INTRODUCTION TO COMPUTERS.

Definition of a Computer:

- A **Computer** is an electronic device that operates (works) under the control of programs stored in its own memory unit.
- A computer is an electronic machine that processes raw data to give information as output.
- An **electronic device** that accepts data as input, and transforms it under the influence of a set of special instructions called **Programs**, to produce the desired output (referred to as **Information**).

A computer automatically accepts data & instructions as input from an Input device, stores them temporarily in its memory, then processes that data according to the instructions given, and finally transfers the processed data (Information) to an Output device.

Explanations;

- A computer is described as an *electronic device* because; it is made up of electronic components and uses **electric energy** (such as electricity) to operate.
- A computer has an internal memory, which stores data & instructions temporarily awaiting processing, and even holds the intermediate result (information) before it is communicated to the recipients through the **Output devices**.
- *It works on the data using the instructions issued,* means that, the computer cannot do any useful job on its own. It can only work as per the set of instructions issued.

A computer will accept data in one form and produce it in another form. The data is normally held within the computer as it is being processed.

Program:

- A computer **Program** is a set of related instructions written in the language of the computer & is used to make the computer perform a specific task (or, to direct the computer on what to do).
- A set of related instructions which specify how the data is to be processed.
- A set of instructions used to guide a computer through a process.

Data:

Data is a collection of raw facts, figures or instructions that do not have much meaning to the user.

- Data may be in form of numbers, alphabets/letters or symbols, and can be processed to produce information.

TYPES OF DATA.

There are two types/forms of data:

a). Digital (discrete) data:

Digital data is discrete in nature. It must be represented in form of numbers, alphabets or symbols for it to be processed by a computer.

- Digital data is obtained by counting. E.g. 1, 2, 3 …

b). Analogue (continuous) data:

Analogue data is continuous in nature. It must be represented in physical nature in order to be processed by the computer.

- Analogue data is obtained by measurement. E.g. Pressure, Temperature, Humidity, Lengths or currents, etc
- The output is in form of smooth graphs from which the data can be read.

Data Processing:

- It is the process of collecting all items of data together & converting them into information.
- *Processing* refers to the way the data is manipulated (or handled) to turn it into information.

The processing may involve calculation, comparison or any other logic to produce the required result. The processing of the data usually results in some meaningful information being produced.

Information:

Information is the data which has been refined, summarized & manipulated in the way you want it, or into a more meaningful form for decision-making.

- The information must be accurate, timely, complete and relevant.

Comparison between Data and Information.

Data	Information
1. Unprocessed (raw) facts or figures.	**1.** It is the end-product of data processing (processed data)
2. Not arranged.	**2.** Arranged into a meaningful format.
3. Does not have much meaning to the user.	**3.** More meaningful to the user.
4. Cannot be used for decision-making.	**4.** Can be used to make decisions.

Characteristics / Features of a Computer.

Before 20th century, most information was processed manually or by use of simple machines. Today, millions of people are using computers in offices and at home to produce and store all types of information

The following are some of the attributes that make computers widely accepted & used in the day-to-day activities in our society:

1. Speed.

Computers operate at very high speeds, and can perform very many functions within a very short time.

They can perform a much complicated task much faster than a human being.

The speed of a computer is measured in **Fractions of seconds**.

Millisecond - a thousandth of a second (10^{-3})
Microsecond - a millionth of a second (10^{-6})
Nanosecond - a thousand millionth of a second (10^{-9})
Picosecond - a million millionth of a second (10^{-12})

The speed of a computer is usually linked to the technology used to build it.

a). 1st Generation computers (1940s & early 1950s).

The computers were built using **Vacuum tubes**, and the speed was measured in **Milliseconds**. E.g., a computer could perform 5,000 additions & 300 multiplications per second.

b). 2nd Generation computers (1950s & early 1960s).

Were built using **Transistors**. Their operation speeds increased & were measured in **Microseconds**. E.g., a computer could perform 1 million additions per second.

c). Mid 1960s.

Integrated Circuit (**IC**), which combined a no. of transistors & diodes together on a silicon chip, was developed.

The speed increased to tens of millions of operations per second.

d). In **1971, Intel Corporation** produced a very small, single chip called a **Microprocessor**, which could perform all the operations on the computer's processor. The chip contained about 1,600 transistors.

e). Today's microprocessors are very powerful, cheaper & more reliable due to the use of the **Large Scale Integration** (**LSI**) & **Very Large scale Integration** (**VLSI**) technologies, which combines hundreds of thousands of components onto a single chip. The computer speeds are now measured in **Nanoseconds** & **Picoseconds**.

2. Accuracy:

Unlike human beings, computers are very accurate, i.e., they never make mistakes.

A computer can work for very long periods without going wrong. However, when an error occurs the computer has a number of in-built, self-checking features in their electronic components that can detect & correct such errors.

Usually errors are committed by the users entering the data to the computer, thus the saying **Garbage in Garbage Out** (**GIGO**).
This means that, if you enter incorrect data into the computer and have it processed, the computer will give you misleading information.

3. Reliability.

The computer can be relied upon to produce the correct answer if it is given the correct instructions & supplied with the correct data.

Therefore, if you want to **add** two numbers, but by mistake, give the computer a "*Multiply*" instruction, the computer will not know that you intended to "ADD"; it will multiply the numbers supplied.

Similarly, if you give it the ADD instruction, but make a mistake and enter an incorrect data; let say, 14 & 83 instead of 14 & 38; then the computer will produce the "wrong" answer 97 instead of 52. However, note that, 97 is 'correct' based on the data supplied.

Therefore, the output produced by a computer is only as reliable as the instructions used & the data supplied.

4. Consistency:

Computers are usually **consistent**. This means that, given the same data & the same instructions, they will produce the same answer every time that particular process is repeated.

5. Storage:

- A computer is capable of storing large amounts of data or instructions in a very small space.
- A computer can store data & instructions for later use, and it can produce/ retrieve this data when required so that the user can make use of it.
- Data stored in a computer can be protected from unauthorized individuals through the use of passwords.

6. Diligence:

Unlike human beings, a computer can work continuously without getting tired or bored. Even if it has to do a million calculations, it will do the last one with the same speed and accuracy as the first one.

7. Automation:

A computer is an **automatic device**. This is because, once given the instructions, it is guided by these instructions and can carry on its job automatically until it is complete.

It can also perform a variety of jobs as long as there is a well-defined procedure.

8. <u>Versatile</u>:

A computer can be used in different places to perform a large number of different jobs depending on the instructions fed to it.

9. <u>Imposition of a formal approach to working methods</u>:

Because a computer can only work with a strict set of instructions, it identifies and imposes rigid rules for dealing with the data it is given to process.

Review Questions.

1. What is a Computer?
2. Why is a computer referred to as an electronic device?
3. Define the following terms as used in computer science.
   a). Data.
   b). Programs.
   c). Data processing.
   d). Information.
4. **(a)** Briefly explain the two forms of data.
   (b) Give THREE differences between Data and Information.
5. The speed of a computer is measured in _____.
6. What does the term GIGO stands for?
7. List and explain 4 salient features/ properties of a computer.
8. List FIVE advantages of a computerized system over a manual system.

PARTS OF A COMPUTER.

A computer is made up of a collection of different components that are interconnected together in order to work as a single entity.

A Computer consists of the following parts/devices: -

1. The System Unit.
2. Input devices.
3. Output devices.
4. Storage devices.

System Unit.

This is the casing (unit) that houses electronic components such as the '*brain'* of the computer called the **Central processing Unit** (**CPU**) and storage devices.

The components in the System unit include: -

- Central Processing Unit (CPU), which is also referred to as **Processor**.
- Motherboard.
- Power supply unit.
- Memory storage devices.
- Disk drives, which are used to store, record and read data.

Types of System units

There are two makes of System units:

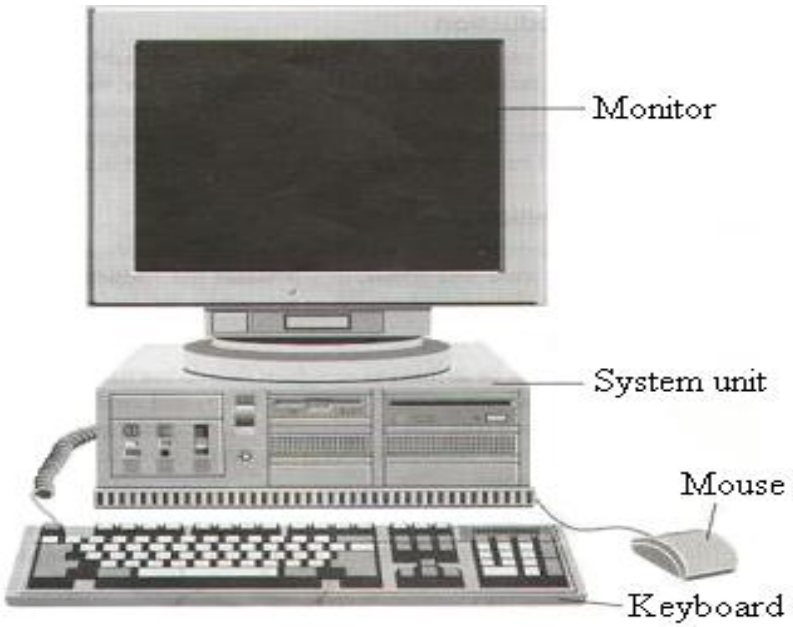
a) *Tower style system unit*

This system unit is made to stand alone. They are designed to be placed on the floor.

- Tower style units have more space for expansion than the typical desktop units.

b) *Desktop system units*

Desktop units lie on the desk with the monitor resting on top of the system unit.



Features of the System unit.

- It houses the CPU.
- It connects to all peripheral devices using ports.
- It has the computer's Power switch.

The Central processing unit (CPU)

This is the brain of the computer, and carries out all the processing within the computer.

Input devices.

These are the devices used to enter/put data into the computer.

- They accept data for processing & convert it into a suitable form that the computer can understand.

Examples: Keyboard, Mouse, Joysticks, Light pen, Scanner, etc.

The Keyboard

The keyboard looks like a typewriter, and has letters, numbers and other keys through which data is entered into the computer.

To enter data & instructions into the computer, the user should press the required keys.

The Mouse

It is a pointing device that enables the user to issue instructions to the computer by controlling a special mouse pointer displayed on the screen.

Output devices.

Output devices are used to give the end results of data that was entered into the computer.

- They extract/ disseminate processed data (information) from the computer.
- They accept data from processing devices & convert it into human sensible form.

Examples: Screens (Monitors), Printers, Graph plotters, Speakers, etc

The Monitor

It is a television like screen used for displaying output. When you type a letter or number on the keyboard, it shows up on the monitor.

Note. The monitor enables the user to monitor/track or see what is going on in the computer.

Printer

Printers are used to create permanent copies of output on paper.

Memory storage devices.

These are devices used to store programs & data in computers.

- They hold data & programs until they are needed for processing.
- They also hold the results after processing.

Computer storage is divided into 2:

i). Primary (main) storage.

This is the storage found within the computer itself. It is used to hold data, programs & instructions required immediately (or currently being used) by the Processor.

Examples: Random Access Memory (RAM) & Read Only Memory (ROM).

ii). Secondary (Backing) storage.

It is used by the computer to store backup information that is not needed immediately by the Processor. It is also used by the computer to supplement the computer's main memory/ internal memory in case of mass storage purposes.

Secondary storage units provide permanent data storage facilities. They allow large quantities of information to be stored permanently on some form of magnetic media such **Magnetic tapes** or **disks**.

The programs & data are transferred to & from the secondary storage units to the Main memory only when they are required; hence the information is said to be **online** to the computer.

Examples of secondary storage devices:

- Hard disk * Floppy disks. ***** Magnetic Tapes.
- Cassette tapes. * Punched cards. * Zip disks.
- Compact disks * Digital Video Disks (DVDs).

Computer peripherals.

A computer is basically made up of a system unit and other devices connected to the system unit called ***Peripheral devices***.

Peripheral devices are the elements (components) connected to the system unit so as to assist the computer satisfy its users.

Peripheral devices are connected to the System unit using special cables called ***data interface cables*** that carry data, programs & information to and from the processor. The cables are connected to the system unit using connectors called ***Ports***.

Examples of peripheral devices include;

- Monitor, - Keyboard, - Mouse
- Printer. - Modem. - Speakers.
- Plotter.

Review Questions.

1. List down the components that make up a computer.
2. Clearly draw and label the main physical parts of a simple computer system.
3. What are computer peripherals?
4. **(a).** Name and explain the two main divisions of computer storage.
(b). Give two common examples of secondary storage devices.
5. Name two output devices.
6. **(a).** Explain the term System unit.
(b). Name some of the components found in the System unit.
(c). Give three features of a computer's System Unit.
7. Why is the screen also called a Monitor?
8. What is a Mouse in relation to computing?

DEVELOPMENT OF COMPUTERS.

HISTORY OF COMPUTING.

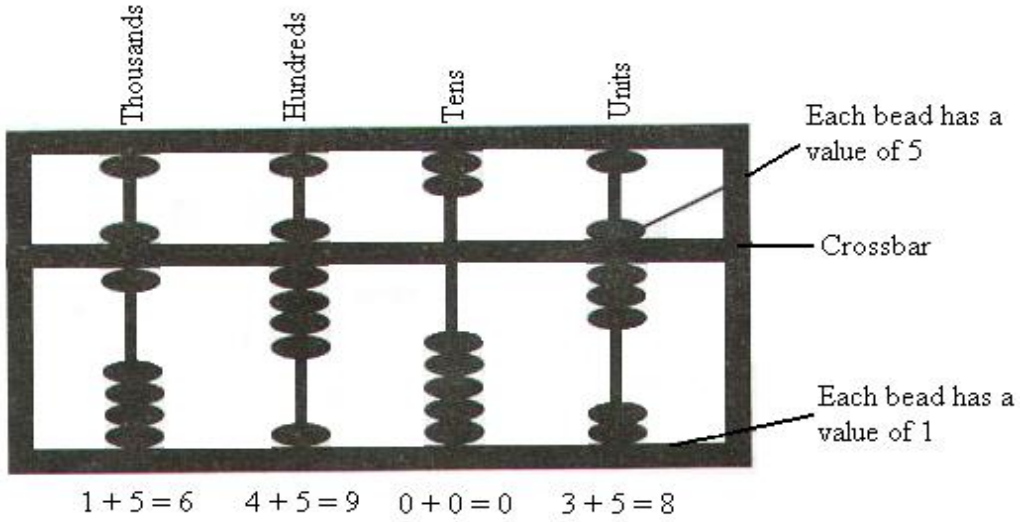
Before 1900, most data processing was done manually using simple tools like stones & sticks to count and keep records.
Around 2000 years ago, Asian merchants came up with a special calculating tool called **Abacus** that could be used to calculate large figures.

An Abacus is made up of a rectangular frame and a crossbar at the middle. It is fitted with wires or strings running across from the frame to the crossbar.

How to represent a number using an Abacus.

Each bead in the lower row has a value of 1, while each bead in the upper row has a value of 5. To represent a number, the bead is moved to the crossbar. Those beads away from the crossbar represent zeros.

The Figure below represents the number 6908 (Six thousand nine hundred and eight).



After Abacus, the first machine that is usually regarded as the forerunner of modern computers was named the **Analytical Engine**, and was developed by an English mathematician called *Charles Babbage*.

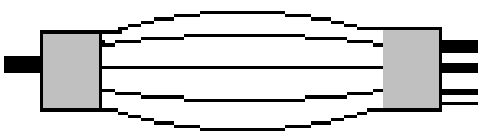
In 1939, *Professor Howard Aken* of Horrard University designed the first computer-like machine named **Mark 1**. Since then, a series of advancements in electronics has occurred. With each breakthrough, the computers based on the older form of electronics have been replaced by a new "generation" of computers based on the newer form of electronics.

COMPUTER GENERATIONS.

A **Computer generation** is a grouped summary of the gradual developments in the computer technology. The historical events are not considered in terms of individual years, but are classified in durations (a period of more than a year).

1ST Generation computers (1946 – 1956).

The 1st generation of computers used thousands of electronic gadgets called ***Vacuum tubes*** or ***Thermionic valves*** to store & process information.



Vacuum tube

The tubes consumed a lot power, and generated a lot of heat during processing due to overheating.

The computers constantly broke down due to the excessive heat generated, hence were short-lived, and were not very reliable.

They also used *Magnetic drum memories*.

Cards were used to enter data into the computers.

Their internal memory capacity was limited. The maximum memory size was approx. 2 KB (2,000 bytes).

The computers used big physical devices in their circuitry; hence they were very large in size, i.e. the computer could occupy several office blocks. For example, ENIAC occupied an area of about $150m^2$ - the size of an average 3-bedroom house.

They were very slow - their speed was measured in **Milliseconds**. E.g., ENIAC (the earliest electronic computer) could perform 5,000 additions per second & 300 multiplications per second.

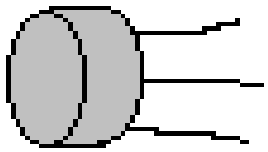
The computers were very costly - they costed millions of dollars.

Examples of 1ST Generation computers:

- **ENIAC** (**E**lectronic **N**umerical **I**ntegrator **A**nd **C**alculator) built in 1946 for use in World War II. It contained 18,000 Vacuum tubes.
- **EDVAC** (**E**lectronic **D**iscrete **V**ariable **A**utomatic **C**omputer) developed in 1945 by Dr. John Von Neumann. It was the first computer that used instructions stored in memory.
- **UNIVAC** (**UNIV**ersal **A**utomatic **C**omputer).
- **IBM 650**.
- **LEO** (**L**yon's **E**lectronic **O**ffice).

2ND Generation computers (1957 – 1963).

The 2nd generation computers used tiny, solid-state electronic devices called ***Transistors***. The transistors were relatively smaller, more stable & reliable than vacuum tubes.



Transistor

The computers consumed less power, produced less heat, were much faster, and more reliable than those made with vacuum tubes.

They used *Magnetic core memories*.

RAM Memory size expanded to 32 KB.

Their operation speed increased to between 200,000 – 300,000 instructions per second. Their speeds were measured in **Microseconds**. E.g., a computer could perform 1 million additions per second, which was comparatively higher than that of the 1st generation computers.

The computers were smaller in size & therefore, occupied less space compared to the 1st G computers.

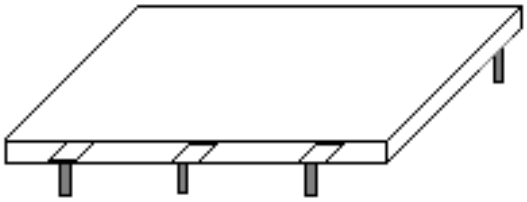
They were less costly than the 1st G computers.

Examples of 2nd Generation computers:

- NCR 501, IBM 300, IBM 1401, IBM 7070, IBM 7094 Series & CDC-6600 Mainframe computers.
- ATLAS LEO Mark III.
- UNIVAC 1107.
- HONEYWELL 200.

3RD Generation computers (1964 – 1979).

Used electronic devices called ***Integrated Circuits*** (**ICs**), which were made by combining thousands of **transistors** & **diodes** together on a semiconductor called a *Silicon chip*.



Integrated circuit

The processing speed increased to 5 Million instructions per second (5 MIPS).

The storage capacity of the computers (i.e., the RAM memory sizes) expanded to 2 MB.

They were smaller in size compared to 2nd generation computers.

The computers used a wide range of peripheral devices.

The computers could support more than user at the same time. They were also able to support remote communication facilities.

Magnetic disks were developed for storage purposes.

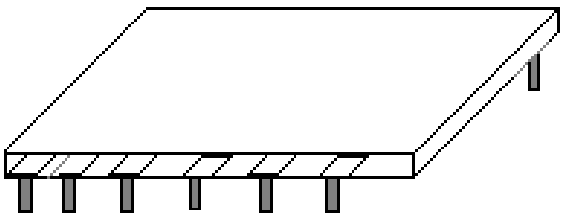
The 1st microcomputer was produced during this period (1974).

Examples of 3rd Generation computers:

- IBM 360, 370;
- ICL 1900 Series;
- 8-bit Microcomputers & PDP-11 Mainframe computers.

4TH Generation computers (1979 – 1989).

The 4th generation computers used **Large Scale Integrated** (**LSI**) circuits & **Very Large Scale Integrated** (**VLSI**) circuits. These circuits were made by compressing more tiny circuits and transistors into even smaller space of the silicon chip.



Very Large integrated circuit

The computers were small, and very fast. Their processing speeds increased to 50 Million instructions per second.

Had large storage capacity, i.e., their memory sizes expanded to several hundred Megabytes.

Memories used included Magnetic disks, Bubble memories & Optical disks.

Examples of 4th Generation computers:

- IBM 308 and 4300;
- Amdahl 580
- Honeywell DPS-88
- Burroughs 7700, and the 16-bit & 32-bit microcomputers. The first microcomputer was called *Apple II*.

5TH Generation computers (1990 – Present).

In this generation fall today's computers.

The technologies used are *Parallel architectures, 3-Dimensional circuit design* & *super conducting materials*.

These technologies have led to the development of computers referred to as *Supercomputers*, which are very powerful, and have very high processing speeds. Their speeds are measured in **Nanoseconds** & **Picoseconds**.

They are able to perform parallel (or multi-processing) whereby a single task is split among a number of processors.

The memory sizes range between 1 Gigabyte & 1 Terabyte.

The computers are designed using **VLSI** and the Microchip technology that has given rise to the smaller computers, known as Microcomputers used today.

The computers have special instruction sets that allow them to support complex programs that mimic human intelligence often referred to as ***Artificial Intelligence***. Such programs can help managers to make decisions and also provide critical expert services to users instead of relying on human professionals.

Review Questions.

1. Briefly describe the history of computers.

2. **(a).** What do you mean by computer generations?
(b). Describe the FIVE generations of computers in terms of technology used and give an example of a computer developed in each generation.
(c). Compare computer memory sizes during the Five computer generation periods.

3. What was the most remarkable discovery during the second computer generation?

4. **(a).** Technology is the basis of computer classification. Based on this, explain briefly the difference between the first three computer generations.
(b). What is so peculiar in the fourth and fifth generation of computers?

5. Match the following generations of computers with the technology used to develop them.

Generation	Technology
First generation	**A).** Very Large Integrated Circuit
Second generation	**B).** Thermionic valves (Vacuum tubes)
Third generation	**C).** Transistors
Fourth generation	**D).** Integrated Circuits

6. Give four characteristics of First generation computer.

7. Write the following abbreviations in full:
(a). ENIAC
(b). VLSI
(c). IC

8. What is Artificial Intelligence?

FACTORS THAT DETERMINE THE TYPE OF COMPUTER.

1) Type of processor (Central processing unit – CPU)

Microcomputers use microprocessors, which are manufactured on a single chip, as their CPU.
In larger computers such as supercomputers, mainframe & minicomputers, the processing is carried out by a number of separate, high-speed components instead of a single processor.

2) Processing speed.

Every computer has a clock that drives its operations.
Larger computers have faster clocks and therefore can process many instructions per second compared to small computers, which have slower clocks.

3) Amount of Main memory (RAM).

All computers have some amount of RAM (**Random Access memory**), which is used to hold the instructions required to perform a task.

Larger computers have more RAM and therefore can handle large volumes of data & also support many and sophisticated programs which might require large memory sizes.

4) Storage capacity of the Hard disk.

The *storage capacity* is the amount of space that is available for storing the instructions required to manipulate data.

Larger computers have higher storage capacities than microcomputers.

5) Cost of the computer.

The cost of computers is directly related to the size. Microcomputers are less costly compared to minicomputers, mainframes or Supercomputers.

6) Speed of Output devices.

The speed of an output device is determined by the amount of information that can be printed in a specified amount of time.

The speed of microcomputer output device is less than that of the larger computers in that:

For a microcomputer, the speed of its output device is measured by the **number of characters printed per second** (**cps**). For larger computers, their output devices are faster and their speeds are measured depending on the **number of lines or pages printed per minute** (lpm / ppm).

7) Number of users who can access the computer at the same time.

Most microcomputers can support only 1, 2 or 3 users at the same time. However, they can be networked to share resources.
Larger computers can support hundreds of users at the same time.

Review Questions.

1. Briefly explain five factors that can be used to determine the type of a computer.

CLASSIFICATION OF COMPUTERS

Computers can be classified according to the following factors:

1. Physical size & processing power.
2. Purpose for which they are designed.
3. Functionality (Method/ mode of operation).

A. CLASSIFICATION ACCORDING TO PHYSICAL SIZE.

Computers can be classified into 5 main groups according to their size as:

- Supercomputers.
- Mainframe computers.
- Minicomputers.
- Microcomputers.
- Portable computers (Laptops, Notebooks & Palmtops).

Supercomputers.

Supercomputers are the fastest, largest, most expensive & also the most powerful computers available.

They are very fast in processing. They can perform many complex calculations in a fraction of a second.

Most Supercomputers use multiple processors. In this case, a single task is split among the processors for faster execution. However, all the processors are controlled by a single central processor.

Supercomputers generate a lot of heat, & therefore require special cooling systems. Sometimes, the whole CPU is deeped in a tank containing **liquid Fluorocarbon** to provide cooling.

Supercomputers are very large & heavy, and are usually kept under special environmental conditions (i.e., in a special room).

They are operated by computer specialists. A Supercomputer can be operated by over 500 users at the same time.

Areas where supercomputers are used:

Supercomputers are mainly used for complex scientific applications that involve many calculations & require a lot of computational power. Some of the applications that use supercomputers include;

- Weather forecasting.
- Petroleum research.
- Defence and weapon analysis.
- Aerodynamic design and simulation.

Note. These tasks use large amounts of data, which need to be manipulated within a very short time.

Examples of Supercomputers:

- CRAY T3D, NEC-500.

Mainframe computers.

Mainframes are less powerful & less expensive than supercomputers.

They are big in size but smaller compared to Supercomputers.

Are powerful computers with very high capacities of Main storage. They also have a large backing storage capacity.

Have a very high processing speed, i.e., can process large amounts of data very quickly.

They can support a large number of peripherals of different types (can support between 5–300 terminals).

They can handle hundreds of users at the same time, e.g., they can be operated by 200 users at a time.

Mainframe computers are general-purpose, and can handle all kinds of problems whether scientific or commercial.

Areas where mainframe computers are used:

Mainframe computers are mostly found in government departments, big organizations and companies which have large information processing needs, e.g., they are used;

- In Banks & Hospitals for preparing bills, Payrolls, etc.
- In communication networks such as the **Internet** where they act as Servers.
- By Airline reservation systems where information of all the flights is stored.

Examples of Mainframes:

- IBM 4381.
- ICL 39 Series.
- CDC Cyber series.

Minicomputers.

A Minicomputer is physically smaller than a mainframe. However, it can support the same peripheral devices supported by a mainframe.

A Minicomputer can support several users at a time, e.g., can be operated by 6 users at a time. Several workstations/ terminals are connected to one central minicomputer so that the users connected can share its resources (C.P.U time, storage, etc).

Minicomputers are easier to manufacture & maintain compared to mainframes.
Minicomputers are cheaper than the mainframes, but more costly than the microcomputers.

They handle small amounts of data, are less powerful, & have less memory than the mainframes.

Minicomputers are slow compared to mainframe computers.

Areas where minicomputers are used:

Minicomputers are used mainly in:

- Scientific laboratories & research institutions.
- Engineering plants/factories to control of chemical or mechanical processes.
- Space industry.
- Insurance companies & Banks for accounting purposes.
- Smaller organizations as Network **Servers**.

Example of Minicomputer:

- PDP-8 built in 1965 by **D**igital **E**quipment **C**orporation in U.S.

Microcomputers.

Microcomputers are the PCs mostly found today in homes, schools & many small offices. They are called ***Personal Computers*** (***PCs***) because they are designed to be used by one person at a time.

They consist of very few connected units, i.e. can support very few peripheral devices (usually 1 or 2).

The data processing in microcomputers is done by a **Microprocessor** (a single chip containing the Arithmetic Logic unit & Control unit).

Microcomputers are smaller in size & also cheaper than minicomputers. Their design is based on **Very Large Scale Integration** (VLSI) that confines several physical components into an IC.

They are less powerful than minicomputers & their internal memory is smaller than that of minicomputers.

Areas where microcomputers are used:

Microcomputers are commonly used in:

- ✔ Training and learning institutions such as schools.
- ✔ Small business enterprises, and
- ✔ Communication centres as terminals.

Microcomputers have become very popular because of the following reasons:

1) Are cheaper than both mini & mainframe computers.
2) Are very fast (i.e. have high processing speeds).
3) Small in size, hence they occupy less space in an office.
4) Are more energy efficient (i.e., consume less power).
5) Are more reliable than the early Mainframe computers.

Examples:

- ♦ IBM PCs such as Apple Macintosh, Dells, Compaq, etc.

Laptops & Notebooks.

A Laptop is a PC sufficiently small & light such that a user can use it comfortably on his/her lap. It is designed to be used by placing it on the lap.

- Laptops are very small in size & are portable. They are small enough to fit inside a briefcase; still leaving room for other items.
- A Laptop computer operates mainly on electricity or by rechargeable batteries.
- Laptops normally have in-built disk drives & Flat screens (*Liquid Crystal Displays*).
- Can only support a limited number of peripheral devices.
- Have limited storage capacities.

Note. The smaller computers like Laptops tend to be more expensive than Desktop computers because of the following reasons:

1) The technology of producing smaller devices is expensive.
2) They are convenient because they are portable.
3) They have advanced power management capabilities (they consume less power since a laptop can operate on rechargeable batteries).

Palmtops.

Palmtops are small enough to fit in the pocket, and can be held in the palm when being used.

- Have limited storage capacities.
- Palmtops are mainly used as Personal Organizers, with some minimal programs for calculations, Word processing, Spreadsheets, & E-mail.

Example of a Palmtop; *Personal Digital Assistant* (*PDA*).

Desktop computer.

This is the name given to any computer designed to be used when placed on a desk in an office environment.

- They are not portable.

Examples of desktop computers:

1) Home computer.

This is a low-cost microcomputer of limited capability designed for domestic use. It has programs that are used typically for computer games or controlling family finances.

2) Personal computer (PC).

This is a microcomputer designed for independent use by an individual at work or in the home mainly for business purposes.

- A PC can support only 1 user at a time.
- PCs are mostly used in offices, schools, business premises, and at home for various applications like computer literacy, Games, Database management, Accounting, Word processing, Telecommunications, etc.
- A PC can be connected to a mini & mainframe computer so as to enable the user access the facilities offered by the larger machines.

3) Workstation.

A *workstation* is usually a desktop computer with all the facilities but interlinked to a network.

A typical workstation works in a similar way to a Personal computer. However, it is more advanced than a typical PC in the following ways:

i). It is larger & more powerful than a PC. E.g., workstations use 32-bit microprocessors, while PCs use 16-bit microprocessors.
ii). It has in-built capabilities for its interconnection & operation with other computers, i.e., it is fully connected to a computer network as any other computer on the network in its own right.
iii). It has high resolution graphics.
iv). It has a Multi-tasking operating system, i.e. it is able to run multiple applications at the same time.

An Embedded computer.

This is a computer that is within another device or system but is not accessed directly. E.g., there are embedded computers operating within Petrol pumps, Watches, Cameras & Video recorders.

B. CLASSIFICATION ACCORDING TO PURPOSE.

Digital computers can be classified further according to the tasks they perform either as:

- General-purpose.
- Special purpose
- Dedicated computers.

General-purpose computers.

General-purpose computers are designed to perform a wide variety of tasks. They use specifically written instructions (programs) to carry out the desired processing tasks.

Example;

A single computer can be used to process documents, perform calculations, process the Payroll, simulate the loading on a bridge, process Insurance policies, and play games, among others.

The programs used in a general-purpose computer are exchangeable. This means that, to perform a particular task, the appropriate set of instructions required to perform that particular task are loaded into the computer memory.

E.g., if you want to play a game, the appropriate program is loaded into the computer's memory & the computer is instructed to execute the instructions which make up the game.

Examples of general-purpose computers: Mainframes, Minicomputers, Microcomputers & Laptops used in most offices & schools.

Special-purpose computer.

A special-purpose computer is designed to handle/accomplish a particular specific task only.

Such computers cannot perform any other task except the one they were meant to do. Therefore, the programs which are used in a special-purpose computer are fixed (hard-wired) at the time of manufacture.

For example;

In a computer Network, the **Front End Processor** (**FEP**) is only used to control the communication of information between the various workstations and the host computer.

A Special-purpose computer is dedicated to a single task; hence it can perform it quickly & very efficiently.

Examples of special-purpose computers:

- Robots used in a manufacturing industry for production only.
- Mobile phones used for communication only.
- Calculators that carry out calculations only.
- Computers used in Digital watches.
- Computers used in Petrol pumps.
- Computers used in Washing machines.
- An Automatic pilot – a computer dedicated to the task of operating an aircraft.
- A Word processor – a special-purpose computer used in the production of office documents, letters, etc.

Reasons why a Mobile phone is regarded to be a computer.

- ✔ It is electronic.
- ✔ Has a screen.
- ✔ It has a Keypad.
- ✔ Has a Memory.
- ✔ It is programmable.

Dedicated computer.

A **Dedicated computer** is a general-purpose computer that is committed to some processing task; though capable of performing a variety of tasks in different application environments. E.g., the computer can be dedicated to carrying out Word processing tasks only.

C. CLASSIFICATION ACCORDING TO FUNCTIONALITY.

Usually, there are two forms of data; **Digital data**, and **Analogue data**. Computers can be classified according to the type of data they can process as either.

- ♦ Digital computers.
- ♦ Analogue computers, or
- ♦ Hybrid computers.

Digital computers.

This is the most commonly used type of computers.

A **Digital computer** is a computer that operates on discrete data only. It can process both numeric & alphabetic data within the computer, e.g., 0, 1, 2, 3…, A,B,C….

Their operation is based on 2 states, "ON" & "OFF" or on digits "1" & "0". Therefore, any data to be manipulated by a digital computer must first be converted to digital form.

Their output is usually in form of numbers, alphabets, & symbols.

Digital computers are usually general-purpose computers; hence, they are widely used in different areas for data processing.

Most of the devices found at homes today are digital in nature.

Digital computers are less accurate, i.e. may not solve all your problems since the facilities provided are generalized.

Examples:

- A Television with a button which is pressed to increase or decrease the volume.
- Digital watches.
- Calculators.
- Microcomputers. They are said to be digital because they posses the ALU.

Analogue computers.

An **Analogue computer** is a computer that operates on continuous data.

They carry out their data processing by measuring the amount of change that occurs in physical attributes/quantities, such as changes in electrical voltage, speed, currents, pressure, length, temperature, humidity, etc.

An Analogue computer is usually a special-purpose device that is dedicated to a single task. For example, they are used in specialized areas such as in:

- Scientific or engineering experiments,
- Military weapons,
- Controlling manufacturing processes like monitoring & regulating furnace temperatures and pressures.
- Weather stations to record & process physical quantities, e.g., wind, cloud speed, temperature, etc.

The output from analogue computers is in form of smooth graphs produced by a plotting pen or a trace on a Cathode Ray Tube (CRT) from which the information can be read.

Note: Analogue computers usually use one characteristic, e.g. a length, to give information about another physical characteristic, such as weight.

Analogue computers are very accurate & efficient since they are dedicated to a single task.

They are very fast since most of them use multiple processors.

Examples of analogue devices:

- **The computer used to control a flight simulator for training pilots.**
  The computer responds to the Cockpit simulator control movements made by the pilot to physically change the environment so that the pilot feels as if he were controlling an actual aeroplane.
- **A Bathroom scale.**
  It uses the weight of a person to move a pointer smoothly/continuously over calibrated scale, which shows the person's weight.
- **Thermometer.**
  It uses a volume of Mercury to show temperature. The Thermometer is calibrated to give an exact temperature reading.
- **Speedometer.**
  In Speedometer, the rotation of the wheel is converted to a voltage, which causes a pointer to rotate over a dial calibrated in Km/h or Miles/h.

- A **Petrol pump** measures the rate of flow of Gasoline (petrol) & converts the volume delivered to 2 readings; one showing the volume & the other showing the cost.
- A **Post-office scale** converts the weight of a parcel delivered into a charge for posting.
- A Monitor with knobs that are rotated to increase brightness.
- A Television with knobs that are rotated to increase or decrease the volume.
- A Radio with a knob that slides in a slot to increase volume.

Hybrid computers.

Hybrid computers are designed to process both analogue & digital data. They combine both the functional capabilities of the digital and analogue computers.

Hybrid computers are designed by interconnecting the elements of a digital computer & analogue computer directly into one processor, using a suitable interfacing circuitry.

Hybrid computers are more expensive.

Example;

In a hospital **Intensive Care Unit**, an analogue device may be used to measure the functioning of a patient's heart, temperature and other vital signs. These measurements may then be converted into numbers and send to a digital device, which may send an immediate signal to the nurses' station if any abnormal readings are detected.

Comparison between a Computer and Calculator.

Computer	Calculators
1. Costly due to the technology used.	**1.** Cheaper – they imitate simple computer technology.
2. Bigger in size.	**2.** Comparatively smaller.
3. Operate at very high speeds.	**3.** Slower than computers.
4. Are more accurate – they give up to over 10 decimal places of accuracy.	**4.** Less accurate – most calculators give up to 8 dp of accuracy.
5. Flexible – can be used in solving any problem.	**5.** Mostly used for numerical calculations involving arithmetic/ mathematical operations
6. Work under the control of programs.	**6.** Calculators are non-programmable, but if programmable, the range is limited.
7. Support a variety of peripherals, e.g. keyboard, mouse, light pen, printer, etc.	**7.** They only use Display units & Keyboards of limited capabilities.
8. Have large internal memory of several KB's.	**8.** their internal memory is very small. Most calculators only use **Registers** for temporary storage during calculations.
9. Support large Backing storage media.	**9.** Some calculators have got some sort of fixed Backing store, though very limited.
10. A computer can support several people at the same time.	**10.** A calculator can serve only 1 user at a time.
11. Have got telecommunication capabilities.	**11.** Have no telecommunication capabilities.
12. Require well-monitored environmental conditions.	**12.** Do not require well-monitored environmental conditions.

Review Questions.

1. State three methods of classifying computers. In each case, list the different types of computers.
2. What is a Personal computer?
3. Differentiate the following types of computers.
a). Supercomputer and Mainframe computer.

b). Minicomputer and a Personal computer.
c). Special-purpose (dedicated) computers and General-purpose computers.
d). Desktop computers and Laptop computers

4. Briefly describe terms "Analogue" and "Digital computers" as used in computer science.
5. Give three examples of Special-purpose computers.
6. Name any **FOUR** classes of computers based on size and complexity.

ADVANTAGES OF USING COMPUTERS.

Computers have many advantages over other types of office and business equipments that are used for data processing functions. Some of the advantages are:

1) *Computers process data faster*:
The processing speed of a computer when measured against other devices like typewriters & calculators is far much higher.

2) *Computers are more accurate & reliable*:
Computers produce more accurate results as long as the correct instructions & data are entered. They also have the ability to handle numbers with many decimal places.

3) *Computers are more efficient*:
A computer requires less effort to process data as compared to human beings or other machines.

4) Computers can quickly and effectively store & retrieve large amounts of data.

5) They are very economical when saving information, for it can conserve a lot of space.

6) Computers occupy very little office space.

7) Computers help to reduce paper work significantly.

8) *Computers are flexible*:
A computer can perform a variety of jobs as long as there is a well-defined procedure.

9) *Computers are cheap*:
They can be used to perform a number of organizational functions/ activities, which are meant for individual persons, hence reducing the number of employees & the costs.

10) *Computers enhance security & confidentiality*:
Data stored in a computer can be protected from unauthorized individuals.

11) Have made communication easier.

12) *Computers produce better information*:
Computer output is usually tidy and error-free (accurate).

13) Computers reduce the problems of data or information duplication:

14) Computers can operate in risky environments, e.g. volcanic sites, dangerous chemical plants, where human life is threatened:

DISADVANTAGES OF USING COMPUTERS.

1) Computers are very costly in terms of purchase & maintenance.

2) Computers can only be used areas where there is source of power.

3) Requires skilled manpower to operate, i.e., one has to have some knowledge so as to operate a computer.

4) The records are usually kept in a form that is not visible or human-readable. This makes it difficult to control the contents of the computer's master file.

5) A computer, like any other machine can break down.

6) Information stored in computers can easily get lost due to power interruptions or machine breakdown.

7) A computer doesn't have its own intelligence, i.e., it cannot do any useful job on its own, but can only work as per the set of instructions issued.

8) Installation of computers causes retraining or retrenchment of staff/ employees.

9) The computer technology is changing very fast such that the already bought computers could be made obsolete/ out dated in the next few years.

In addition, this rapid change in the computer technology makes computers & related facilities to become outdated very fast, hence posing a risk of capital loss.

10) The emergence of computers has increased the rate of unemployment since they are now being used to perform the jobs, which were done by human beings.

11) Computers have led to increase in computer crimes especially in Banks. The computer criminals steal large amounts of funds belonging to various companies by transferring them out of their company accounts illegally. In addition, they destroy vital data used in running the companies.

AREAS WHERE COMPUTERS ARE USED.

The following are some of the areas where computers are used:

1. Supermarkets.

- Supermarkets and other retail stores use computers for stock control, i.e., to help them manage their daily activities.
  The stock control system keeps record of what is in store, what has been sold, and what is out of stock. The Management is automatically alerted when a particular item or items are running out of stock and need to be reordered.
- For calculating customer's change.
- For production of receipts.
- It can be used as a barcode reader.

2. Industries.

The use of computers has made Industries more productive & efficient. They are used:

- To monitor and control industrial processes. The industries use remote controlled devices called **Robots**. A *Robot* is a machine that works like a human being, but performs tasks that are unpleasant, dangerous, and tedious to be done by human beings.
- For management control, i.e. to keep track of orders, bills and transactions.
- By companies as a competitive tool. E.g., they are used to assist in defining new products & services. They also help industries form new relationships with suppliers and therefore, enable the producers maintain a competitive edge against their competitors.
- For advertisement purposes, which enable an industry to attract more customers.

3. Banks/Insurance industries

Computers are used by Banks & Insurance industries:

- To manage financial transactions. They use special cash dispensing machines called **Automated Teller Machines (ATMs)** to enable them provide cash deposit & withdrawal services.
- For processing of Cheques.
- For preparation of Payrolls.
- For better record keeping and processing of documents.
- To provide electronic money transfer facilities.

4. Process control.

Computers are used in production environments such as factories to control chemical & mechanical processes. The computers are usually loaded with specialized programs & each computer is designed to do a specific job.

5. Hospitals.

Computers are used in hospitals:

- To keep & retrieve patient's medical records.
- For automatic diagnosis of diseases like Cancer, electro-cardiogram screening & monitoring.
  They are used to get a *cross-sectional view of the patient's body* that enables physicians to properly diagnose the affected part of the body with high levels of accuracy.
- In medical equipments, e.g. blood pressure monitors, blood analyzers, etc.
- To control life-supporting machines in the **Intensive Care Units** (**ICU**).
- To enable medical experts in different countries to share their expertise or labour, thus reducing the transportation of patients & professionals.

6. Offices.

- For receiving & sending of messages through e-mails, fax, etc.
- Production of documents.
- Keeping of records.

7. Government Institutions.

Computers are used in government ministries & agencies:

- To store/keep records and improve the efficiency of work within the Civil service.
  If computers were not used, the large number of files in government registries would make information recovery extremely difficult.
- To produce bills & statements.

8. Education.

Computers are widely used in the teaching & learning process. Learning and teaching using computers is referred to as *Computer Aided Learning* (*CAL*) and *Computer Aided Teaching* (*CAT*).

- Computers are used in learning institutions (schools & colleges) as teaching aids, i.e. to help in teaching various subjects.
  E.g., they are used to demonstrate experiments in subjects like Chemistry or Physics using a special program that can illustrate them on the screen through a process called **Simulation**.
- To assist the Long distance learning in universities usually referred to as the *Open University Concept*.
- To analyze academic data.
- Computers are used in Aviation for training of pilots. **Flight simulators** are used to monitor the control movements made by the pilot while the computer is used to physically change the environment so that the pilot feels as if he were controlling an actual aircraft.

9. Research.

Computers can be used for research in various fields. They are used by:

- Scientists to analyse their experimental data, e.g., in weather forecasting.
- Engineers & Architects to design & test their work.
- Computers have greatly assisted in space exploration.
  - They are used to study the movement of stars.
  - They have made manned & unmanned space exploration possible – they are used to launch space vehicles and monitor the flights & activities both onboard and around them.

10. Communication industry.

The integration of computers & telecommunication facilities has made the transmission and reception of messages very fast and efficient.

- They are used in telephone exchanges to switch incoming & outgoing calls.
- For sending & receiving electronic messages, e.g. fax and e-mails, if connected to a computer network.

11. Transport industry.

Computers are used in:

- Automobile traffic control, e.g., to monitor vehicle traffic in a busy town.
- Railway corporations to co-ordinate the movement of their goods & wagons.
- Shipping control. The computers are used for efficient management of fleets & communication.
- Airports (Airline industry). The computers are used;
  - To control the movement of aircrafts, take off & landing through the use of radar equipment.
  - Making reservations (booking purposes).
  - Storing flight information.

12. Police (Law enforcement agencies).

- Computers are widely used in fighting crime. The Police use computers to keep databases on fingerprints and also analysed them.
- The Police also use computers for face recognition, scene monitoring & analysis, which help them to arrest traffic offenders and criminals.

The information held in computers such as fingerprints, photographs and other identification details helps law enforcers to carry out criminal investigations speedily.

13. Defence.

- Computers are used in electronic news gathering, efficient communication, detecting and tracking of targets; in radar systems, warning systems & in guided missile systems.
- Computers are used in military defence equipments, e.g. Fighter jets, Rockets, Bombers, etc.

14. Multimedia applications.

- Computers are used to prepare business presentations for advertisement purposes.
  The presentations are done using overhead projectors attached to computers running slide shows & digital video clips taken using a ***Camcorder***. An overlaid voice is used to describe the product.
- Computers are used in music related equipment such as **Synthesizers.**
- In entertainment (i.e., games & movies), computers are used to add stereo sound & digital video clips, which make games more realistic.
- In Education & Training, Multimedia discs are used as teaching aids for all types of subjects.

15. Domestic and Entertainment systems.

Computers are used at homes:

- For watching movies, playing music and computer games.
- For storing personal information.
- For calculating and keeping home budgets.

- For shopping purposes. They provide people with lists of shopping items as well as their prices. They also provide electronic money transfer facilities.
- In household items, such as, Microwave ovens, Televisions, etc.

16. Library services.

Computers can be used in a library:

- To enable the library personnel to easily access & keep updated records of books and other library materials.
- To search for book titles instead of using the manual card catalogue.

17. Employment.

The emergence of computers has provided employment opportunities to very many people.

Review Questions.

1. Explain exhaustively the importance of computers in the following areas:
   i). Industries.
   ii). Hospitals.
   iii). Education
   iv). Research.
   v). Communication industry.
   vi). Law enforcement agencies.
   vii). Domestic and Entertainment.

2. Explain various ways computers have been mostly used in our country.

3. List down and explain 6 uses of computers in our society.

4. Explain the similarities and differences between human beings and computer systems.

COMPUTER LABORATORY.

Definition:

A *Computer laboratory* is a room that has been specially prepared to facilitate installation of computers, and provide a safe conducive environment for teaching & learning of Computer Studies.

SAFE USE & CARE OF COMPUTERS (COMPUTER HYGIENE)

Computer systems are expensive to acquire & maintain, and should therefore be handled with great care. Most computer breakdowns are caused by failure to follow the correct instructions on use of equipment, carelessness, and neglect.

Computer hygiene involves keeping the computers in good care & order.

Factors to consider when preparing a computer laboratory.

The following factors must be considered when preparing a computer laboratory:

1. Security of the computers, programs and other resources.
2. Reliability of the source of power.
3. Number of computers to be installed, and the amount floor space available.
4. The maximum number of users that the laboratory can accommodate.

Requirements of a Computer Laboratory.

i). Standard and Enough furniture.
ii). Good ventilation.
iii). Reliable & Enough source of power supply.
iv). Free from Dust and Moisture.
v). Enough floor space.
vi). Proper cabling of electric wires.
vii). Fire fighting equipment.
viii). Good lighting equipment.
ix). Strong rooms & doors for the security of computers.

Review Questions.

1. Define a computer Laboratory.
2. Give three factors to be considered when preparing a computer laboratory.
3. What are the requirements of a computer laboratory?

SAFETY PRECAUTIONS & PRACTICES IN A COMPUTER LABORATORY.

After establishing the computer laboratory, a number of safety precautions, rules, and practices need to be observed in order to avoid accidental injury to the users, damage of computers or lack of a conducive environment for teaching and learning.

The safety precautions and practices include;

1. BEHAVIOUR IN THE COMPUTER LABORATORY.

The following rules must be followed in and around a computer laboratory.

a). Entering the computer room.

- Only authorized people should enter the computer room.
- Remove your shoes before entering the computer room to prevent dust.
- Avoid smoking or exposing computers to dust. This is because; smoke & dust contain small abrasive particles that can damage computer components and cause wearing of the moving parts.

- Do not carry foods such as Toffees, chocolates, chewing gums, & drinks/beverages to the computer room.

  Food particles may fall into the moving parts of the computer and damage them. Liquids may spill into the computer parts causing rusting or electrical faults.
- Collect any waste materials (e.g., paper bits) which might be lying in the computer room & put them into the dustbin.
- Avoid unnecessary movements, because you may accidentally knock down the peripheral devices.
- Computer users should be trained on how to use computers frequently.
- Computer illiterates should not be allowed to operate the computers.
- Shut the door of the computer room properly.

b). Starting and shutting down the computer.

- Always follow the proper procedure for starting & shutting down the computer to avoid loss of data and damage to computer programs.
- Avoid turning the computer **on** & **off** frequently as it is harmful. Every time a PC is turned on, the internal components *get heated* and again *cool down* when the computer is turned off. As a result, the circuit boards expand & contract and this can badly affect the **solder-joints** of the computer.
- Do not open up the metallic covers of computers or peripheral devices without permission and particularly when the computer's power is still on.

2. PROTECTION AGAINST FIRE AND ACCIDENTS.

Fire outbreaks in the laboratory can be caused by either:

a). *Inflammable chemicals*, such as those used for cleaning & servicing the computer equipment.
b). *Electrical faults*, such as open wires or cables.
c). *Smoking.*

- Keep the chemicals away in a store after using them to avoid any accidents.
- Ensure that all electrical wires are properly insulated. Open wires or cables must be properly covered with an Insulating tape or replaced with new ones as they can cause fire leading to damage of equipment.
- The computer room must always have a gaseous fire extinguisher especially those containing **Carbon dioxide** in case of any accidents.

  Note. Water based or Powder extinguishers should not be used in the computer room because; they can cause damage to computer components.

  Water causes rusting of the metallic parts and short circuits, while *Powder particles* normally settle on storage devices and may scratch them during read/write operations.
- Any incidence that may result in damage to equipment should be reported to the person in charge of the laboratory.
- No student should attempt to repair the equipment as this may lead to complete damage of the equipment.

3. INSULATION OF CABLES.

- All power cables in the computer room must be properly insulated and laid away from busy pathways in the room (i.e., preferably along the walls). This prevents the user from stumbling on the cables, which might cause electric shock or power interruptions.
- System cables should be of the best quality & type, and should also be properly clipped (fixed).

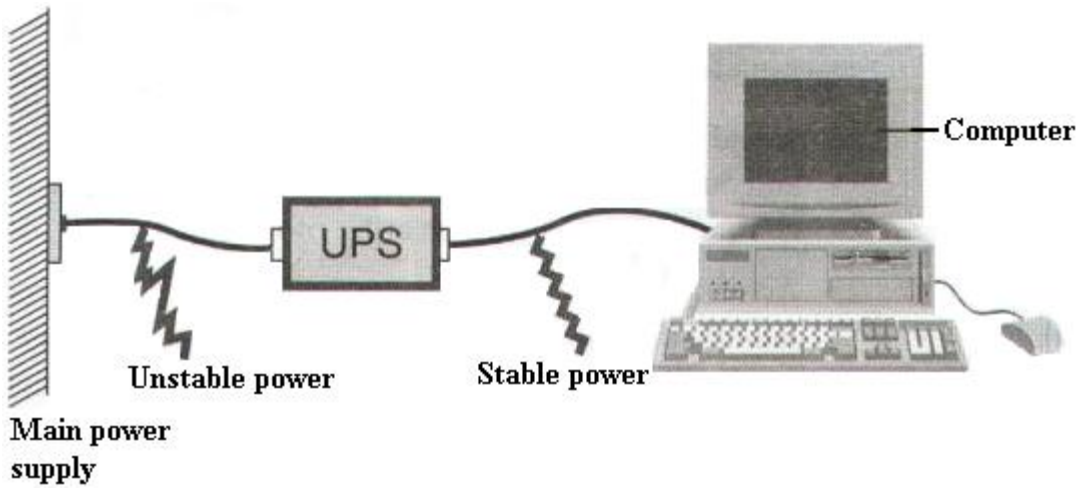
- The cables should be handled carefully especially at the ends to avoid breaking the pins.

4. STABLE POWER SUPPLY.

Computers are delicate devices that require a stable source of power.

- Ensure that there is a steady flow of input power to the computer in order to prevent loss of data or information & also prevent damaging the computer's secondary storage media.

Note. Power from main supply is not always stable and may sometimes experience power surges or under voltage (also referred to as **Brownout**). To protect the computer from being damaged due to power instabilities especially in areas where power fluctuates, avoid connecting it directly to the main supply. Instead, it is important to connect the computer to a special power correction equipment or device such as a **Stabilizer** or **Uninterrupted power supply /source** (**UPS**), then connect the UPS to the main supply.



The UPS gets charged when the main power is on. When the main power goes off, the UPS gives some sound (usually a beep) to alert the user.

Functions of the UPS

1. It regulates power from an unstable power source to the required clean stable voltage.
2. It prevents power surges and brownouts that might destroy the computer.
3. It temporarily provides power to the computer in case of the main power failure. This allows the user to save his/her work and shutdown the computer using the correct procedure.
4. Alerts the user of any power loss (by beeping).

To ensure that work continues even in the absence of main power, organizations that give important services such as banks, schools, & hospitals usually install devices that provide alternative sources of power such as *standby generators, solar panels, rechargeable batteries,* etc that automatically comes on in case of a power failure. Such devices are referred to as **Power backups**.

However, note that, power from a generator must pass through a UPS before being fed to the computer, because it is also not stable.

- Ensure that all power or electrical sockets are firmly fixed.

5. BURGLAR PROOFING.

Physical access to the computer room should be restricted to ensure that only authorized persons get access to the computers.

To prevent unauthorized access to the computer room, the following controls should be implemented:

- Fit strong metallic grills and locks on the doors, windows & roofs (in case the roofing is weak).
- Lock the doors, (i.e., keep the computers in a strong room, which should remain firmly locked when not in use).
- Avoid welcoming strangers into the computer room.
- Use of Personal Identification cards.
- Use of fingerprint identification.
- Install security alarms at strategic access points so as to alert the security personnel in case of a break in.
- Use of special voice recorders that would be able to analyse the voice of a trespasser & check against the database containing the voice patterns of valid users.
- Secure/protect the computers with Passwords to minimize chances of theft.

6. VENTILATION.

Both computers and human beings emit heat energy into the environment. Therefore, the computer room must have good circulation of air to avoid overheating and suffocation.

Proper ventilation enables the computers to cool, and therefore, avoids damaging the electronic parts.

The following facilities can ensure proper ventilation in a room:

- ✔ The room should have large & enough windows & doors.
- ✔ Installing an air-conditioning system.
- ✔ Installing cooling fans.
- ✔ Avoid overcrowding of either machines or people in the room.

7. DUST CONTROL

- ♦ Set up the computer laboratory in a location away from excessive dust.
- ♦ Remove your shoes before you enter the computer room to prevent dust.
- ♦ The computer room should be fitted with special curtains that would reduce entry of dust particles.
- ♦ The floor should be covered with Carpets in order to absorb dust, and also absorb the noise made by chairs.
- ♦ Cover the computer devices with Dust covers when not in use or when cleaning the computer room.

NB: If the environment is dusty, the computers should be regularly serviced to get rid of harmful dust.
The service should include; blowing dust from the System unit, cleaning the floppy drives, cleaning the Keyboard, cleaning the Monitor externally, and also cleaning all peripheral devices such as Printers and Mouse.

8. DUMP CONTROL.

Humidity in the computer laboratory must be regulated to remain at an optimum 50%. If the humidity is low, it allows static electricity to build up and causes damage to sensitive electronic components. Similarly, high humidity of over 70% causes rusting of the metallic parts of the computer system.

To eliminate low humidity, place humidifiers in the room, while high humidity can be controlled by installing dehumidifiers in the room.

9. HANDLING OF MATERIALS & EQUIPMENT.

Computer devices must be handled with a lot of care as they are extremely fragile and can easily get damaged. Dropping or bumping can cause permanent damage on the device, e.g., to transport the System unit always handle it on its frame.

- Always use the manufacturer's shipping carton when transporting the devices.
- Do not place heavy objects on the computers.
- Protect the computer devices especially the Monitor & the disks from any electrostatic discharge.
- The computer devices should not be exposed to direct sunlight or warm objects. This causes the internal components of the computer to get heated, and as a result, effects the computer's solder-joints.
- Students should only perform operations on the computer that they are sure of and under supervision. If in doubt, the student should ask to ensure that no damage is caused due to lack of proper knowledge.
- Computer equipment should be regularly checked and serviced.

Floppy disk management.

Floppy disks are used to store data, and if properly taken care of, they reduce the likelihood of destroyed or corrupted data.

Note. Data is very difficult & expensive to reconstruct, unlike application software, which can easily be re-loaded.

Handling precautions for diskettes.

1). Insert the diskette in the drive with the correct side up & in the correct direction. The diskette should slide in easily (with no force at all) until it locks in the drive. To remove the diskette out of the drive, press the **Eject** button.

2). Don't touch the exposed surface of the diskette when inserting or removing it.

3). Don't remove the diskette from the drive if the drive light is shining. This indicates that the diskette is in use, and removing it might damage the files on the diskette.

4). Never leave the diskette in the computer after finishing its job.

5). Ensure that all your diskettes are labelled carefully using meaningful names that indicate the right contents of the diskette. The labels should be applied at the slightly depressed region at the top surface of the diskette.

Labelling prevents confusing the data in the different diskettes, and also mixing diskettes that are used everyday with those used for long-term storage of important data.

6). Use a soft writing material such as a soft felt pen to write on the diskette.

7). Use the shutter at the bottom of the diskette to write-protect it in order to protect the data stored in it.

Note. To write-protect the diskette, the shutter is pushed up until the hole is covered & no data can be written to the diskette. To write to the diskette, the hole must be left open.

8). Avoid overusing the diskette. If used for long (usually over 6 months), its surface wears out.

9). Never place heavy objects on the diskette to avoid damaging it.

10). Keep your disks safely away from extreme temperatures or direct sunlight, i.e., avoid placing the diskette near possible heat sources, e.g. on top of monitor displays.

11). Keep floppy disks away from any magnetic media, e.g., near power supplies & magnets. They can corrupt the data.

12). Never carry disks in loose bags or in pockets to prevent dust from getting in & harming them.
Store your diskettes in disk banks or a proper storage jacket. Use envelopes or enclosed polythene when carrying them.

13). Always store the disks vertically in the storage box/container.

14). Never use clips or staples to hold the disks to avoid damaging them.

15). Do not bend the diskette, or leave it lying on top of the desk.

16). Protect the diskettes against computer viruses, i.e. you should not use foreign diskettes in your computer, especially if you suspect that they might have viruses in them.

Use of Printers.

1. Different printers have different sensitivity to *printing papers*. Using the wrong quality paper in a particular printer can make the paper get stuck.
2. Printers are very specific to manufacturer's *cartridges* & *ribbons*. Use of clones or imitations (i.e., the wrong make & model) can damage the printer mechanism.
3. Avoid refilling of cartridges or re-inking of Ribbons. This can spoil the printer due to leakage or use of poor quality materials.

10. LABORATORY LAYOUT.

- The computer laboratory should have enough floor space to facilitate free movement from one place to another.
- The laboratory furniture must be well arranged to prevent accidents.
- Your working surface must be large enough to hold the computer equipment & any other additional items required. This prevents squeezing the devices together & also minimizes breakages.
- The sitting arrangement of users should be proper.

11. STANDARD FURNITURE & POSTURE.

- The table/bench on which a computer is placed must be strong and wide enough to bear the weight and accommodate all the peripheral devices.
- The seat for the user must be comfortable, and have a straight backrest that allows someone to sit upright. This prevents muscle pains & backaches caused by poor sitting posture.
- Adjust the furniture to meet your needs for comfort.

  For example;
  - Adjust the height of the chair or working surface so that your forearms are parallel with the floor and your wrists are straight.
  - The seat must be high enough relative to the table to enable the user use the hands on the keyboard comfortably.
  - The eyes must be at the same level with the top of the screen when the user is seated upright.
- You should be able to maintain your proper arm position and place your feet firmly flat on the floor.
- Adopt a relaxed, upright working posture. Avoid slouching (bending) forward or leaning far backwards.
- The Chairs should have low back support & footrest and should also be adjustable.

Keyboard, Mouse and Input devices.

Place frequently used work materials within easy reach.

For example;

- The Keyboard, Mouse & other input devices should be positioned such that your hands are in a relaxed, comfortable position.
- Position the Keyboard directly in front of you. This makes it possible to type with your shoulders relaxed and your upper arms hanging freely at your sides.
- Position the Mouse at the same level as the keyboard.

12. LIGHTING & VISION CARE.

A computer room must be well lit to avoid eyestrain that eventually leads to headaches, stress, and fatigue. Similarly, when you work at your computer for long periods of time, your eyes may become irritated. Therefore, special care should be given to your vision.

- Tilt the computer so that the display faces away from the windows. This will minimize glare (or bright reflections) on the screen.
- Position the lighting equipment or sources of light such that glare (or bright reflections) on the display are minimized. Where necessary, use indirect lighting to avoid bright spots on the display.
- Use/fit *radiation filter screens* that are specially *tinted* to reduce the light that reaches the eye.
- Avoid using a *flickering monitor*. This causes extreme eyestrain that can damage your eyesight.
- The wall paints used should not be very bright as they reflect too much light causing eyestrain.
- Use the brightness & contrast controls on the Monitor to adjust the brightness of the computer monitor until the eyes feel comfortable, and also to improve image quality of your display.
- Turn off the screen when not in use or reduce its brightness in order to prevent screen burnout.
- If the room has windows, use blinds or shades to control the amount of daylight in the room.
- Take frequent breaks and rest your eyes.
- You should have glasses that are specifically suited for working with the computer display.
- Keep your glasses and the display clean.
- Have your eyes examined regularly by a vision care specialist.
- The distant between the user & screen should be between 450 – 500 mm.

Review Questions.

1. List down THREE safety precautions one should observe when entering a Computer laboratory.
2. Why must foods and beverages be kept out of the computer room?
3. Discuss TWO main causes of fire or accidents in the computer laboratory and give the precautions that should be taken to guard against them.
4. **(a).** Give Six safety precautions you should take when handling diskettes.
(b). Where should the arrow on a diskette point when being inserted into the floppy drive.
5. List THREE things that can spoil a Printer if they are not of the correct specification, and explain what damage may be caused.

6. Why are powder based and water-based fire extinguishers not allowed in the computer room?
7. Identify three facilities that will ensure proper ventilation in a room.
8. Give THREE reasons why it is important to regularly service the computer.
9. Explain precisely how the Keyboard, mouse, and other Input devices should be arranged to avoid strain while working on the computer.
10. **(a).** What name is given to alternative sources of power in a computer.
    (b). Name any THREE sources of power in a computer system.
11. State two reasons why a computer needs to be connected to a stable power supply.
12. State two functions of the UPS.
13. State two reasons that are likely to cause eye-strain in the computer room.
14. Identify three proper sitting postures while using the computer.

STARTING-UP (BOOTING) A COMPUTER.

1. Before switching on a computer, make sure that all the components are properly connected, and that the computer is connected to an active power source.
2. Turn on the switch at the **source of the power supply**. If your computer is connected to a constant voltage **Stabilizer** or an **Uninterrupted power supply** (**UPS**), turn it on after switching the main supply.
3. Turn on the switches on the System unit and the Monitor. Switch on the power button on the Monitor first, then followed by that of the System unit.

After the power is on, the computer automatically goes through a process called Booting. **Booting** is a term used to describe the starting up of a computer. It is the entire process that makes the computer ready for use.

Types of Booting.

There are 2 types of booting, namely;

a). Cold booting.
b). Warm booting.

Cold booting.

This happens when a computer that was originally off is switched on by pressing the power button on the system unit.

Warm booting.

This happens when a computer that was originally on is forced to restart by pressing the *Restart* button on the System unit or by pressing a combination of keys on the keyboard (**Ctrl+Alt+Del**).

In Windows operating systems, one can use the **Restart** option on the Shutdown dialog box to perform a warm boot.

When Power is switched on, the computer starts by checking all its components to determine whether they are available for use and whether they are functioning correctly. It does this by executing a small program called the **Power-On-Self-Test (POST)** that is permanently stored in ROM.

POST prepares the computer for use by instructing it to perform a number of diagnostic tests when booting up. It instructs the computer to check the *memory* (*RAM*) to make sure it is operating correctly; check the *CMOS* (*BIOS*), *Hard disk controller*, *Floppy disk drive controller* & the *Keyboard*.

During this process, some monitors display information showing the status of each device being tested. If a problem is found, e.g., in case one of the devices is faulty or missing, the process will halt and display an appropriate error message on the screen indicating to the user where the problem is located. Sometimes, an error code is displayed with the message, or an abnormal number of beeps are sounded.

The special program that directs the POST process is called the ***Basic Input Output System*** (***BIOS***).

Shutting down a computer.

After finishing working with the computer, the user must follow the correct procedure of shutting down the computer in order to ensure that loss of data, damage of programs and computer components does not occur.

1. Save all the work done on the computer, and close all programs that may be currently running.
2. Remove any floppy disk you might have inserted in the computer.
3. Follow the proper shut-down procedure required before switching off the computer.

For example;

To turn off any computer running Windows operating systems:

a). Click the **Start button** on the screen, then select **Shut Down** from the list.

b). In the prompt that appears, select **Shut down**, then press the **Enter** key on the keyboard.

c). After a few seconds, the message "*It is now safe to turn off the computer*" appears on the screen. Switch off the System unit, then the Monitor.

Note. Some system units switch themselves off automatically. In such a case, press the button on the Monitor to turn off the screen.

4. Press the button on the monitor to turn off the screen.

5. Switch off your Printer and any other output devices.

Review Questions.

1. **(a).** What is meant by the term 'booting up'?
(b). Differentiate between cold booting and warm booting.

2. Write down the procedure to be followed when switching on a computer.

3. Complete the abbreviation 'POST' in computer technology and explain briefly its purpose.

4. List down the steps that must be followed before switching off the computer.

KEYBOARD.

The **Keyboard** is a computer input device by which data & instructions is typed into the computer memory.

It enables the user to enter data & instructions into the computer by pressing its keys.

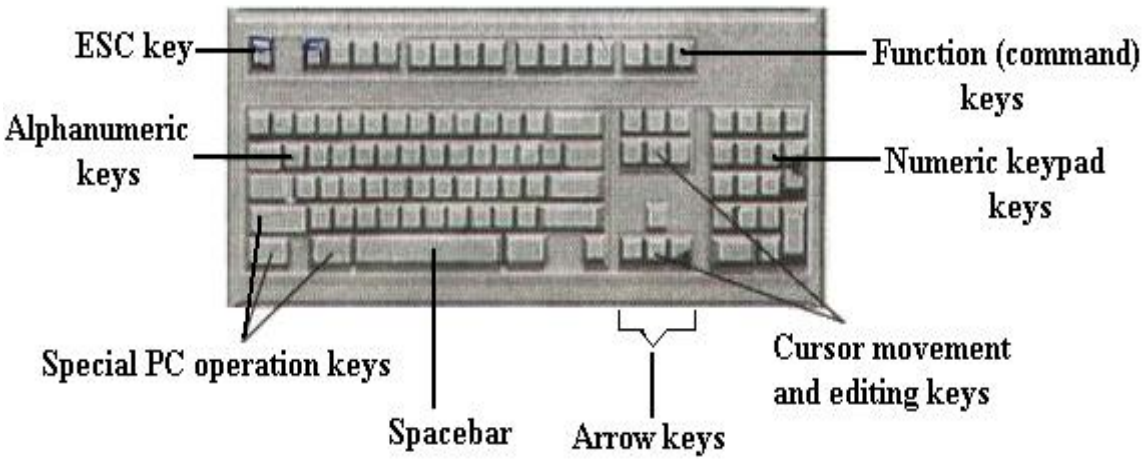
Types of Keyboard.

1. Standard Keyboard – has 99 keys.

2. Enhanced Keyboard – has between 102 & 105 keys.

KEYBOARD LAYOUT.

The Keyboard of a computer consists of keys similar to those of a typewriter. It contains the usual range of alphabetic characters (A – Z), digits 0 – 9, and other symbols frequently used to represent data items. However, it has some *command keys* for giving special instructions to the computer.



Data & programs are input into the computer by pressing the appropriate keys. When you type data into the Keyboard devices, it converts it into machine-sensible forms.

SECTIONS OF THE KEYBOARD.

Most Keyboards have a total of 101 keys, which are divided into 5 different groups: -

(a). Function/ Command keys.

These are the keys located along the top of the Keyboard marked F1 up to F12. They are used to issue commands into the computer.

Each of these keys is used to perform a special function in various application packages, e.g., **F1** is used in most applications for **help**.

Function keys are used differently by different applications, i.e. their functions vary with different programs, and are therefore sometimes called **Programmable Keys**.

(b). Alphanumeric keys.

This section consists of alphabetic & numeric keys. Alphanumeric keys are mostly used for typing of text.

It has the 26 letters of the English alphabet marked on them in capital letters, and Number keys arranged in their natural order from 0 – 9. Along with these keys are *Punctuation marks* (comma, full-stop, etc) and some Symbols.

At the bottom of the alphanumeric keys, is the **Space bar**, which is used to separate words or sentences from each other (or to create a blank space after typing each word).

(c). Numeric Keypad keys.

It is on the rightmost part of the Keyboard. It has keys with digits (numbers) 0 - 9 marked on them in rows from the bottom upwards.

The keypad also has some mathematical symbols marked on its keys. They include: the multiplication sign (*), subtraction sign (-), addition sign (+), division sign (/) & the decimal point (.).

The Keypad is used for fast entry of numeric data into the computer.

Note. The numbers on the Numeric keypad can only be used when the **Num Lock** key is turned on.

(d). Directional (or Cursor positioning) keys.

They are used to move the Cursor (insertion point) within the window of an application.

They include; *Page Up, Page Down, Home, End,* & the four *Arrow Keys*.

- ***Arrow keys:***

  To move the cursor one character to the right in a Word processing document, press the *Right arrow* key; to move the cursor one character to the left, press the *Left arrow* key.

  To move the cursor one line up, press the *Up arrow* key; to move the cursor one line down, press the *Down arrow* key.

- ***Page Up & Page Down:***

  To move the cursor up one page in case the document has many pages, press the *Page Up* key; to move the cursor down one page, press the *Page Down* key.

- ***Home & End keys:***

  To move the cursor to the beginning of the current line, press the *Home* key; to move the cursor to the end of the current line, press the *End key*.

Editing keys.

They are used to delete or insert characters in a document. These are:

i). <u>Backspace key.</u>

It has a backward arrow (←) marked on it.

√ Used to erase characters to the left of the cursor (i.e., from right to left on the same line).

When pressed, it makes the cursor move one space backwards and the immediate letter or number to the left is erased.

ii). Delete (Del) key.

It is used to erase characters to the right of the cursor, (i.e., from left to right).

iii). Insert (Ins) key.

√ Used in a word processor to switch between the **Insert mode** & **Overtype mode**. When pressed, it helps the user to insert text in the middle of a sentence or replace a character at the cursor position (i.e., overwrite the text).

(e). Special PC operation keys.

They are used in combination with the other keys or on their own to perform special functions/tasks, or to give special instructions to the computer.

Examples; Esc, Tab, Caps Lock, Shift, Ctrl, Alt, Enter, Num Lock, Scroll Lock.

TAB key (⇤⇥).

It is used in certain programs such as Word processors to move the text cursor or a certain text at set intervals on the same line to the required position on the screen, e.g., 10mm, 20mm, etc.

A **Cursor** is a blinking underscore (__) or a vertical beam (**I**) that shows where the next character to be typed will appear.

CAPS Lock.

Used to switch between capital (uppercase) letters & small (lowercase) letters.

When pressed ***on,*** an indicator with a Green light appears on the top-right hand corner of the Keyboard, and all the text typed will appear in capital letters. When pressed ***off***, all the text typed will appear in small letters.

SHIFT key (⇧).

This special key works in combination with other keys.

√ It can be used to get single capital letters. Hold down the *SHIFT key* & press an alphabet key to get the letter in its capital form.

√ It is used to get the punctuation marks on top of the Number keys or the symbols on top of certain keys especially on the alphanumeric section.

To get the punctuation mark on top of a number key or the symbol on top of a certain key; press & hold down the **SHIFT key** before pressing the required key.

ENTER key (↵).

√ It is used as a *RETURN* key. When pressed at the end of a text line or paragraph in a word processor, it forces the text cursor to move to the start/ beginning of the next line or paragraph.

√ It is used to issue completion commands to the computer. It is used to instruct the computer to carry out (execute) a command that has been typed or selected on the screen.

ESCAPE (ESC) key.

It generates special code for the computer. In some programs, it is used when you want to quit doing some task, i.e. escape from or to cancel a task.

CONTROL (CTRL) key.

It controls various functions in combination with other keys, e.g. **CTRL**+"**S**" is used to give the command for saving the text/object.

Commonly confusing keys.

Some key shapes cause much confusion. If you use the wrong key, the process you are working on may not work as expected, but it may be very difficult to determine what is wrong.

The I, 1, l and o, O, 0 keys.

Look closely to spot the difference between capital "**I**", one (**1**) and "**l**" (lowercase "L"), and between small "**o**", capital "**O**" and zero "**0**".

The Slash (/) and Backslash (\) keys.

The **slash** ("/") is used as:

- A division symbol when writing a formula.
- A command key to get into the menus in Lotus 1-2-3.
- To separate parts of a path in a UNIX file name.

The **backslash** ("\") is used:

- In Lotus 1-2-3 to fill a cell with a character.
- In MS-DOS to separate parts of a path in a file name.

The Space, Hyphen (-) and Underscore (_) Keys.

The **Space** is entered using the *Spacebar* on the keyboard.

Note. A blank space is a printing character; it takes up memory, has an ASCII code, and is printed on the screen in the same manner as any other character.

The **Hyphen key** (dash or minus) & the **Underscore** (underline) are on the same physical key top. To get the underscore, use the SHIFT.

The Underscore is often used in places where a space is needed to separate individual words, but is not legal in the context. E.g., the filename TAX 1990 is illegal in MS-DOS because of the blank space between TAX and 1990, but TAX_1990 is legal. The Underscore takes the places of the blank space.

Single & Double quote, Accent grave, and Tilde.

Single quote (**'**) & **Double quote** (**"**).

Both symbols are on the same physical key top. To get the double quote, use the SHIFT.

Accent grave (**`**) & **Tilde** (**~**) are found on the same key top. The Tilde is used in Mathematics, foreign languages, or in UNIX operating system to indicate the home subdirectory.

The Parenthesis ( ), Square brackets [ ], & Curly braces { }

Each of these symbols is used differently depending on what program you are running.

Mathematical symbols (+, -, *, /, ^).

Slash (/)	- used for division,
Asterisk (*)	- for multiplication,
Plus (+) symbol	- for addition,
Minus (-) symbol	- is used for subtraction,
Up carat (^)	- indicates exponential (raising to a power).

Practical Keyboard skills.

When using the keyboard, observe the following typing rules:

1). Sit upright with both feet firmly on the ground, maintaining an alert posture.
2). Place the material to be typed on your left in a position you can read without strain.
3). Rest both hands on the keyboard with fingers resting on the Home keys.

Home keys are the keys on which fingers rest during typing in readiness to press other keys. The home keys for the left hand starting with the small finger are A, S, D, F with the thumb on the Spacebar, while those of the right hand are the apostrophe (‘), semicolon (;), L, K with the thumb on the Spacebar.

4). Start typing the text slowly at first, making sure you are using all the ten fingers, and that you press the key nearest to the home keys with the closest finger, e.g., to press Q, use the small finger on the left hand, while to press J, use the index finger on the right hand.

Descriptive Questions.

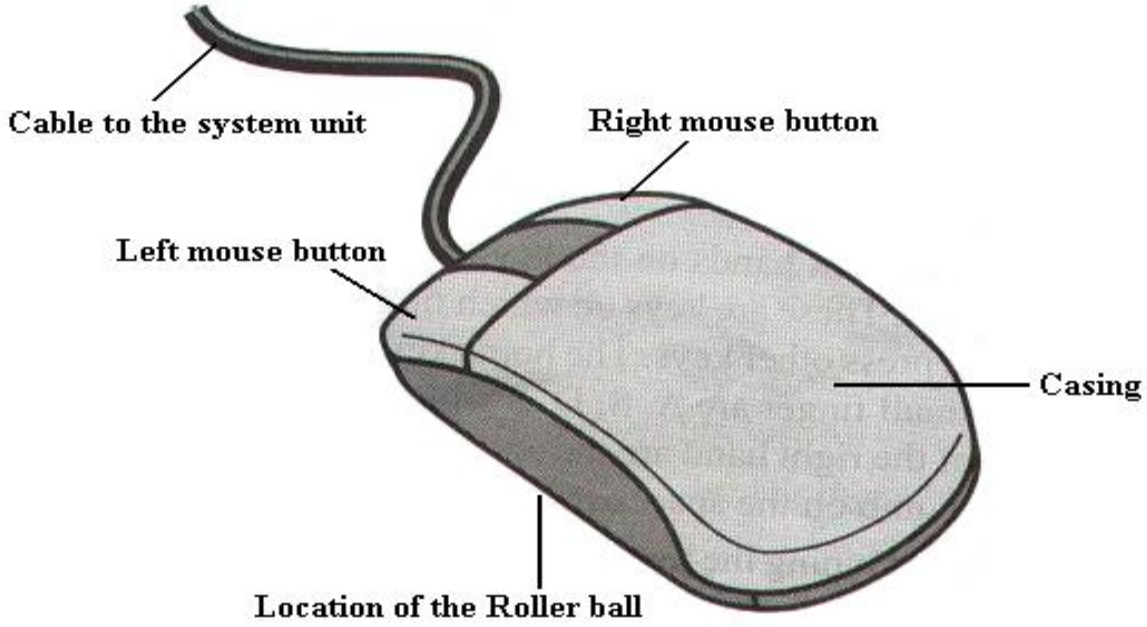
1. Define a Keyboard.
2. **(a)** Give the TWO types of Keyboards found in the current market.
(b) State and briefly explain the functions of five categories of keys found on a standard keyboard.
3. State the use of each the following section or combination of keys on the keyboard:
a). Function keys.
b). Numeric keypad.
c). Arrow keys.
d). Control key.
4. Name 3 main sections of the Keyboard that are used in typing.
5. What is the difference between Function keys and Special PC operation keys?
6. State the functions of the following keys on the keyboard.
i). Caps Lock.
ii). Spacebar.
iii). Shift Key.
iv). Enter Key.
v). Backspace.
vi). Delete.
vii). Escape.
viii). Num Lock.
7. Give two uses of the SHIFT key.

MOUSE.

A **Mouse** is a pointing device that enables the user to issue instructions to the computer by controlling a special mouse pointer displayed on the screen.

A Mouse consists of 4 parts: -

1). A **Casing** - to assist in holding the mouse in the hand.
2). A **Roller ball** – used to slide/move the mouse on a flat surface. It also enables the cursor to move on the screen as required.
3). The **Sensor Buttons** (**Right** & **Left**) – used for making selections.
4). A **Cable** - connects the mouse to the System unit.



Using the Mouse.

To use a mouse, hold it in your hand and move it across a flat surface or on top of a table. When you move the mouse, an arrow-shaped pointer called the **Mouse pointer** moves across the computer screen in the same direction. The pointer is usually controlled by moving the mouse.

To select an option/ item on the screen;

- ☞ Position the tip of the pointer (cursor) over the item to be selected;
- ☞ Press a button on the mouse to make your selection.

When using the mouse, observe the following rules:

a). Place the mouse on a flat smooth surface.
b). Gently hold the mouse with your right hand, using the thumb and the two rightmost fingers.
c). The index finger should rest on the left button, while the middle finger rests on the right button.

Terminologies associated with the use of a Mouse.

Point: - this means moving the mouse until the tip of the pointer on the screen is over the item you want to select.

To select an item on the screen, point the item, then press a mouse button. Use the **Left button** (Primary button) for most tasks or the **Right button** (Secondary button) to quickly accomplish common tasks.

Clicking: - pressing & releasing the left mouse button once. A click usually selects an object/item on the screen.

Double-clicking: - pressing the left button twice in a row (in a quick succession) without moving the mouse. Double-clicking usually opens a file or starts a program.

Right-clicking: - pressing the right mouse button once (or, selecting an item by use of the right mouse button).

A right click usually displays a list of commands from which the user can make a selection. This list of commands is called a ***Shortcut menu*** or ***Context-sensitive menu***. This is because; the commands on this menu apply to the specific item that has been right-clicked.

Shortcut menu:

- ♦ A list of commands that appears when you right-click an object.
- ♦ A menu that shows a list of commands specific to a particular right-clicked item.

Drag and drop: This is whereby the user moves an item from one location on the screen to another.

To move an item on the screen by dragging;

1. Point to the item you want to drag.
2. Press & hold down the left mouse button.
3. Slide the mouse until the pointer reaches the desired position on the screen while still holding down the mouse button.
4. Release the mouse button to 'drop' the item in its new location.

Review Questions.

1. What makes a mouse move a pointer on the screen?
2. State THREE advantages of using a Mouse instead of a keyboard.
3. Explain the meaning of the following terms associated with the use of a mouse:
   (a). Mouse pointer.
   (b). Clicking.
   (c). Double-clicking.
   (d). Right-clicking.
   (e). Drag and drop.
4. Distinguish between:
   (a). Click and right-click.
   (b). Double-clicking and dragging.
5. What is a Shortcut menu?