron oxide or barium ferrite. It is used in security systems and for processing cheque in bank.

- **OMR**

  It stands for Optical Mark Reader. It is used for answer sheet correction in multiple choice questions. With the use of OMR answer sheet correction will be faster and error free.

- **BCR**

  It stands for Bar Code Reader. Bar codes are the magnetic lines used for storing the information about the product like manufacturing date, expiry date, company name, etc. BCR is used to read the information stored in bar codes. Bar codes are also used in security system.

Output Device

- Output device is a peripheral device that receives information from the CPU and present the user in the desired form.
- The computer system needs an output device to communicate the processed information to the user.
- The output device translates processed data from a machine-coded form to a form that can be read and used by people.
- Eg: Monitor, printer, etc.
- The output normally can be produced in two ways: either on a display unit or on paper i.e hard copy and soft copy.

- **Softcopy Devices:** It gives screen displayed output which is lost when the computer is turned off. Monitor, projectors are the example of softcopy devices. There is no stationary expenditure and output can be seen faster.
- **Hardcopy Devices:** It is an output, which is printed on paper or on some other materials. It can be touched and carried for being shown to others. They are permanent in nature. Printers are the examples of hard copy devices because they print the output in hard paper.

Visual Display Unit (VDU)/Monitors

- All computers are connected to some type of graphic display unit, which is called a monitor. It is the most popular soft copy output device which is used to display the information. They are available in many different type and size.
- Three basic type of monitor used are cathode ray tube (CRT), Liquid Crystal Display (LCD) and plasma display.
- CRT monitor looks like a television and are used with non-portable computer systems.

- The thinner monitors used on notebook and other small computer are known as flat-panel display.
- Compared to CRT based monitors, flat panel displays consume less electricity and take up much less space.
- Most flat panel displays use LCD technology. LCD displays sandwich cells containing tiny crystal between two transparent surfaces. By varying the electrical current supplied to each crystal, an images forms.

Classification of Monitors based on Color

- In terms of color capabilities, monitors are classified into three classes:

1. **Monochrome monitors:**

It display two colors, one fore background and one for foreground. The colors can be black and white, green and black, or amber (yellowish-brown) and black. These monitors are used for text displays only where the user does not need to see color graphics.

2. Gray-scale Monitors:

They are a special type of monochrome monitor capable of displaying different shades of gray from a very gray to black against a white or off-white background, and are essentially a type of monochrome monitor. It is used in low-end portable systems to keep costs down. They are classified by the numbers of bits they used to represent each pixel. 8 bit monitor represents eacg pixel with 8 buts.

3. Color Monitors:

They are often called RGB monitor because they accept three different separate signals- red, green , blue. All color computer monitors are RGB monitors which 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.

They are often classified by the number of bits they used to represent each pixel. For example, 24 bit monitor represents each pixel with 24 bit. The more bits per pixel, the more colors the monitor can display.

Factors Affecting Monitor Quality

Quality of monitor is judged in terms of following factors:

1. Monitor size
2. Resolution
3. Dot pitch
4. Refresh Rate
5. Bandwidth
6. Convergence

1. **Monitor size**:

The most important aspect of a monitor is the screen size. Like televisions, screen sizes are measured diagonally, in inches, the distance from lower left corner to the upper right corner diagonally. The sizes of the display determines monitor quality.

2. Resolution:

The maximum number of points that can be displayed without overlap on a monitor screen is referred to as the resolution. The resolution of a monitor indicates how densely the pixels are packed. Pixel is short form for Picture Element. A pixel is a single point in a graphic image. Graphic monitors display pictures by dividing the display screen into thousands or millions of pixels arranged in rows and columns.

The number of bits used to represent each pixel determines how many colors or shades of gray can be displayed. Example: 8- bit color monitor uses 8 bit for each pixel making it possible to display 2 to the 8th power i.e. 256 different colors or shades of gray.

3. Dot pitch:

It is the distance between the phosphor dots that make up a single point on the display screen. It is one of the principal characteristics that determine the quality of display monitors measured in millimeters. and a smaller number means a sharper image. In desk top monitors, common dot pitches are .31mm, .28mm, .27mm, .26mm, and .25mm. Personal computer users will usually want a .28mm or finer. It is also known as phosphor pitch.

4. Refresh rate:

Display monitors must be refreshed many times per second. The refresh rate is the number of times per second that the electron guns scan every pixel on the screen and is measured in Hertz(HZ) or in cycles per second.

It is important because phosphor dots fade quickly after the electron gun passes over them. Therefore, if the screen is not refreshed often enough, it appears to flicker which is the main cause of eyestrain.

5. Bandwidth:

It is the amount of data that can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits or bytes per second and for analog it is expressed in Hertz.
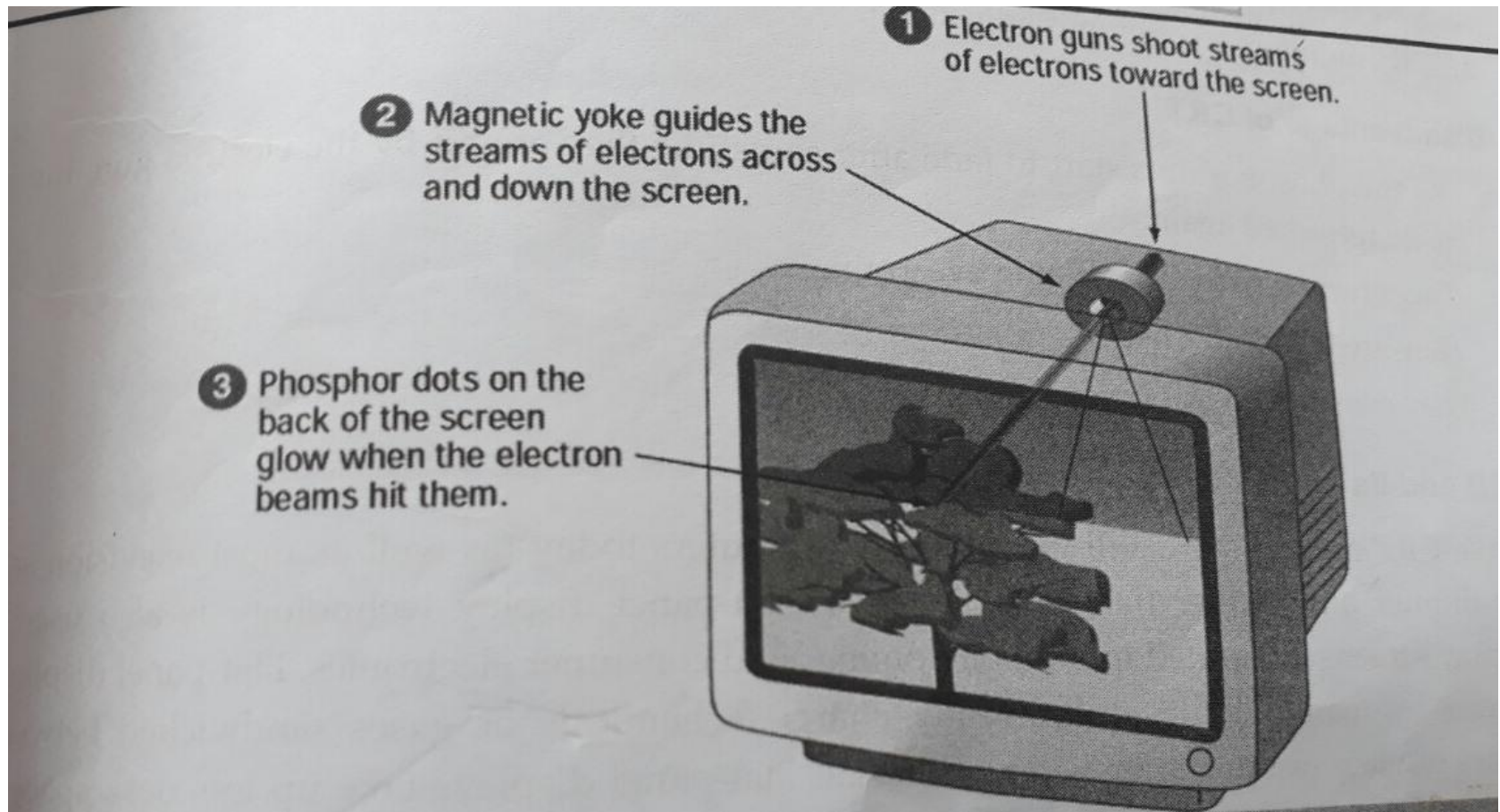
6. Convergence:

It refers to how sharply an individual color pixel on a monitor appears. Each pixel is composed of three dots- red, blue and green. If the dots are badly misconverged, the pixel will appear blurry.

There are three categories of display screen technology. They are:

1. Cathode Ray Tube (CRT)
2. Liquid Crystal Display (LCD)
3. Plasma Display

CRT and its uses

- CRT monitors look like a television and are normally used with non-portable computer systems.
- They use the same cathode ray technology used in conventional television in which an electron gun sealed inside a large glass tube projects an electron beam at a screen coated with red, green and blue phosphor dots; The beam lights up the appropriate colors in each pixel to display the necessary image. As a result, they are large, bulky and heavy.

1 Electron guns shoot streams of electrons toward the screen.

2 Magnetic yoke guides the streams of electrons across and down the screen.

3 Phosphor dots on the back of the screen glow when the electron beams hit them.

- Figure shows how a typical CRT monitor works. Near the back o f a monitor's housing is an electron gun. The gun shoots a beam of electrons through a magnetic coil (sometimes called a yoke), which aims the beam at the front of the monitor The back of the monitor's screen is coated with phosphors, chemicals that glow when they are struck by the electron beam. The screen's phosphor coating is organized into a grid of dots. The smallest number of phosphor dots that the gun can focus on is called a pixel, a contraction of the term picture element.
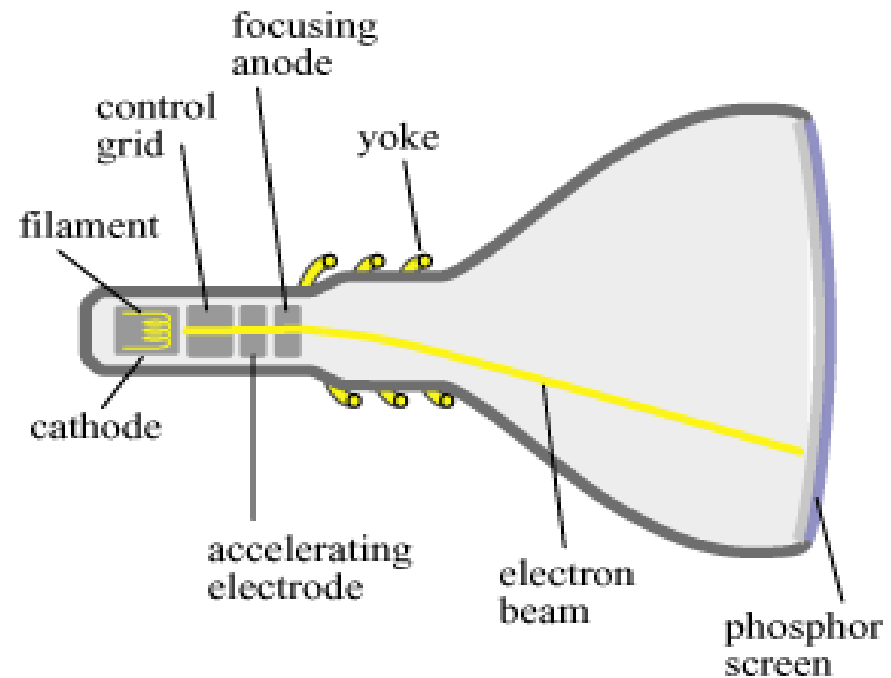
Actually, the electron gun does not just focus on a spot and shoot electrons at it. It systematically aims at every pixel on the screen, starting at the top left corner and scanning to the right edge. Then it drops down a tiny distance and scans another line, until it reaches the bottom of the screen. Then it starts over.

A color monitor works like a monochrome one, except that there are three electron beams instead of one. The three guns represent the primary additive colors (red, green, and blue), although the beams they emit are colorless. In a color monitor, each pixel includes three phosphors—red, green, and blue—arranged in a triangle.

When the beams of each of these guns arc combined and focused on a pixel, the phosphors light up. The monitor can display different colors by combining various intensities of the three beams.

A CRT monitor contains a shadow mask, which is a fine mesh made of metal, fitted to the shape and size of the screen. The holes in the shadow mask's mesh are used to align the electron beams, to ensure that they strike precisely the correct phosphor dot. In most shadow masks, these holes are arranged in triangles.
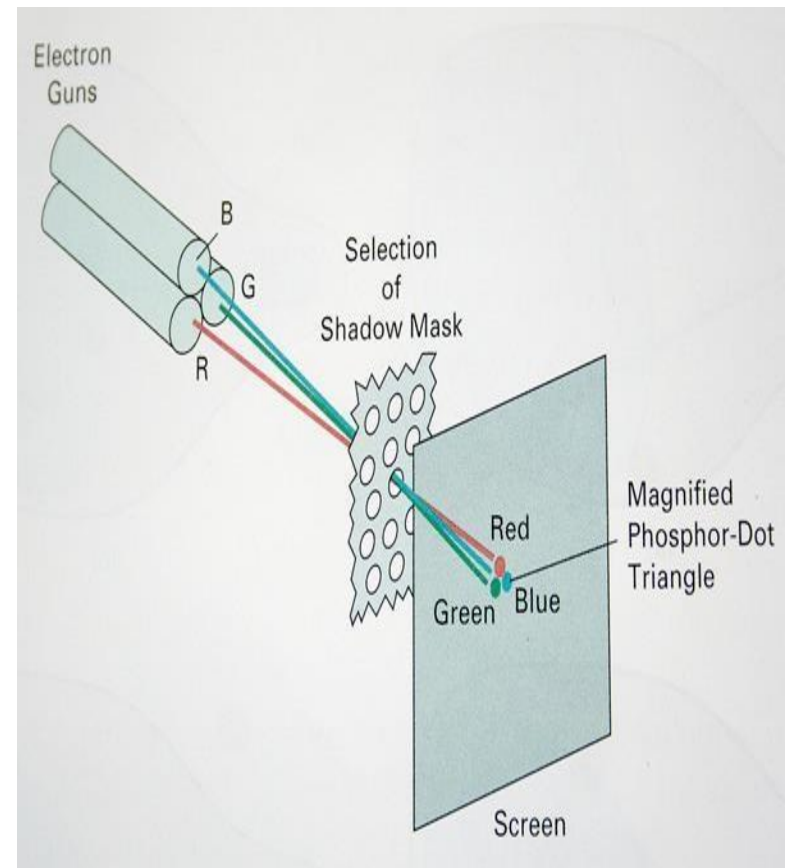
LCD and its uses

- Although flat-panel monitors have been used primarily on portable computers, a new generation of large, high-resolution, flat-panel displays is gaining popularity among users of desktop systems. These new monitors provide the same viewable area as CRT monitors, but they take up less desk space and run cooler than traditional CRT monitors.

- Flat-panel displays form images by manipulating electronically charged chemicals or gases sandwiched between the panes of glass or other transparent material.

- There are several types of flat-panel monitors, but the most common is the **liquid crystal display (LCD) monitor**. The LCD monitor creates images with a special kind of liquid crystal that is normally transparent but becomes opaque when charged with electricity.
- When a voltage is applied the crystals line up in a way that blocks light from passing through them and the absence of light is seen as characters on the screen.

- One disadvantage of LCD monitors is that their images can be difficult to see in bright light. For this reason, laptop computer users often look for shady places to sit when working outdoors or near windows. A bigger disadvantage of LCD monitors, however is their limited viewing angle—that is, the angle from which the display's image can be viewed clearly.

- With most CRT monitors, you can sec the image clearly even when standing at an angle to the screen. In LCD monitors, however; the viewing angle shrinks; as you increase your angle to the screen, the image becomes fuzzy or blurred quickly.

Plasma Display

- It is a type of flat panel display used for large TV displays. These thin displays are created by sandwiching a special gas such as neon or xenon between two sheets of glass. When the gas is electrified via a grid of small electrodes, it glows. By controlling the amount of voltage applied at various points on the grid, each point acts as a pixel to display an image.
- They are expensive but they provide high-quality images and can be much larger than LCDs. They are also used as a large-screen television.

A schematic matrix electrode configuration in an AC PDP
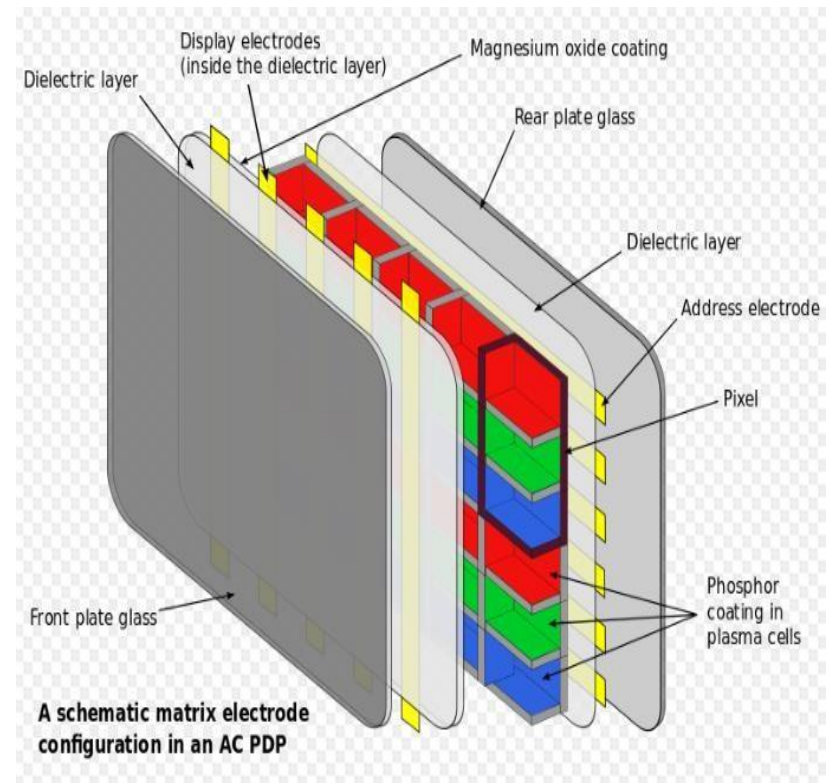
- The use of plasma in displays became popular because it could be used to create flat, large, thin televisions at a reasonable cost.
- Compared to conventional CRT displays, plasma displays are about one –tenth the thickness around 4 inch and one sixth the weight under 67 pounds for a 40 inch display.
- The use over 16 million colors and have a 160 degree-viewing angle.
- They offer excellent picture quality, they are quite expensive and are fast becoming the popular choice for HDTV.

ASSIGNMENT

1.WRITE THE ADVANTAGES AND DISADVANTAGES OF CATHODE RAY TUBE

2.WRITE THE ADVANTAGES AND DISADVANTAGES OF LCD.

3.WRITE THE DIFFRENCES BETWEEN CRT AND LCD.

4.WRITE THE ADVANTAGES AND DISADVANTAGES OF PLASMA

Printers

- Printers are one of the most popular output devices available for personal computers.

- It is hard-copy output device that prints text or any other information on paper.

- The first printers were actually typewriters are teletypewriters that were adapted to print binary data. These printers were often slow and noisy.

- Today, these are printers that print entire pages of text and graphics at full speed.

Factors Determining Printer Quality:

While determining printer quality, following factors should be considered important:
1. Resolution
2. Speed
3. Duty cycle

1. **Resolution:**

All printers work by laying down tiny dots of ink, toner. The dots are so small and close together that it seems like solid images. The sharpness of text and image per inch is called resolution. It is measured in linear dots per inch or "dpi".

2**. Speed:**

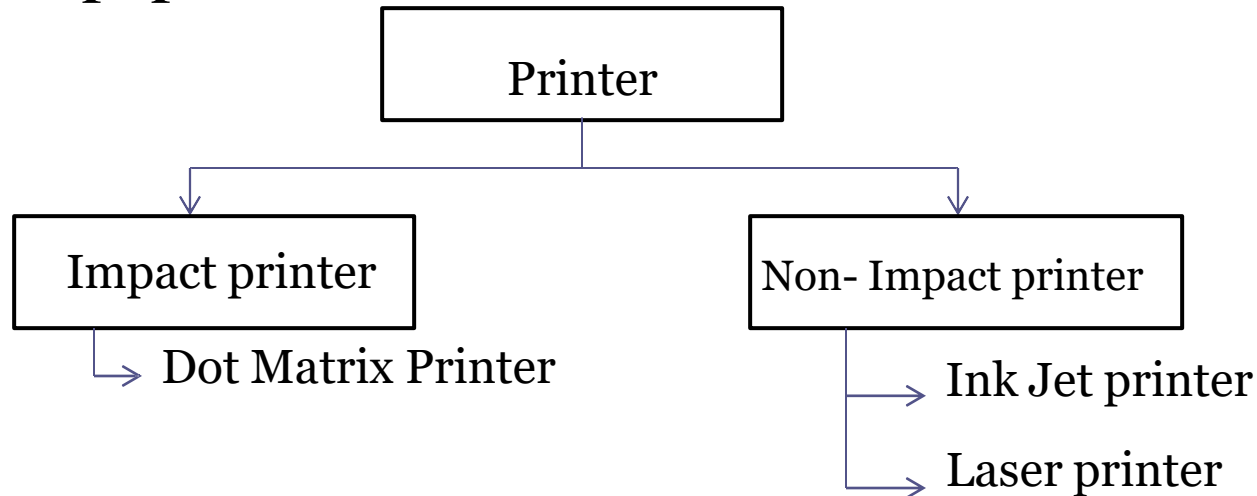It is measured in either character per second (cps) or pages per minute (ppm). Most printers have different cps or ppm ratings for text and graphics because graphics usually take longer time to print.

3. Duty Cycle:

It is generally expressed in pages per month, refers to how long you can work printer before it finishes its toner. Heavy duty cycle printers are required for offices having large volume of printing works.

Types of printer

Printers are classified as impact or non-impact printers, depending on the method used to print the characters on the paper.

```
                    ┌─────────────────┐
                    │     Printer     │
                    └─────────────────┘
                   ┌──────────┴──────────┐
                   ▼                     ▼
         ┌──────────────────┐   ┌──────────────────────┐
         │  Impact printer  │   │  Non- Impact printer │
         └──────────────────┘   └──────────────────────┘
                └──▶ Dot Matrix Printer      │──▶ Ink Jet printer
                                             │
                                             └──▶ Laser printer
```

1. Impact printer

- It creates an image by pressing an inked ribbon against the paper, using pins or hammers to shape the image.
- A simple example of impact printer is typewriter, which uses small hammers to strike the ribbon. Each hammer is embossed with the shape of the alphanumeric character; that shape is transferred through the inked ribbon onto the paper resulting in a printed character.
- It makes a lot of noise while printing. They can produce multiple copies of document at the same time.
- Example: Dot Matrix printer, Daisy Wheel printer, Line printer

2. Non-impact Printer

- They use several technology for printing, such as xerographic, electrostatic, electro sensitive, electro thermal, ink jet and laser. These printers print a complete page at a time and therefore are called as "page printers".
- These are the fastest of printers with speed approximation 20,000 lines of print per minute.
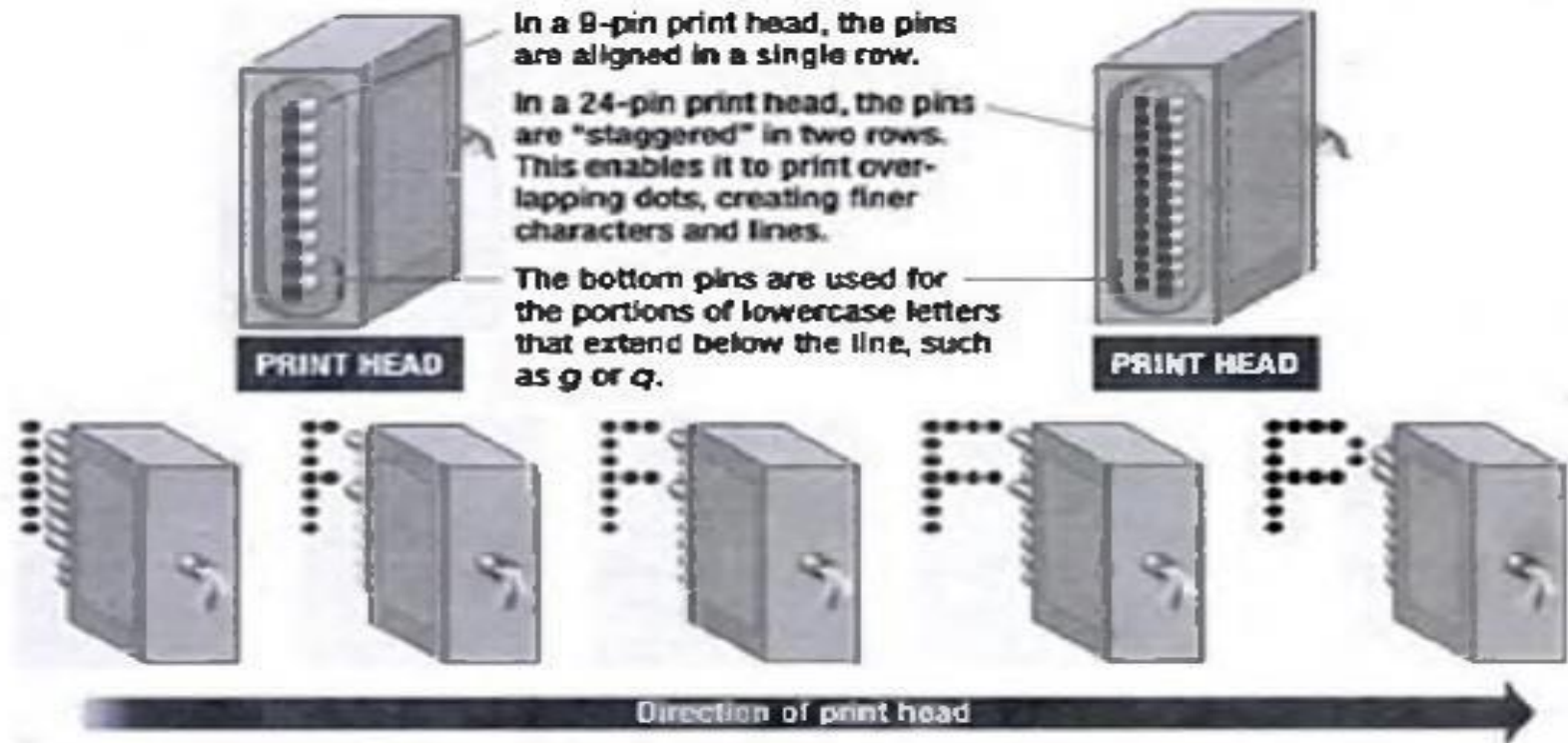- They are also much quieter than impact printer.

Differences

Impact printer	Non-impact printer
It is based on electromechanical mechanism.	It is based on thermal, chemical, laser mechanism.
It is slow while printing.	It is fast while printing.
It cannot print graphics perfectly.	It can print graphics perfectly.
Prints the document character by character ,line by line.	It prints the document one page at a time.
Low print quality and printing cost is also low.	High print quality and printing cost is high.
It produces noise while printing.	It is silent in nature while printing.
It can produce multiple copies of document at a time.	It produces one copy of document at a time.
Initial, operational and maintenance cost is low.	Initial, operational and maintenance cost is high.

Dot Matrix Printer

- These printers print the characters and all kinds of images by putting dots onto paper.

- These printers can produce multiple sheets of documents very quickly in a single print by using carbon papers.

- Compared to laser and ink-jet printers, dot matrix printers make lots of noise.

- The printing speed of these printer can be upto 360 cps.

- A dot matrix printer creates an image by using a mechanism called a print head, which contains a cluster (or matrix) of short pins arranged in one or more columns. On receiving instructions from the PC, the printer can push any of the pins out in any combination. By pushing out pins in various combinations, the print head can create alphanumeric characters.

In a 9-pin print head, the pins are aligned in a single row.

In a 24-pin print head, the pins are "staggered" in two rows. This enables it to print over-lapping dots, creating finer characters and lines.

The bottom pins are used for the portions of lowercase letters that extend below the line, such as g or q.

PRINT HEAD
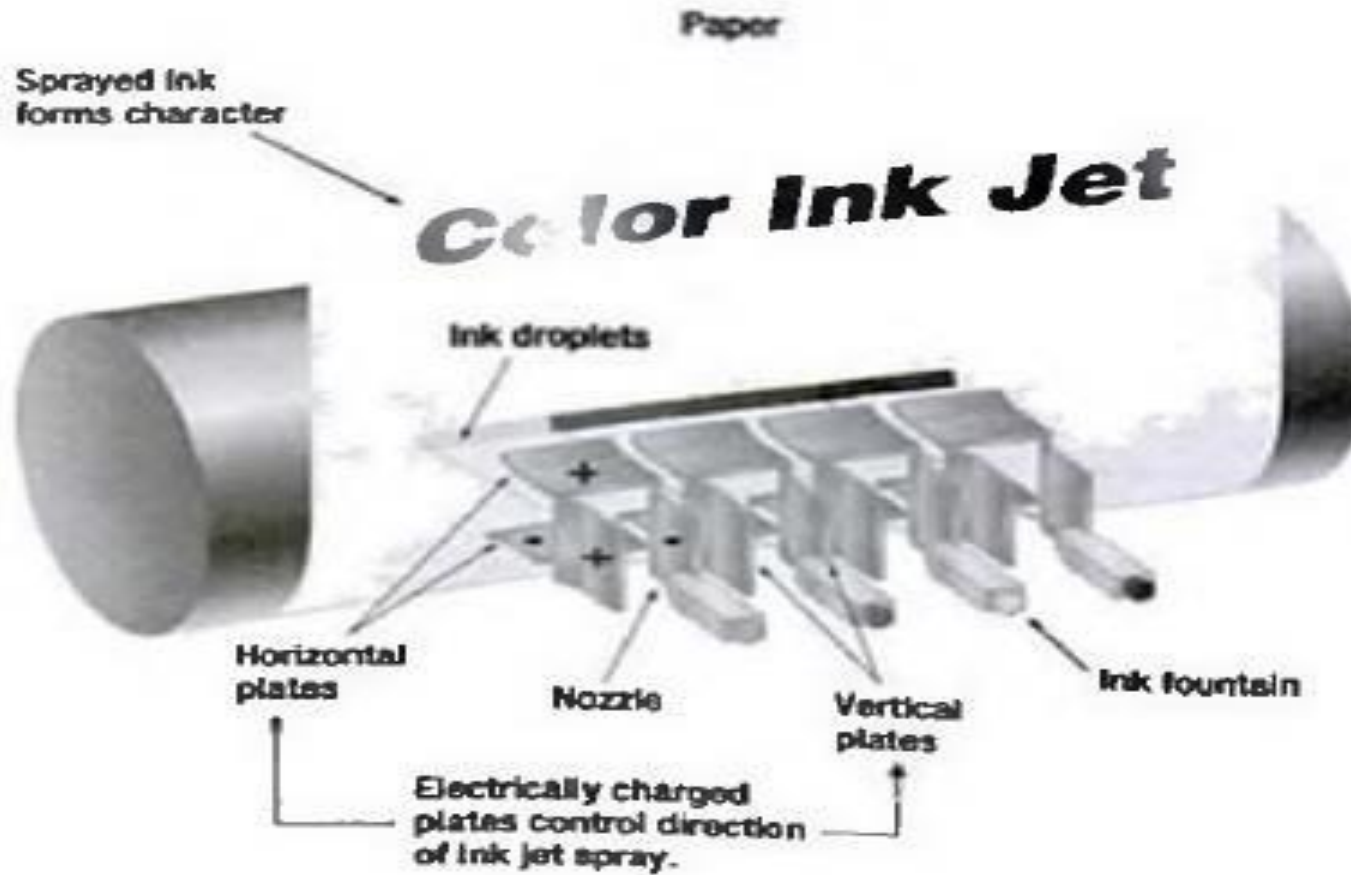
PRINT HEAD

Direction of print head

- When pushed out from the duster, the bulging pins' ends strike a ribbon, which is held in place between the print head and the paper. When the pins strike the ribbon, they press ink from the ribbon onto the paper. The more pins that a print head contains, the higher the printer's resolution. The lowest-resolution dot matrix printers have only nine pins; the highest-resolution printers have 24 pins.
- The speed of dot matrix printers is measured in characters per second (cps). The slowest dot matrix printers create 50 to 70 characters per second; the fastest print more than 500 cps. Although dot matrix printers arc not commonly used in homes, they are still widely used in business.

Ink jet Printer

- These printer prints character by spraying ink having iron content at a sheet of paper. Magnetized plates in the ink's path direct the ink into the paper in the desired shapes.
- These printers are capable of producing high quality print approaching that produced by laser printers.
- It provides a resolution of 300 dpi, although some new model offers higher resolutions.
- They are non-impact printers because they print by spraying ink on papers. These printers can print many special characters, different sizes of print and graphics such as charts.

- Some printers print with one single-sized ink droplet; others print using different-sized ink droplets and using multiple nozzles or varying electrical charges for precise printing.
- The print head for an ink-jet printer typically travels back and forth across the page, which is one reason why they are slower than laser printers.
- Color ink-jet printers provide an inexpensive way to print full color documents.
- Many ink jet printers use one cartridge for color printing and a separate black-only cartridge for black-and-white printing. This feature saves money by reserving colored ink only for color printing.
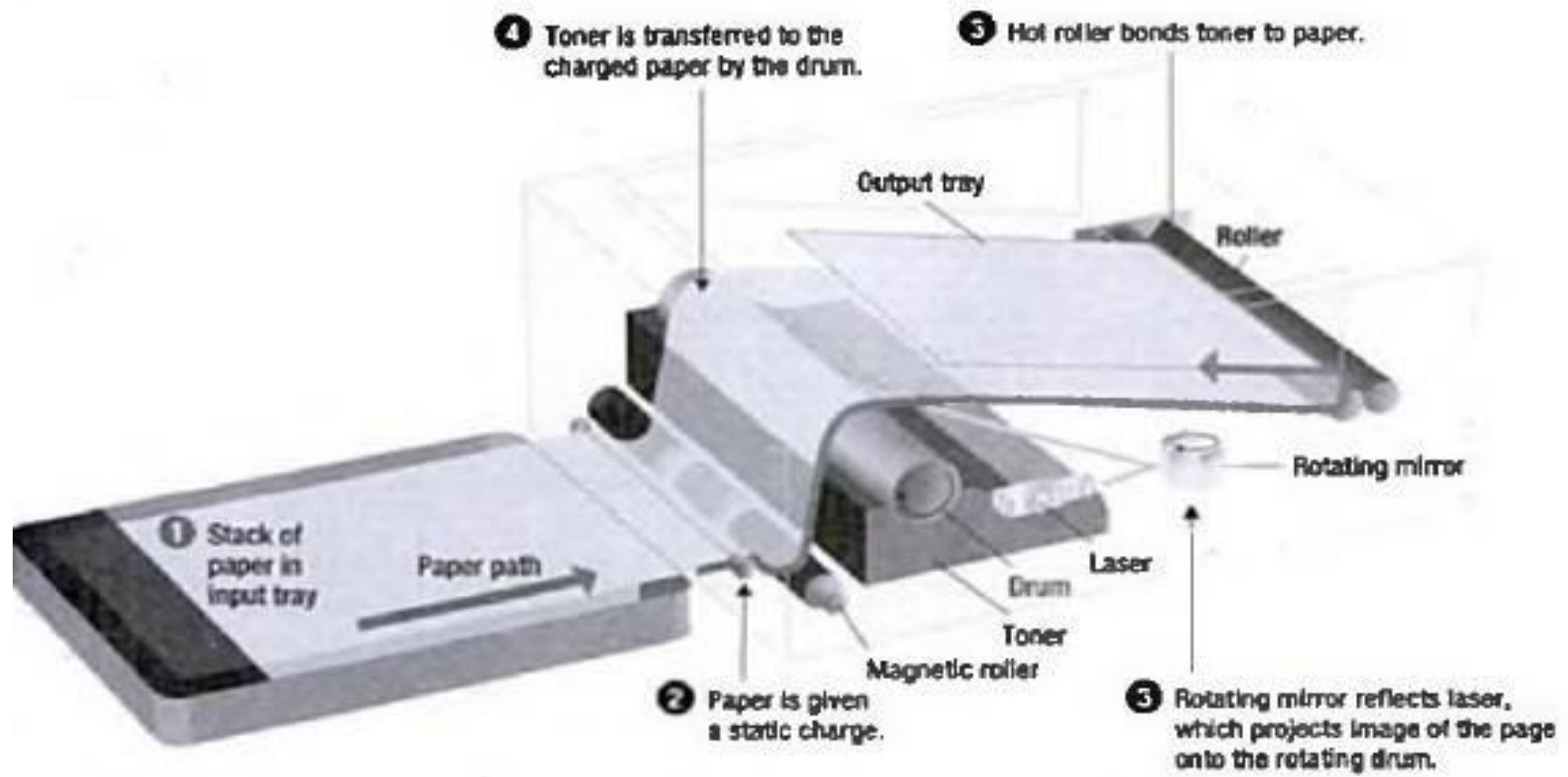
Paper

Sprayed ink forms character

Color Ink Jet

Ink droplets

Horizontal plates

Nozzle

Vertical plates

Ink fountain

Electrically charged plates control direction of ink jet spray.

- Color ink jet printers have four ink nozzles: cyan (blue), magenta (red), yellow, and black. These four colors arc used in almost all color printing because it is possible to combine them to create any color.
- Notice that the colors are different from the primary additive colors (red, green, and blue) used in monitors. Printed color is the result of light bouncing off the paper, not color transmitted directly from a light source. Color printing is sometimes called four color printing.

Laser Printers

- It utilizes a laser beam to produce an image on a drum.
- Laser technology is the latest development in high speed and high quality printing.
- Laser printers are the standard for business documents and available both as color and black and white printers.
- Laser printers print one entire page at a time and have better output quality than ink-jet.

- Just as the electron gun in a monitor can target any pixel, the laser in a laser printer can aim at any point on a drum, creating an electrical charge. Toner, which is composed of tiny particles of ink, sticks to the drum in the places the laser has charged.
- Then, with pressure and heat, the toner is transferred off the drum onto the paper. The amount of memory that laser printers contain determines the speed at which documents are printed.
- The speed of laser printers from about 10 to 200 pages of text per minute (ppm).

❹ Toner is transferred to the charged paper by the drum.

❺ Hot roller bonds toner to paper.

Output tray

Roller

Rotating mirror

Stack of paper in input tray

Paper path

Laser

Drum

Toner

Magnetic roller

❷ Paper is given a static charge.

❸ Rotating mirror reflects laser, which projects image of the page onto the rotating drum.

Speakers

- Speaker amplifies sound output.
- A good pair of speakers connected to sound card will give you loads of listening pleasure.
- Sound cards enable the computers output sound through speakers connected to the board, to record sound input from microphone connected to the computer, and manipulate sound stored on a disk.
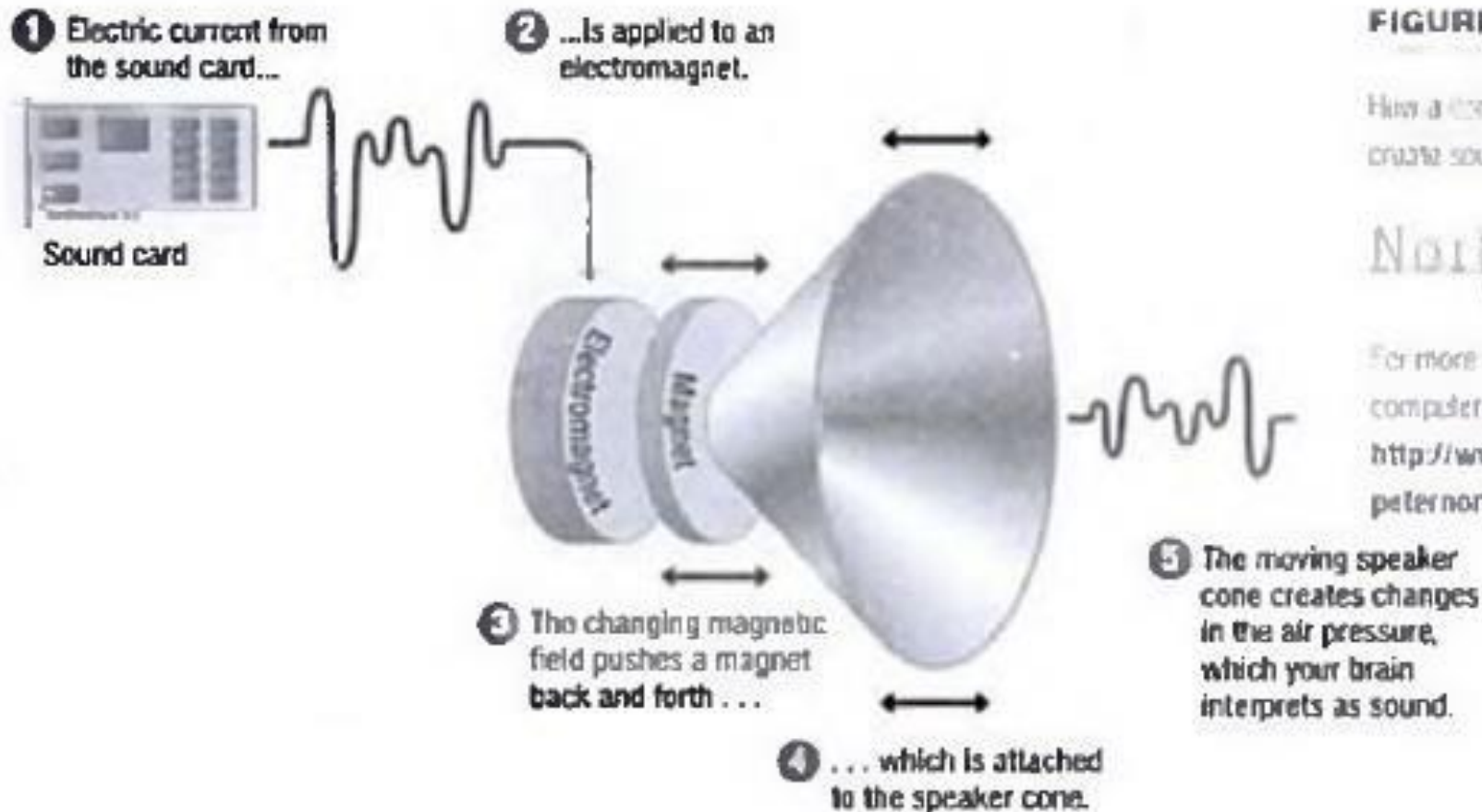- The audio output of the computer system relayed through the speakers.

① Electric current from the sound card...

② ...is applied to an electromagnet.

Sound card

Electromagnet

Magnet

③ The changing magnetic field pushes a magnet back and forth . . .

④ . . . which is attached to the speaker cone.

⑤ The moving speaker cone creates changes in the air pressure, which your brain interprets as sound.

FIGURE 3A

How a computer create sound

Norton
ON

For more inform computer soun

http://www.m

peter norton

Central Processing Unit (CPU)

- CPU is the main part of the computer that controls the overall operation of the computer. It is the brain of a computer which organize and executes the instruction.
- It is the most complex computer system component, for interpreting and executing most of the commands from the computers hardware and software.
- CPU runs program by fetching instructions from RAM, evaluating them, and executing them in sequence.
- The CPU circuitry of a microcomputer called a microprocessor that fits on a chip.
- As a computer generation has evolved, the size of the CPU has become smaller and its speed and capacity have increased tremendously.

Components of CPU

ALU

Does all the computing

Control Unit
Controls and checks

Registers
Workspace

RAM

ROM
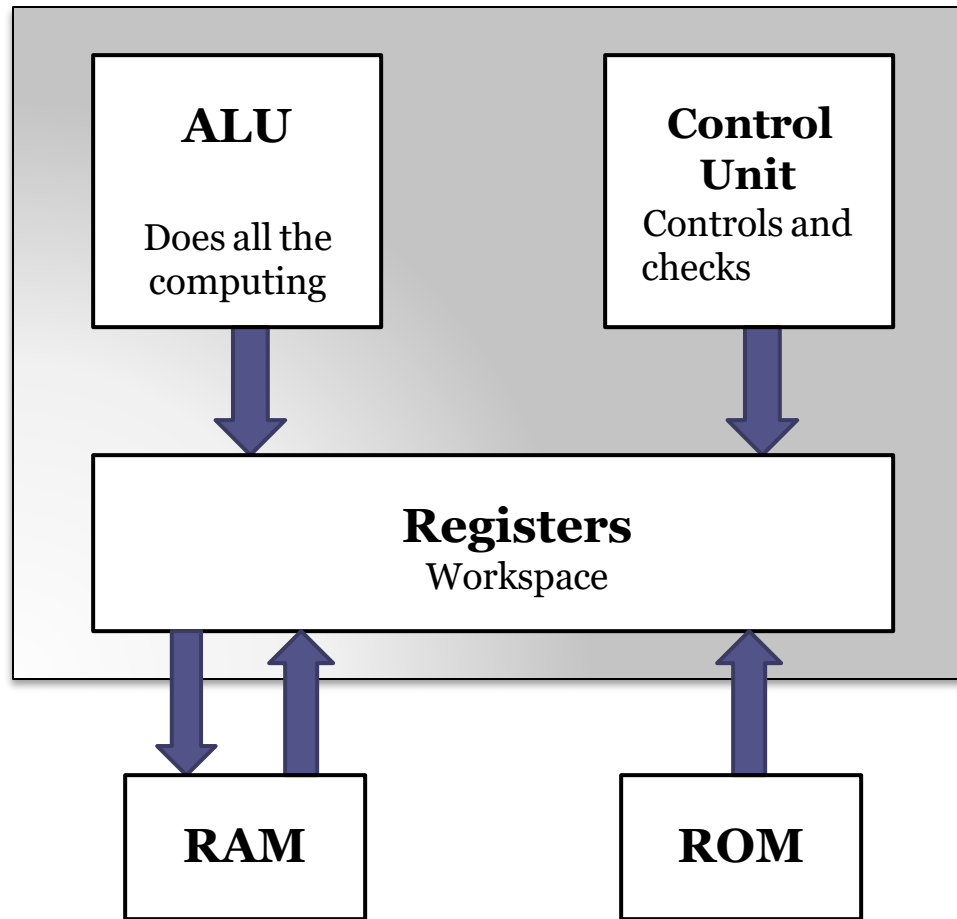
Figure: Block Diagram of CPU

Arithmetic Logic Unit (ALU)

- The ALU performs all the arithmetic and logical (comparison) functions i.e. it adds, subtracts, multiplies, divides and does comparisons.

- Many instructions carried out by the control unit involve simply moving data from one place to another- from memory to storage, from memory to the printer and so on.

- When the control unit encounters an instruction that involves arithmetic or logic, however, it passes that instructions to the ALU.

Functions of ALU:

- It accepts operands from registers.
- It performs arithmetic and logical operations.
- It results to register or a memory.
- The status of an ALU operation i.e. negative, carry, zero, overflow is available for writing into Flag register.

Operations Performed by the Arithmetic Logic Unit

Arithmetic Operations		Logical Operations	
+	add	=, ≠	equal to, not equal to
−	subtract	>, ≯	greater than, not greater than
×	multiply	<, ≮	less than, not less than
÷	divide	≥, ⊉	greater than or equal to, not greater than or equal to
∧	raise by a power	≤, ⊈	less than or equal to, not less than or equal to

Control Unit (CU)

- The control unit is responsible for directing and coordinating most of the computer system activities.
- The CPU's instructions for carrying out commands are built into the control unit. The instructions or instruction set, list all the operations that the CPU can perform. Each instruction in the instruction set is expressed in microcode- a series of basic directions that tell the CPU how to execute more complex operations.
- It determines the movement of electronic signals between the main memory and the ALU unit as well as the control signals between the CPU and input/ output devices.
- It controls the entire operation and manages all the computer's resources.

Functions of Control Unit

- It sends the input from the input device to the main memory.
- Then, raw data is send to the ALU for processing.
- It interprets the instructions in the program.
- It then sends back the processed data from the ALU to the memory.
- Finally it sends the meaningful information from the primary memory to the output unit.
- **The control unit repeats a set of four basic operations: <u>Fetching, Decoding, Executing and Storing.</u>**

Registers:

- Registers are special temporary storage locations within the CPU.
- They hold various types of information such as data, instructions, addresses and the immediate results of calculations when ALU performs the operation.
- Registers very quickly accept, store and transfer data and instructions that are being used immediately.
- To execute an instruction, the control unit of the CPU retrieves it from main memory and places it into a register.
- The number and types in a CPU vary according to the CPU's design.
- Newer microcomputer have 32-bit registers.

Although the number of registers varies from computer to computer, there are some registers which are common to all computers. Five registers that are essential for the instruction execution are:

- **Program Counter (PC):** contains the address of the next instruction to be fetched.
- **Instruction Register (IR):**contains the instruction most recently fetched i.e holds the last instruction fetched.
- **Memory Address Register (MAR):** contains the address of a location in memory for read and write operation.
- **Memory Buffer Register (MBR):** contains the value (data) to be stored in memory or the last value read from memory.
- **Accumulator (AC):** is a general purpose register used for storing temporary results produced by ALU.

BUS and its types:

- A collection of wires through which data is transmitted from one part of a computer to another is known as bus.
- It is an electrical or digital pathway through which bits are transmitted between the various computer components.
- The term bus refers to the internal bus of a computer system. It is also known as communication pathways.
- In other words, bus is the channel which lets the parts of a computer communicates with each other.

- It is a bus that connects all the internal components to the CPU and main memory.
- The size of a bus, known as width is important because it determines how much data can be transmitted at one time.
- Buses transfer data in parallel.
- In a 32 bit bus, data are sent over 32 wires simultaneously.
- Every bus has a clock speed measured in MHz.
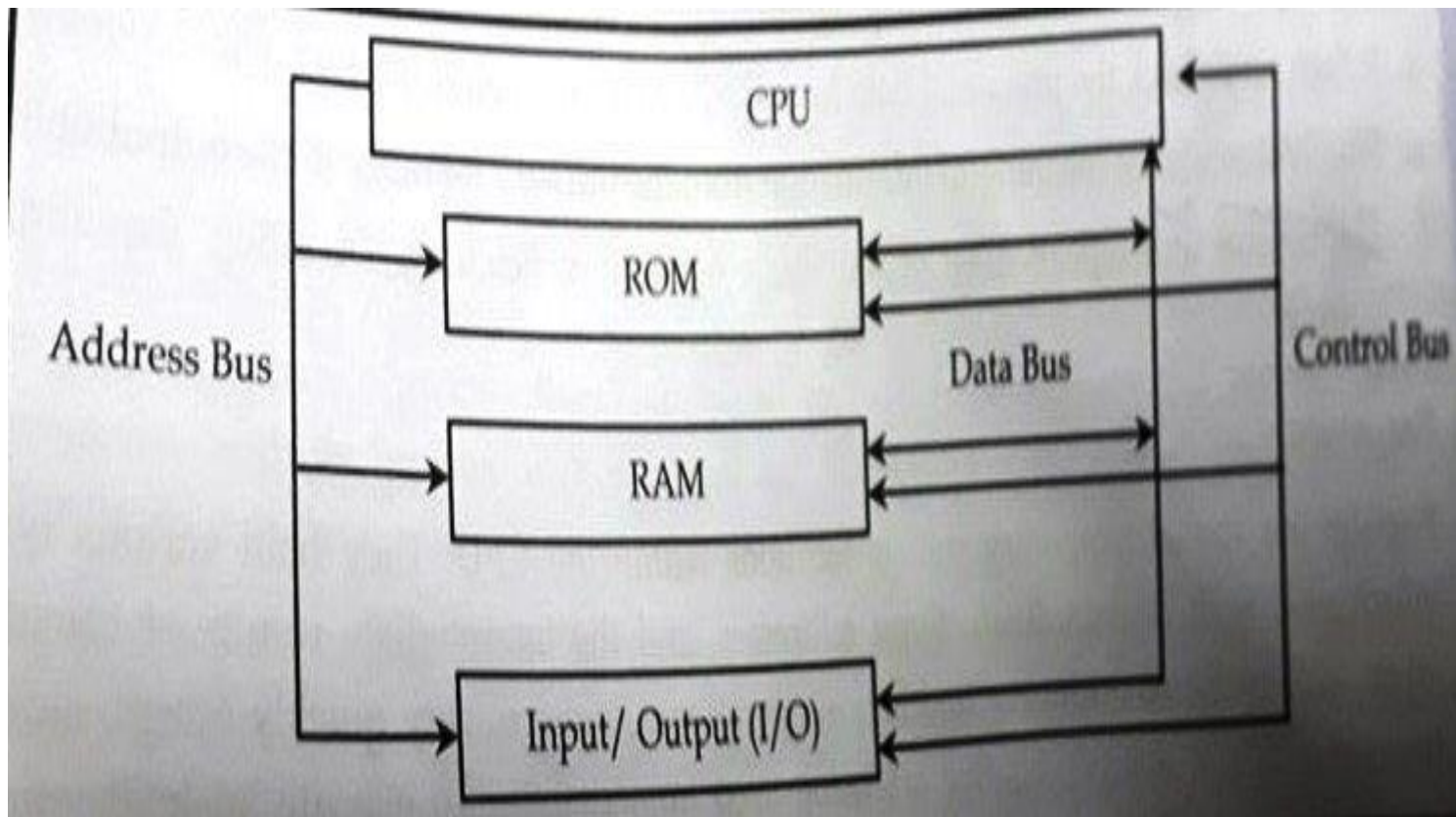
A bus is classified by name according to its functions:

1. **Control bus:**

- The physical connections that carry control information between the CPU and other devices within the computer.

- It carries signals that report the status of various devices.

- It is the path for all timing and controlling functions sent by the control units to other units of the system.

- For example, one line of the bus is used to indicate whether the CPU is currently reading from or writing to main memory. Others are *I/O Read/Write*

2. Address Bus:

- It is a channel which transmits addresses of data (not the data) from the CPU to memory.
- The address bus connects only the CPU and RAM and carries only memory address.
- The address bus consists of 16,24, or 32 parallel signal lines.
- The number of lines (wires) determines the amount of memory that can be directly addressed as each line carries one bit of the address.
- If the CPU has N address lines, then it can directly address 2^N address lines.
- For example, a computer with 32 bit address can address 4GB of physical memory.

3. Data Bus:

- Data bus is a channel across which actual data are transferred between the CPU, memory and I/O devices.

- The data bus consists of 8, 16, 32 or 64 parallel signal lines. Because each wire can transfer 1 bit of data at a time, an 8 wire bus can move 8 bits at a time which is a full byte.

- The number of wires in the bus affects the speed at which data can travel between hardware components. The wider the data bus, more data it can carry at one time.

- The data bus is **bidirectional** this means that the CPU can read data in from memory or it can send data out to memory.

Storage (Memory)

- Computer data storage, often called storage or memory that holds digital data used for computing for some interval of time.

- Storage of information is done in order to use them later.

- According to the nature of storage computer memory are classified as :

a) Primary memory

b) Secondary or Auxiliary memory.

Memory Hierarchy

The **memory hierarchy design** in a computer system mainly includes different storage devices. Most of the computers were inbuilt with extra storage to run more powerfully beyond the main memory capacity. The following **memory hierarchy diagram** is a hierarchical pyramid for computer memory. The designing of the memory hierarchy is divided into two types such as primary (Internal) memory and secondary (External) memory.
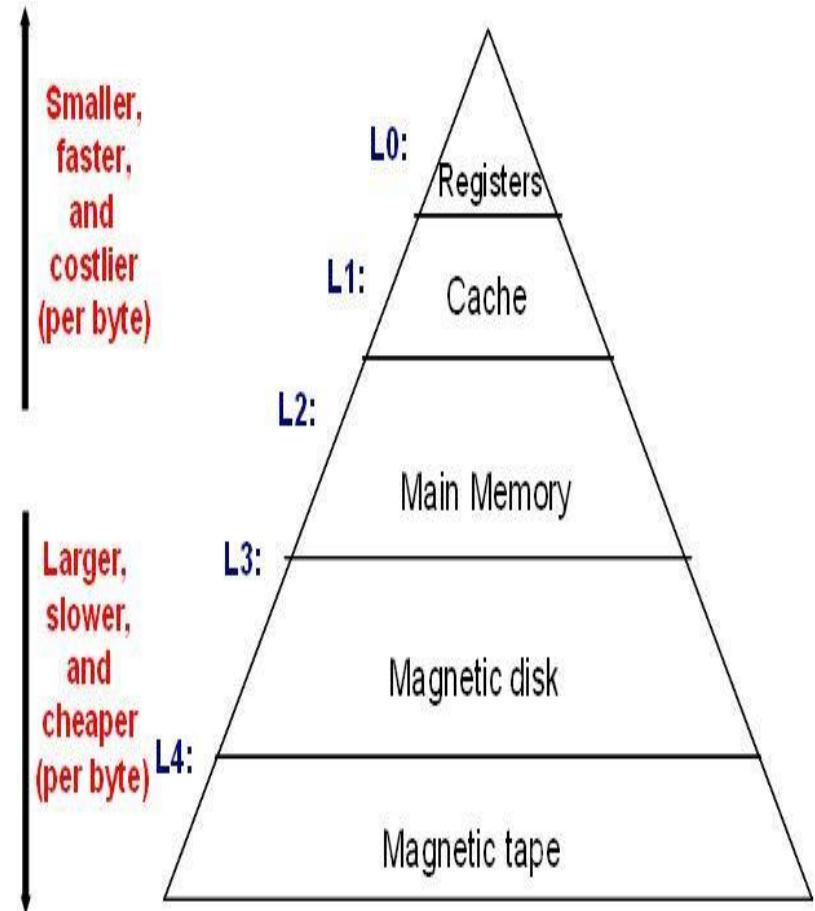
- ASSIGNMENT

EXPLAIN MEMORY HIERARCHY DIAGRAM IN YOUR OWN.

Primary Memory or Main memory

- It is the main area in a computer system where data is stored for quick access by the computer's processor also called main memory.
- CPU continuously reads instruction stored and executes from main memory. It is the working space used by computer to hold the program that is currently running, along with the data it needs to process.
- It is faster, expensive and small in size relative to the secondary memory. Normally, it is made up of semiconductors.
- The memory is accessed by CPU, in random fashion that means any location of this memory is accessed by CPU to either read information from it, or store information in it.
- It is attached to the processor via its address and data buses and it capacity is measure in terms of KB, MB or GB.

The primary memory is further divided into three categories:

a) Cache Memory
b) Random Access Memory (RAM)
c) Read only Memory (ROM)

Cache Memory

- A cache memory is supplementary primary memory system that temporarily stores frequently used instructions and data for quicker processing by the processor of computer.

- It is high speed memory that resides between the CPU and RAM in a computer.

- It stores data and instructions that the CPU is likely to need next.

- It is very expensive and generally incorporated in the processor, where valuable data and program segments are kept. This enables the processor to access data quickly whenever needed.

| Processor | ⟷ | Cache | ⟷ | Main memory |
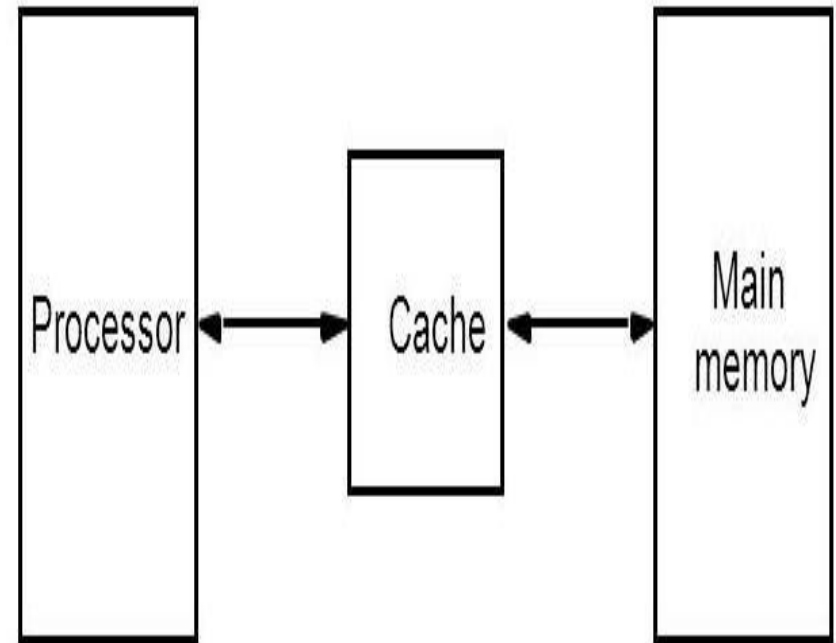
- The advantage of cache memory is that the CPU does not have to use the motherboard's system bus for data transfer so the CPU retrieves data or instruction more quickly from cache memory than it does from RAM or disk.

- To access the main memory CPU sends an address to it. In response of this, the main memory sends data contained at the specified memory address.

- On the other hand, cache memory uses parallel searching for required data. It first compares the incoming address to the address present in the cache. If the address matches, it is called **cache hit.** If cache hit is success then the data is retrieved from cache memory by the CPU. Then the corresponding data is read by the CPU.

- If the address does not match it is said that miss has occurred. **Cache miss** is the failure of retrieval of data from cache memory by the CPU. When a miss occurs, data is read from the main memory is also written to cache memory so that when this specific address is accessed next time a hit occurs.
- Cache can be further classified into two categories:

Level 1 Cache (L1):

also known as primary cache or internal cache, is built into the processor chip. It is a small fast memory area that works together with the Level 2 cache to provide the processor much faster access.

Level 2 Cache (L2):

also known as secondary cache or external cache, is a collection of static RAM chip that are built onto the motherboard. It is little larger and slower than L1 but is faster than main memory. L1 and L2 are used together for optimal use of the processor.

RAM (Random Access Machine)

- Memory that can be instantly changed is called read-write memory or random-access memory.
- It is a high speed memory that holds a copy of operating system, currently executing programs, and other information being processed.
- It can be written to and read from at any time.
- It is random because any of the bits and bytes that resides in RAM can be accessed non-sequentially.
- However, the information stored in RAM is temporary and volatile because the moment another program is fed in it, the initial program stored in that memory location gets erased.
- The data in RAM stays there only as long as the computer is on, and electricity is flowing through the machine.

- The information stored on the RAM gets wiped off when the power supply is turned off, increasing RAM improves the system performance.
- RAM has the following characteristics:
- Data within the RAM can be read or modified, i.e. you can either read from the RAM or write onto it. Hence it is called read/write memory.
- The contents of the RAM are lost when the computer is switched off. Hence RAM is said to be volatile.

Types of RAM

- The most common form of RAM used is built from semiconductor integrated circuit which are either static (SRAM) or dynamic (DRAM)

- **SRAM (Static Random Access Memory):**

- SRAM is a type of RAM that does not need to be refreshed as often and retains a value as long as power is supplied.

- This memory is made up of flip-flops and it stores a bit as a voltage.

- Each memory cell requires six transistors, therefore the memory chip has low density but high speed. Since they retain information for longer time, they are used as cache memory.

- SRAM is also considerably faster than that of DRAM.
- It is more expensive and consumes more power than DRAM and is not used frequently in PCs.
- **DRAM (Dynamic Random Access Time):**
- Dynamic RAM is made up of transistors, capacitors.
- These RAM are needed to be refreshed hundreds of times in a second. As the capacitors has the property of getting discharge the input has to be fed again and again.
- Slower, Cheaper, easily available & require less power
- Due to above advantages these are mostly used in today's world in all normal computers.
- They need to be recharged many time each second or they will loose their contents.

Other Types of RAM

- **Synchronous Dynamic RAM (SDRAM):**
- Its speed is synchronous means that it is directly dependent in the clock speed of the entire system.
- It is designed mainly to operate with stability at higher bus speeds such as 100 MHz.
- The advantage of SDRAM is its increased speed.
- It uses a pipelined design to cope up with the speed of CPU.
- **Video RAM:**
- It is the specialized RAM used in video cards.\
- It is dual ported that means it can be accessed by two different devices simultaneously.
- This enables data to be read from video RAM at the same time data is written to video RAM.

- **Non Volatile RAM (NVRAM):**
- Type of RAM that retains the information even when the power is turned off.
- It is integrated circuit chip and is thus able to obtain power needed to keep it running from the CMOS battery installed in motherboard.
- It keeps track of various system parameters such as serial number, MAC address, date of manufacturer, etc.

ROM (Read Only Memory)

- ROM is built-in computer memory containing data that can only be read, not written to it.
- It contains the program that allows computer to be "booted up" or regenerated each time you turn it on.
- ROM is non volatile memory because the data in ROM is not lost when the computer power is turned off. It is sustained by a small long-life battery in the computer.
- It is an ideal place to put the computers startup instruction that is software that boots the system called 'firmware'.
- So, it is necessary to contain the software that enables the computer to boot up, otherwise the processor would have no program in memory to execute when it is powered on.

- It contains the basic input/output system (BIOS) which is a set of instruction that is automatically activated when the computer is turned on.
- The memory of ROM depends on the model of the computer.

Types of ROM

- **Masked ROM:**
- The very first ROMs were hard wired devices that contained a pre-programmed set of data or instructions. These kinds of ROMs are known as masked ROM.
- The content if such ROMs have to be specified before chip production.
- **Programmable Read Only Memory (PROM):**
- It is the type of ROM chip that is blank when new and must be written with whatever data is necessary with a special device called a PROM programmer or burner.
- Once the PROM has been programmed, the information written is permanent and cannot be erased or deleted, so PROM is the ROM that can be written once.

- **Erasable Programmable Read Only Memory (EPROM):**
- It is the ROM that can be erased and reused.
- An EPROM can be erased by simply exposing the device to a strong source of ultraviolet light for 10 to 20 minutes, the ultraviolet light erases the EPROM chip by causing a chemical reaction that melts the fuse back.
- It is reconfigured using EPROM programmer.
- To store the content stored in EPROM, the chip should be removed from the system.

- **Electrically Erasable Programmable Read Only Memory (EEPROM):**
- It is a type of ROM that can be erased and reprogrammed using an electrical charge or electrical voltage.
- It is like an EPROM chip since it can be written in or programmed more than once.
- It need not to be taken out of the computer or electronic device of which it is a part when a new program or data needs to be written.
- The user can alter the value of certain cells without needing to erase the programming on other cells.
- Data stored in EEPROM is permanent until the user decides to erase and replace the information it contains.

- **Flash Memory:**
- It is a special type of EEPROM which can be erased and reprogrammed in blocks instead of single byte at a time.
- Many modern PCs have their BIOS stored on a flash memory chip so that it can be easily be updated if necessary. Such BIOS is sometimes called flash BIOS.
- It is used in digital phones, digital cameras, LAN switches, etc.

ASSIGNMENT:

1. WRITE ANY 6 DIFFERENCES BETWEEN SRAM AND DRAM.
2. WRITE 6 DIFFERENCES BETWEEN RAM AND ROM.
3. WRITE 5 DIFFERENCES BETWEEN PROM AND EPROM
4. WRITE 5 DIFFERENCES BETWEEN EPROM AND EEPROM

Secondary or Auxiliary Memory

- The primary or main memory is used to store only those instructions and data which are to be used immediately. Also, they are volatile in nature.
- However, the computer has to store a large amount of information. So, secondary storage is used for this purpose.
- Secondary storage is also called auxiliary storage and is used to store data and programs when they are not being processed.
- When the electricity supply to the computer is off, all data stored in the primary storage is destroyed except ROM. On the other hand, this is not true for secondary storage.
- The data stored in secondary storage can be stored for the desired time i.e. it holds information until it is deleted or overwritten.

- They function as backup devices which allows backup of the valuable information that is being worked on.
- They have high storage capacity and data stability and are less expensive.
- It is also known as external storage. In contrast, disks are random access media because a disk drive can access any point at random.
- Example: magnetic tape, magnetic disk, pendrive, floppy disk, memory card, etc.

ASSIGNMENT

WRITE THE DIFFERENCES BETWEEN PRIMARY AND SECONDARY MEMORY.

Magnetic Tape

- It is one of the most popular sequentially access storage mediums for large data.
- It consists of a thin tape with a coating of a fine magnetic material.
- It is used for recording analog or digital data. Data is stored in frames across the width of the tape. Magnetic tape is one-half inch or one-quarter inch ribbon of plastic material on which data is stored.
- The tape drive is an input/output device that reads, writes and erases data on tapes.
- They are erasable, reusable and durable.
- It is not suitable for data files that are revised or updated frequently because it stores data sequentially. It is still been used by some banks to take backup.

- Storing data on tapes is considerably cheaper than storing data on disks. It also have large storing capacities ranging from a few hundred KB to several GB.

- Accessing data on tapes however is much slower than accessing data on disks. Tapes are sequential access media, which means that to get to a particular pint on the tape, the tape must go through all the preceding points.

- Because tapes are slow, they are generally used only for long-term storage and backup.

Magnetic Disk

- These are the most widely used storage medium for computers.
- It offers high storage capacity, reliability and the capacity to directly accessing stored data.
- It holds more data in a small place and attain faster data access speed. Data from magnetic disk can be accessed randomly.
- They are flat circular plates of metal or plastic coated on both sides with iron oxide.
- Input signals, which may be audio, video or data are recorded on the surface of a disk as magnetic patterns or spots in spiral tracks by a recording head while the disk is rotated by a drive unit. The head is also used to read the magnetic imprsessions on the disk.

- Data can be recorded and erased on a magnetic disk any number of times.

- Types of magnetic disks include hard disk, removable disk cartridges.
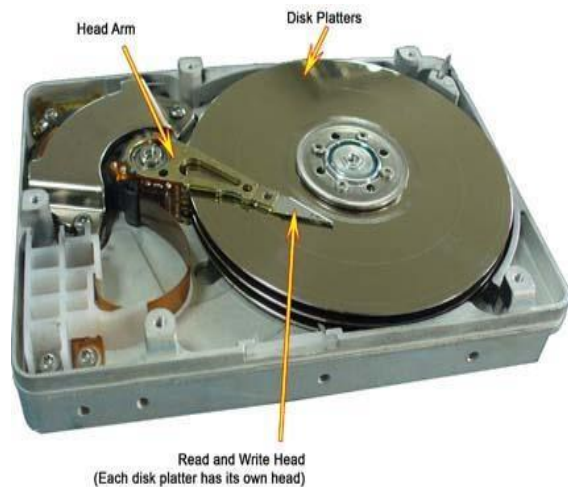
ASSIGNMENT

1. Write the advantages, disadvantages of magnetic tape.
2. Write the advantages, disadvantages of magnetic disk.
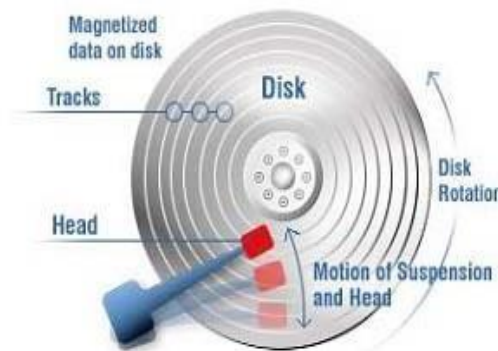3. Write notes on Floppy Disk.

Hard Disk

- It is the storage medium within the computer that stores and provides relative quick access to large amount of data.

- It is a set of stacked (piled up) disks called patters made up of aluminum material that are coated with iron-oxide on both sides.

- The disk is permanently sealed in a metal case due to the sensitive operation they perform; the presence of even a small dust particle can destroy the hard disk.

- A single hard disk usually consists of several platters. Each platters require two read/ write heads one for each side. All the read, write heads are attached to a single access arm so that they cannot move independently. The platters are spaces several millimeters apart.

- Each platter has a same number of tracks and n^{th} track of each platter taken together is called a cylinder.
- The storage capacity of the hard disk contains several GBs.
- The major drawback of hard disk is to achieve the optimum performance, the read/ write head must be extremely close to the surface of the disk.

Head Arm   Disk Platters

Read and Write Head
(Each disk platter has its own head)

Inside Hard Disk

HARD DRIVE DATA READ & WRITE OPERATION MOTION DIAGRAM

Magnetized data on disk

Tracks   Disk

Disk Rotation

Head

Motion of Suspension and Head

Pendrive

- It is a portable USB flash drives consist of flash memory media integrated into a self-contained unit that connects to a computer or other device via a standard USB port.

- USB (Universal Serial Bus) is a standard that allows a wide array of devices to connect to a computer through a common port.

- They are designed to be very small and very portable. These devices can be used to transfer different files from hard drive of one computer to another. It also functions as portable hard disk.

- They are plug and play portable storage devices that use flash memory and are light weight enough to carry. To read from or write to a pen drive just plug it into a USB and files can be read from or written to the pen drive until it is plugged from the USB port.

Memory Card

- A memory card sometimes called a flash memory card or a storage card is a small storage medium used to store data such as text, pictures, audio and video for use on small, portable computing devices.

- It is used in digital cameras, mobile phones, music players, etc.

- They offer high re-record-ability, power-free storage.

- They are available in variety of formats such as SD (Secure Digital), SDHC (Secure Digital High Capacity), etc.

Optical Disks

- They are a storage medium from which data is read and to which it is written by lasers.
- These disks consist of a circular disks, which are coated with a thin metal or some other material that is highly reflective. A very fine laser bean is projected to the reflective surface to read data from the disk. By detecting the light intensity reflected from the surface, the information stored on the disk can be accessed.
- It became preferred medium for music, movies and software program because of its many advantages.
- It is compact, durable. lightweight and digital.
- It provides a minimum of 650 MB of data storage. Examples: CD, DVD, Blu-ray, etc.

Compact Disk (CD)

- It is a small, portable, round medium made of molded polymer for electronically recording, storing, and playing back audio, video, text and other information in digital form.

- The process of recording/ writing data to the optical disk is called burning.

- Initially, CDs were read-only but newer technology allows user to record as well.

- Standard CDs have a diameter of 120 mm and can hold upto 80 minutes of audio. There is also Mini CD, with diameters ranging from 60 to 80 mm, which can store upto 24 minutes of audio.

- Some variations of the CD include:
1. CD-ROM: information in CS-ROMs are stamped by the vendor, and once stamped; they cannot be erased and filled with new data but its contained data can be read several times.
2. CD-R (CD- Recordable):it is also Write Once Read Many (WORM). The data can be written only once. After that this disk behaves like CD-ROM.
3. CD-RW (CD- Read/Write): optical disks that can be erased and loaded with new data like magnetic disks. They are also referred as "Erasable Optical" disks.
4. Video CD (VCD): is a standard digital format for storing video on compact disk.

DVD (Digital Video/ Versatile Disk)

- It is an optical disk technology with 4.7 GB storage capacity on a single-sided, one layer disk which is enough for a 133 minute movie.

- It can be single or double sided, and can have two layers on each side; a double-sided, two layered DVD will hold upto 17 GB of video, audio, etc.

- DVD was originally said to stand for Digital Video Disk, and later for digital versatile disk.

- Variations of the term DVD often describe the way the data is stored on the disk: DVD-R and DVD+R can only record data once and then function as DVD-ROM. DVD- RW, DVD+RW and DVD-RAM can both record and erase data multiple times.

- The DVD specification supports disks with capacities form 4.75 GB to 17 GB with access rates of 600KBps to 1.3 MBps.
- An additional feature of DVD drives is that the are backward-compatible with CD-ROMs meaning they can play CDs as well as DVDs.

Blu-ray Disk

- It is an optical disk format designed to display high definition video and store large amount of data. It is the successor to DVD.
- The standard was developed collaboratively by Philips, samsung, sony, LG.
- The format's name comes from the fact that a blue laser reads from and writes to the disk rather than the red laser of DVD players.
- Single sided Blu-ray can store up to 27 GB and dual-layer can store upto 50 GB.
- Its high capacity makes it the perfect media for distributing high –definition movies.