INTRODUCTION TO FUNCTIONAL COMPUTING

Aims of Teaching Functional Computing:

1. To help learner develop and consolidate his/her knowledge of ICT and be aware of new and emerging technologies.

2. To encourage learner to develop as an independent user.

3. To encourage learner to develop ICT skills to enhance their work in a variety of subject areas.

4. To empower the learner and prepare him/her for lifelong learning.

List of topics to be covered:

1. Introduction to Computers
2. Lab Care, Troubleshooting and Maintenance
3. Computer word processing
4. Computer Hardware
5. Computer Software
6. Electronic spreadsheets
7. Internet and World Wide Web
8. Electronic presentation
9. Data Communication and Networking
10. Databases
11. Desktop Publisher
12. Trends in Computing

CHAPTER ONE

INTRODUCTION TO COMPUTING

DEFINITION OF A COMPUTER

A computer is an electronic device capable of accepting data, processing it, giving out data/information and storing it for later use.

CHARACTERISTICS OF MORDEN COMPUTERS

(1) Speed:
The ability of a computer to process data assigned to it in a very short time period. Computers are relatively faster in their processing speeds if compared to humans and other data processing means. Their operation speeds are in millions of calculations in a second. Processing speed is measured in Megahertz (MHZ)
(2) **Accuracy:**
This is the ability of computers to work without making mistakes. Once given the right instructions, computers are very precise and exact. Hence being the right tool in places where a lot of precision is needed. Computers are even capable of detecting mistakes and correcting them once made by the users.
Consider Garbage In Garbage OUT (GIGO!!!).

(3) **Diligence:**
The ability of Computers to repetitive work / similar tasks without tiring or getting bored

(4) **Versatility**
The ability of computers to carry out a number of different tasks at the same time and in different ways

(5) **Storage (Memory Capacity)**
This is the capability and ability of computers to hold large amounts of data. Unlike other data processors, computers are capable of holding data for long time without losing it through their storage media like; HDD, CDs, flash disks, DVDs, etc.

(6) **Artificial intelligence (AI):**
The ability of Computers to receive and respond to requests, and give the appropriate response
AI = Ability of computer to mimic human thought.

(7) **Automation:**
The ability of Computers to receive and work on instruction on their own without or with minimal human intervention. It controls automatically different devices attached with the computer. It executes without human involvement some program instructions one by one

(8) **Communication**
The ability of computers to transmit data, instructions and information to other computers and devices

**COMPONENTS OF A COMPUTER SYSTEM**
These are the basic parts that make up the computer system
These include hardware, software, human ware (users), data and procedures

1. **COMPUTER HARDWARE**
This refers to the physical and tangible components of a computer system. They are components which can be seen, touched or felt.

**COMPONENTS OF COMPUTER HARDWARE**
These can generally be categorized as Input devices, output devices, storage devices and processing devices.

(a) INPUT DEVICES (operation and usage)

Input devices send data and instructions to the computers. There are many input devices but the most common ones are the keyboard and the mouse. Examples of input devices include the following:

1) Keyboard
2) Mouse
3) Trackball
4) Touchpad
5) Joystick
6) Touch screen
7) Light pen
8) Stylus and Graphics Tablet
9) Digital Camera
10) Scanner
11) Optical Character Recognition Reader
12) Optical Mark Recognition Reader
13) Bar Code Reader
14) Magnetic Strips Reader
15) Magnetic Strips Reader
16) Microphone
17) Voice Recognition Device
18) MID Device
19) Digital Video Camera
20) PC Camera
21) Web Cam
22) Sensor and Remote Sensor
23) Terminal

**Keyboard** - The keyboard is the primary device for entering data into the computer.

**Mouse** - The mouse is the primary device for navigating and interacting with the computer by way of moving the pointer.

Input devices can be classified into **manual input devices** and **automated input devices**. Manual input devices provide more flexibility for data input. Examples of manual input devices include: **Keyboard, mouse, touchpad, touch screen, and microphone**. Automated input devices are quicker and usually generate fewer mistakes than manual input devices.
Examples of automated input devices include: *bar code reader, OMR reader, OCR reader, MICR reader, scanner, and sensor.*

**(b) OUTPUT DEVICES**

These are devices that display or output work which is processed or stored data in the computer to the users. These include the following:

- Monitors
- Printers
- Plotters
- Speakers
- projectors
- Actuators
- Facsimile machine
- Multifunction machine

*Monitor* - The monitor is the primary device for displaying information from the computer.

FORMS OF COMPUTER OUTPUT

A computer outputs information in one or more of the following forms:

- Graphics and images
- Sound
- Characters (text, numbers and symbols)
- Computer usable output

The computer output devices are of two major types

(i) Hardcopy output devices like printers

**Hardcopy** is the tangible output produced on print media like paper (it is in relatively permanent form)

(ii) Softcopy output devices like projectors, speakers

**Softcopy** is the intangible output displayed on the screen (it is temporarily) e.g. temporary characters, images displayed on a monitor, sound produced by speakers etc

**(c) STORAGE DEVICES**

**STORAGE HARDWARE or MEMORY UNIT**

Memory hardware devices house/store computer programs or instructions, data and information.

(a) **Primary Memory/Main/Internal/Memory**

Primary memory consists of:

(i) **Read Only Memory. (ROM)**

(ii) **Random Access Memory (RAM)**

(b) **SECONDARY MEMORY.**

Secondary memory relates to either removable or fixed data storage devices which provide information storage for reference purposes. They supplement RAM which is very volatile.

a) Hard Disks
b) Floppy Disks
c) Magnetic tapes
d) Zip Disk
e) Data Cartridges  

f) Compact discs

Types of secondary storage devices/media
- Magnetic
- Solid state
- Optical devices

(i) Secondary Magnetic Storage examples

<table>
<thead>
<tr>
<th>Storage</th>
<th>Size</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Tape</td>
<td>20Gb - 200 Gb</td>
<td>Backing up the school network overnight</td>
</tr>
<tr>
<td>Hard Disk</td>
<td>40Gb - 250 Gb</td>
<td>Storing all of your software applications and documents</td>
</tr>
<tr>
<td>Floppy Disk</td>
<td>1.44 Mb</td>
<td>Copying a small homework file to take to school. Unlikely to contain large images.</td>
</tr>
<tr>
<td>Zip Disk</td>
<td>100 Mb to 250 Mb</td>
<td>Transferring files between computers. Need a specialist drive. This storage media is not so commonly used nowadays.</td>
</tr>
</tbody>
</table>

(ii) Optical Storage media

An optical storage device is an electro-mechanical unit that can save and retrieve (write and read) information on a special disc medium using a laser light. Optical drives are designed to work with several types of media: CDs ("compact disc"), DVDs (digital versatile disc" or "digital video disc") and Blu-ray discs.

<table>
<thead>
<tr>
<th>Storage</th>
<th>Size</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>650 Mb -700Mb</td>
<td>Storing general software applications. Copying fairly large files to transfer from home to school.</td>
</tr>
<tr>
<td>DVD</td>
<td>4.7 Gb (single) 9.7 Gb (double)</td>
<td>Storing a large computer game or a movie</td>
</tr>
</tbody>
</table>

(iii) Solid state

Solid state storage (SSS)/flash memory: is a type of computer storage media that is made from silicon microchips. SSS stores data electronically instead of magnetically. Examples include

Memory Stick:
Smart Card
A smart card,
An intelligent smart card
Note

Removable storage - Removable storage devices allow you to add new information to your computer very easily, as well as save information that you want to carry to a different location.

1. Floppy disk - Floppy disks are extremely inexpensive and easy to save information to. They are gradually leaving the scene.

2. CD-ROM - CD-ROM (compact disc, read-only memory) is a popular device for distribution of commercial software and music. This is because the device is non volatile.

✓ Flash memory - Based on a type of ROM called electrically erasable programmable read-only memory (EEPROM), Flash memory provides fast, permanent storage. CompactFlash, SmartMedia and PCMCIA cards are all types of Flash memory.

✓ DVD-ROM - DVD-ROM (digital versatile disc, read-only memory) is similar to CD-ROM but is capable of holding much more information.

(d) PROCESSING DEVICES

THE SYSTEM UNIT
This is a metallic/plastic casing housing the electronic components of the computer. It contains the following components.

1. Central processing unit (CPU) - The microprocessor "brain" of a computer is called the central processing unit. Everything that a computer does is overseen by the CPU.

2. Memory - This is very fast storage used to hold data. It has to be fast because it connects directly to the microprocessor. There are several specific types of memory in a computer:
   a) Random-access memory (RAM) - Used to temporarily store information that the computer is currently working with
   b) Read-only memory (ROM) - A permanent type of memory storage used by the computer for important data that does not change.
   c) Basic input/output system (BIOS) - A type of ROM that is used by the computer to establish basic communication when the computer is first turned on.
   d) Virtual memory - Space on a hard disk used to temporarily store data and swap it in and out of RAM as needed.

3. Motherboard - This is the main circuit board that all of the other internal components connect to. The CPU and memory are usually on the motherboard. Other systems may be found directly on the motherboard or connected to it through a secondary connection. For example, a sound card can be built into the motherboard or connected through PCI.

4. Power supply Unit - An electrical transformer that regulates the electricity used by the computer.

5. Hard disk - This is large-capacity permanent storage used to hold information such as programs and documents.
6. Sound card - This is used by the computer to record and play audio by converting analogue sound into digital information and back again.

7. Graphics card - This translates image data from the computer into a format that can be displayed by the monitor.

Connections: Ports

- **Parallel** - This port is commonly used to connect a printer.

- **Serial** - This port is typically used to connect an external modem.

- **Universal Serial Bus (USB)** - Quickly becoming the most popular external connection, USB ports offer power and versatility and are incredibly easy to use.

Behind the system unit:

<table>
<thead>
<tr>
<th>Port</th>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard &amp; Mouse</td>
<td><img src="keyboard_icon.png" alt="Icon" /></td>
<td>The keyboard and mouse jacks look identical on most PCs, so look for colours and icons to help you with plugging in these devices. Some mice and keyboards use USB ports. Older mice may use a serial port.</td>
</tr>
<tr>
<td>Serial or COM</td>
<td><img src="serial_icon.png" alt="Icon" /></td>
<td>Serial (or COM) ports are a very versatile type of port. Some of the things you can plug into a serial port include: a mouse, modem, scanner, or digital camera. Most computers have two serial ports: COM1 and COM2.</td>
</tr>
<tr>
<td>Parallel or Printer</td>
<td><img src="parallel_icon.png" alt="Icon" /></td>
<td>You plug your printer into the parallel, or printer, port. Many newer printers may use a USB port.</td>
</tr>
<tr>
<td>USB</td>
<td><img src="usb_icon.png" alt="Icon" /></td>
<td>Designed to replace older Serial and Parallel ports, the USB (Universal Serial Bus) can connect computers with a number of devices, such as printers, keyboards, mice, scanners, digital cameras, PDAs, and more. Better yet, the USB port supports plug-and-play, so you can simply plug in a USB device and start using it. USB 1 ports can transfer information at a speed up to 12 Mbps (Megabytes per Second). Newer USB 2 ports can transfer information at a speed up to 480 Mbps. Most computers come with two USB ports.</td>
</tr>
</tbody>
</table>
**Video or Monitor**
You plug your monitor into the video port.

**Line Out**
Plug in your speakers or headphone into the Line Out jack.

**Line In**
The Line In jack allows you to listen to your computer using a stereo system.

**Microphone**
You can plug a microphone into this jack to record sounds on your computer.

**Joystick or Game**
If you have a joystick, musical (MIDI) keyboard, or other gaming device, this is where you plug it in.

**Phone or Modem**
The phone or modem jack is where you plug your computer into a phone line.

**Network or Ethernet**
You can connect your computer to a network by plugging in an Ethernet cable in this port.

**SCSI**
An SCSI port is one of the fastest ways to connect a hard drive, CD-ROM drive, or other device to a computer.

**PROCESSING HARDWARE**
This is composed of the **Central Processing Unit (CPU)**.
This is the area which is responsible for the control and execution of all the computer operations. For instance, it accesses data from memory, carries out intended operations and stores the result into memory again.
The CPU is composed of three main parts i.e.
1. **Arithmetic Logic Unit**
2. **The control unit**
3. **Registers/Accumulators**

**2. COMPUTER SOFTWARE**
This refers to electronic instructions, commands or programs which tells the computer how to perform tasks. It relates to all forms of information processing instructions.
Alternatively, a **program** is a complete sequence of instructions for data processing to be performed by a computer.
**Software consists of:-**
- Application software.
- System software.

(a) **SYSTEM SOFTWARE**
These are programs which contribute to the control and performance of the computer system. They enable application software to interact well with the computer, and also help it in managing its internal and external resources.

**TYPES OF SYSTEM SOFTWARE**

System software is usually found already installed by the computer manufacturer or vendor. It consists of:-

1. Operating system/the executive
2. Service or utility programs/system utilities.
3. Programming Languages

**Diagram showing structure of computer software**

**3. Computer professions (Computer scientist)**

1. Application analyst
2. Business analyst
3. Certified software manager
4. Chief networking officer
5. Computational scientist
6. Computer operator
7. Computer repair technician
8. Computer systems analyst
9. Configuration management
10. Data wrangling
11. Database administrator
12. Enterprise architect
13. Graphic designer
14. Hacker (computer security)
15. Network administrator
16. Programmer
17. Silicon Milkroundabout
18. Software analyst
19. Software design
20. Software developer
21. Software development
22. Software engineer
23. Software testing
24. System administrator
25. Systems analyst
26. Systems architect
27. Technical writer
28. Web developer
29. Web operations
30. Webmaster
31. Website content writer
THE CONCEPTS OF DATA AND INFORMATION

DATA:
These are raw and unprocessed facts, figures, and symbols entered into the computer and they do not have much meaning to form a basis for planning or decision making.

INFORMATION
This is processed data that is in useful/meaningful form. Information should be the basis for decision and policy making.

Examples of data and information

<table>
<thead>
<tr>
<th>Data</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letters e.g. a, b, c, d, e.</td>
<td>Words e.g. come, go boy, computer</td>
</tr>
<tr>
<td>Numbers e.g. 1, 2, 3, 4, 5</td>
<td>Mathematical formulae.</td>
</tr>
<tr>
<td>Symbols and words</td>
<td>Essays, reports, letters, memos</td>
</tr>
<tr>
<td>Examination scores</td>
<td>Grades, comments</td>
</tr>
<tr>
<td>Musical notes</td>
<td>songs</td>
</tr>
</tbody>
</table>

Data processing
Data processing therefore means transforming the raw facts into information.

N.B. Data processing is an iterative process i.e. an on going process (one step leads to another),

Information processing cycle
This is the sequence of transforming the raw facts into information which involves input, processing, output and storage.

The five basic stages of information processing

1. Collection of Data -- capturing data from their sources and recording it onto some media. This can be done using questionnaires, interviews, reading related literature, through observations, etc.

2. Preparation of Data -- copying, grouping, or arranging data in a more convenient way for input. Checking and verifying the data collected are often done at this stage.

3. Input of Data -- entering the data or sending the stored data into the processing system. Checking the accuracy and validity of the input data are often done at this stage.

4. Processing of Data -- calculating or manipulating the input data and even storing the results for future use.

5. Output of Information -- giving out the processed results in a readable form (e.g., a report).
Common information processing methods:

1. A **batch processing system** is one where data are collected together in a batch before processing starts.

2. **Real-time Processing System** is one that processes data without significant delay.

   ✓ Examples of real-time processing systems include electronic fund transfer systems, tickets reservation systems.

   ✓ Real-time processing systems are usually interactive processing systems.

3. **Interactive Processing System** is one that involves communications between the user and the computer during processing.

   ✓ Examples of interactive processing systems include electronic fund transfer systems, tickets reservation systems, and point-of-sales systems.

4. **Multi-tasking System** is one that can handle a number of different jobs at the same time.

   ✓ Actually, the CPU cannot do two things at the same time, but makes use of 'idle time' to increase the capacity of a computer.

   ✓ An example of multi-tasking is typing in a word processor while listening to music played from a CD-ROM.

   ✓ Both batch and interactive jobs may be run in a multi-tasking environment.

5. **Multi-user System** is a time-sharing system that allows different users to independently run different programs at the same time.

6. **Time-sharing System** is one that allows multiple users to share time on a single computer.

**Advantages of using computers for information processing**

1. Computers with communicating capability can share data and information with other computers.

2. Tasks can be completed faster because computers work at amazing speed.

3. Computers can process large amounts of data and generate error-free results, provided that the data is entered correctly.

4. Computers can store enormous amounts of data for future use.

5. The high reliability of components inside modern computers enables computers to produce consistent results.

6. Efficiency and productivity can be raised.

7. Running cost becomes lower in the long term.

8. Tasks can be completed with little human intervention (i.e., automatic).
9. Overall security can be raised due to less human intervention.  
10. The management can observe new information and new trends more quickly.  
11. Customer services can be improved due to more efficiently management and operations.

**Disadvantages of using computers for information**

1. Initial investment cost can be high. (Setting up)  
2. Extra cost is required to employ specialized staff to operate and design the data processing system.  
3. Some jobs may be lost due to computerization and thus lower the morale of staff members.  
4. Some staff has to be trained or retrained.  
5. Face-to-face interactions among staff may be reduced.  
6. Easier transmission of viruses via the internet, which may lead to creating untimely, costs to the recipient and sender computers.  
7. Abuse: computers load personal information, which may be misused. It is easy to misuse personal information held about an individual but privacy rights have been enacted to minimize this.  
8. Failure: problems may arise when computers cannot be used either because they are malfunctioning or damaged. This can bring an organization to a halt if no backup exists.  
9. Security has to be provided to protect personnel and staff from preying eyes.

**WORLD OF ICTS**

ICT as an acronym stands for information and communication technology

**Information technology (IT)** is the combination of computer and communication technologies to process data into information.

**IT in everyday life**

**Examples** of IT applications in everyday life include:

- Payment by phone services at home
- Payroll system in a factory
- Report card system in a school
- Billing system in the Town Gas Company
- Electronic funds transfer system in a bank
- Mailing list system in a company
- Stock control system in a department store
- Ticket reservation system in a cinema
- Point-of-sale system in a supermarket
- Traffic control system in transportation

**Applications of IT at home include:**
✓ Pay bills through the payment by phone services (PPS)
✓ With a PPS account, bills can be paid either by phone or on the Internet
✓ Budgeting and personal financial management
✓ Balance a checkbook
✓ Buy and sell stocks online
✓ Prepare taxes
✓ Manage investments and family budgets

COMPUTERS IN EDUCATION

In education computers are being used from kindergarten to university, in both administrative and educational functions.

- Printing examination papers and assignments, reports
- Printing levy and tuition invoices.
- Keeping of records
- Students can now do collaborative learning with other students anywhere in the world and can also have Internet group discussions.
- Online study
- Computer aided research
- Communication using the internet
- Using some educational software the teacher becomes a facilitator rather than the source of information. Students can find information from other sources like the Internet and share it with the teacher.
- Software such as Tutorials can directly instruct students.
- Simulation softwares give students a better visualisation of a real biological process or phenomenon, without using the real biological or chemical material.
- Computers are being used to develop problem-solving abilities.
- Programming languages are being taught in schools.
- Homework can be done and submitted electronically.
- Computer-Assisted Instructions (CAI), so that teachers can use computers and other IT equipment to present teaching materials in a more interesting way.
- Computer-Assisted Learning (CAL), so that students can use computers and appropriate software to learn at their own pace.
- Computer-Assisted Assessment (CAA), which may reduce the time and labor to mark the answer scripts.

Advantages of using IT is learning and teaching include:

✓ A CAI and CAL package that usually contains multimedia effects make learning more interesting and interactive.
✓ Students can learn by themselves when teacher is not available.
✓ Students can learn and proceed at their own pace.
Students can usually get their results or feedback immediately after they have answered the question or taken an action.

- There are rich educational resources on CD-ROMs and the Internet.
- Teachers can present subject matter and explain abstract concepts more clearly with multimedia.
- Teachers can show experiments that are difficult to perform or dangerous in nature through simulations software.
- Advanced instructions can be given to students in areas where the teacher may not be qualified.

**Disadvantages** of using IT in teaching and learning include:

- Face to face interaction between students and teachers may be reduced.
- Students can only follow what the CAL packages are predefined to offer.

**Personal and business communications**

- Organize names and addresses
- Communicate with others around the world using e-mail and chat rooms

**Applications of IT at school include:**

1. Computer-based training, which includes:
   - Computer-Assisted Instructions (CAI), so that teachers can use computers and other IT equipment to present teaching materials in a more interesting way.
   - Computer-Assisted Learning (CAL), so that students can use computers and appropriate software to learn at their own pace.
   - Computer-Assisted Assessment (CAA), which may reduce the time and labor to mark the answer scripts.

2. Distance learning through computer-based training and Web-based training.

3. Simulations of experiments or real-life situations that may be hazardous.

4. Electronic library system for searching, borrowing, and returning books.

5. The School Administration and Management System (SAMS) for keeping records of students and producing report cards or other related documents.

6. Edutainment, which is a type of educational software that combines education with entertainment.

**Applications of IT in office include:**
✓ Create memos, letters, and reports.
✓ Calculate payroll, prepare income statements and balance sheets.
✓ Track inventory and generate invoices and receipts.
✓ Present projects and ideas by means of presentation graphics software.
✓ Use of facsimile, electronic-mail, electronic bulletin, and video conferencing.
✓ Use of document processing system to facilitate data entry.
✓ Use of telecommuting, so that employees can work away from a company's standard workplace.
✓ Create Web sites to provide selected information, advertise products and services, and conduct e-commerce.

Applications of IT in bank includes:

1. Automated teller machine (ATM)

An automatic teller machine (ATM) is a self-service banking machine attached to a host computer through a telephone network.

Services available through an ATM include

✓ Make deposits of cash and checks
✓ Withdraw cash
✓ Transfer money between accounts
✓ Application for a check book
✓ Obtain account balances

2. Make deposits, withdraw cash, and transfer money between accounts.
3. Receive information on bank account balance.
4. Online Banking
5. Transfer money electronically among different accounts.
6. Loan and credit card applications.
7. Obtain credit card statements, bank statements, and account balances.
8. Download monthly transaction information.
9. Use magnetic ink character recognition (MICR) to process checks.
10. Use microfilm and microfiche to store transactions records.
11. Electronic commerce (e-commerce) is a financial business transactions that occurs over an electronic network, such as the Internet.

✓ Online shopping and banking are two popular types of e-commerce that uses either electronic money (e-money) or electric data interchange (EDI).
✓ E-money is a means of paying for goods and services over the Internet.
✓ EDI is a set of standards that control the transfer of business data and information among computers both within and among companies.

E-commerce businesses can be grouped into three basic models:
Business-to-consumer (B2C) e-commerce consists of the sale of goods to the general public.

Consumer-to-consumer (C2C) e-commerce occurs when one consumer sells directly to another, such as in an online auction.

Business-to-business (B2B) e-commerce consists of businesses providing goods and services to other businesses.

**Advantages** of e-commerce include:

- Transactions can occur instantaneously and globally, thus save time for participants on both ends.
- Transactions can occur 24 hours per day.
- Businesses have access to millions of people with Internet connections.
- Businesses have the ability to gather customer information, analyze it, and react if appropriate.
- Information can be changed and be available quickly.
- Customers can compare prices easily.
- Feedback can be immediate.
- Manufacturers can buy and sell directly, avoiding the cost of the middleman.
- Distribution costs for information is reduced or eliminated.

**Applications** of IT in entertainment include:

- Play computer games
- Listen to music
- Watch a video or a movie
- Compose and edit a video
- Retouch a photograph
- Read a book or magazine online
- Plan a vacation

**Applications** of IT in industry include:

- Data sensing and logging
- Robotics: A **robot** is a computer-controlled device that can move and react to feedback from the outside world.

Robots are best used for jobs that require

- Repetitive tasks
- Lifting heavy equipment
- High degrees of precision

- Quality control

- Computer-aided design and computer-aided manufacturing

**Computer-aided designed (CAD) software** is mainly used for creating engineering, architectural, and scientific drawings.
Three-dimensional (3-D) CAD programs even allow users to rotate designs of 3-D objects in order to view them from different angles.

Popular CAD software includes Autodesk AutoCAD and Microsoft Visio Technical

**Applications of IT in health care include:**

- Maintain patient records in hospitals and clinics.
- Monitor patients' vital signs in hospital rooms and at home.
- Computer-assisted medical tests.
- Research and diagnose medical conditions.
- Implant computerized devices (e.g., pacemakers) that allow patients to live longer.
- Use computer-controlled devices during operations that require great precision (e.g., laser eye surgery and heart surgery).
- Telemedicine through computers with videoconferencing capabilities.
- Use of computer-aided surgery for training prior to performing surgery on live humans.

**Computer uses - Areas where computers are used**

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

1. **Supermarkets**

Most retail stores use computers to help in the management of daily activities like stock control. The stock control system keeps account of what is in store, what is to be 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 reordering.

2. **Offices**

Computers have increased effectively in offices by reducing the time and effort needed to access and retrieve information. Most modern office functions have been automated for faster message distribution and document processing.

3. **Banks**

Special cash dispensing machines called automated teller machines (ATM) have enabled automation of cash deposit and withdrawal services. Efficiency has been increased due to better record keeping and document brought about by computers.

4. **Industries**

Computers are being used to monitor and control industrial processes. The computer age has seen the wide use of remote controlled devices called robots. A robot is machine that works like a
human being but performs tasks that are too unpleasant, dangerous, or complex and tedious to assign to human beings.

5. **Hospitals**

Computers are used to keep patients records in order to provide easy access to patient’s treatment and diagnosis history.

Computerized medical devices are now being used to get a cross section view of the patient’s body that enables physicians to get proper diagnosis of the affected part of the body with high level of accuracy.

Computers also control life support machines in the intensive care unit (ICU).

6. **Transport**

Computers are used to monitor vehicles traffic in busy towns – this is done by the computers detecting which roads have high traffic jams of cars and gives those roads more priority than the normal roads with less traffic jam depending on the time.

Aircraft navigation – here computers are used to detect any nearby plane within its neighborhood and diverts and when landing which runway to use.

7. **Communication**

Integration of computers and telecommunication facilities has to made message transmission and reception to be very fast and efficient.

Because of the speed with which information can be transmitted around in the world is said to have become a global village.

8. **Law enforcement agencies**

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

9. **Education**

Computers are widely used in the teaching and learning process. Learning and teaching using computers is referred to as computer aided learning (CAL) and computer aided teaching (CAT).

For example experiments in subjects like chemistry or physics may be demonstrated using a special computer programs that can depict them on the screen through a process called simulation.

10. **Domestic and entertainment**
Computers can be used at home for recreational activities such as watching movies, playing music and computer games. They can also be used in storing personal information, calculating, keeping home budgets and for research in various fields.

11. Library services

In a computerized library, a computer enables library personal to easily access and keep updated recorded records of books and other library materials. Library users can also use computers to search for titles instead of using the manual card catalogue.

IMPACT OF IT/ICTs ON SOCIETY

The introduction of IT in society has changed the way many people live. Although not everyone has access to a computer, there are many different types of communication equipment like radios, televisions, satellite dishes, telephone and fax machines, which all use modern technology. All these affect how information travels and it now takes only a few seconds to send a letter abroad. ICTs have had both positive and negative contributions to society.

BENEFITS/ADVANTAGES OF INFORMATION TECHNOLOGY

I. Increased interaction / collaborations through e-mails, chat rooms, video conferencing, etc
II. Increased sharing and access to common databases within and outside organizations through networking.
III. Increased access to information through Data Base Management Systems (DBMS). Huge amounts of material on all subjects now exist – ease research.
IV. Increased inventions and innovations.
V. More and more technology in management fields.
VI. Improved and sustained quality goods and services.
VII. Increased efficiency and effectiveness’ leading to increased productivity (hence less wastages & more efficient use of resources).
VIII. Increased investment opportunities in commercial tele-centers, Internet cafes, chart rooms, etc.
IX. More leisure as people get shorter working hours. Increased use of ICTS implies higher standards of living.
X. Highly skilled jobs are being created like programming, systems analysis. Software engineering, etc.
XI. Many IT products for the disabled.
XII. Reduced costs of production through less demanding ICTs
XIII. Improved corporate image.

DISADVANTAGES OF INFORMATION TECHNOLOGY

I. Widens the gap between the rich and the poor as the rich producing with the help of ICTs produce faster and flood the markets.
II. Isolate older people since it is not very easy for them to cope with the many IT changes.
III. Bombards (internet) people with too much information—(good and bad)
IV. Increased instability as people get compelled to learn new things every now and then.
V. Health problems e.g. eye sight losses, repetitive strain injury, etc
VI. Moral problem through access of pornographic materials on the net.
VII. Erosion of individual privacy as more data about people is stored on databases and can be accessed any time.
VIII. Unemployment as less skilled people get retrenched and their roles taken over by more effective ITs.
IX. Addictions to computer games plus surfing by young people
X. It’s isolate man and also erodes the social aspect of work as some people opt for executing their office duties from their homes.
XI. Initial, maintenance and on-line IT costs are very high segregative.
XII. Virus threats make data stored on computers very insecure.
XIII. Increased crime through forgeries, piracy, etc.

CHAPTER TWO
COMPUTER MANAGEMENT

BOOTING A COMPUTER
Booting is the process of starting or resetting a computer, which involves loading an operating system into memory.

The two types of booting a computer are cold booting and warm booting.

1. Cold booting: is the process of turning on a computer after it has been powered off completely.

The steps that occur during a cold boot using the Windows operating system are:
   i. The power supply sends an electrical signal to the motherboard and other devices located in the system unit.
   ii. The CPU resets itself and looks for the ROM that contains the BIOS.
   iii. The BIOS executes the Power-On Self Test (POST) to make sure that the computer hardware is connected properly and operating correctly.
   iv. The results of the POST are compared with data in a CMOS battery on the motherboard.
   v. If the POST is completed successfully, the BIOS looks for the boot program that loads the operating system.
   vi. Once located, the boot program is loaded into memory and executed, which then loads the kernel of the operating system into RAM.
   vii. The operating system loads system configuration information, and the remainder of the operating system is loaded into RAM, and the desktop and the icons display on the screen.

2. Warm booting: Is the process of resetting a computer system that is already powered on by pressing the reset button or pressing CTRL+ALT+DEL.

A warm boot can be accomplished by pressing the CTRL - ALT - DEL keys simultaneously, or by selecting the restart command from an operating system menu. Warm boots run faster than turning a computer off and on again.

Reasons for restarting a computer include:
   i. Commonly used to recover from errors that cannot be recovered.
   ii. When a computer locks or freezes.
   iii. After installing of certain new software program.
   iv. After installing a new hardware device like a flash disk.
   v. After uninstalling a hardware device.
2. After uninstalling a software program.
3. When the computer slows down.
4. After changing CMOS or BIOS setup.
5. When a computer has a virus, it can restart itself.

**FILE MANAGEMENT**

**Elements of Desktop and Taskbar**

(i) **Desktop** is the first screen you see when you start your computer. The desktop is composed of **Icons** and the **Taskbar**.

Major icons on desktop include:

- **a)** **My computer**: Allows user to explore the contents of the computer drives and manage the computer files
- **b)** **Recycle bin**: Temporary storage location for deleted files and folders by the user from the file manager but not yet permanently erased from the computer
- **c)** **Network/network places**: Displays shortcuts to shared computers and other devices on the network
- **d)** **My documents**: Special folder on hard disk the system uses to store the users documents, music pictures, downloads and other files
- **e)** **Shortcut Icons**: Shortcut icons provide a fast means of executing a program or opening a file
- **f)** **Control Panel**: contains many icons dealing with system and hardware configuration

**Icons**: Small graphical images that can represent computer programs, files, folders, printers, etc.

To activate the feature that the icon represents, point the mouse arrow to the icon and double click the left-hand mouse button in quick succession.
A list of options for an icon can be brought up by moving the mouse pointer to the icon and then clicking the right-hand mouse button.

- **Rename** allows you to change the name associated with an icon, along with its file extension.
- The **Open With** option enables you to select which program to use to open a file. A shortlist of possible programs will often be listed, along with the option **Choose Program**, which brings up a more comprehensive listing.

**Recycle Bin** icon: Temporary storage for deleted files and folders. Files may be retrieved from the Recycle bin by either dragging the icon onto the desktop or by right clicking on the icon or selecting **Restore** from the menu.

ii) **Taskbar**: The Taskbar includes the **Start button**, **Window tabs** and the **System tray**.
Windows tasks may be monitored by using the **Task Manager Window** accessed by right clicking on the Taskbar and selecting **Task Manager** from the resulting menu.

- **Applications** – Shows all currently running applications
- **Processes** – Lists all currently running processes along with the user they are being run under, the CPU usage and memory usage
- **Performance** - Displays CPU and memory usage graphs
- **Networking** - Displays the network utilization graph for your network adapters
- **Users** – Lists all users currently logged into Windows, locally or remotely.

1) **Start Button**: Start Button brings up the start menu, which allows access to a number of Windows features.

2) **Window Tabs**: One of the main uses of the Task Bar is to switch between programs that are currently running on Windows

3) **System Tray**: Contains icons for some of the programs that are currently running, along with the clock.

II) **Launching Applications**

   Once a new piece of software has been installed on Windows there are four main ways in which to launch them:

   - **Start Menu**: Click on the **Start Button**, select **All Programs** and click on your application from the resulting list.
   - **My Computer**: Clicking on this icon brings up a window that allows you to view files and applications on any drive on your computer.
     
     Double click on the C-drive icon, navigate through the directory tree until you find your application file and double click the icon the start the executable.
   - **Desktop Shortcut Icon**: Simply double click on the short cut icon usually created on your desktop, to start your application.
   - **Run Command**: Click on the **Start Button** and select **Run** from the menu to bring up the dialog box. Enter the path and name of the application you want to run and click OK. Alternatively, use the browse feature to find your desired application.

III) **Shortcut Keys**

   Shortcut keys help provide an easier and faster method of navigating through the Windows operating system. The shortcuts are commonly accessible by using Alt, Ctrl and/or Shift in conjunction with a single letter.

   - **The following list of shortcuts is useful in word processing programs like Word, Notepad or WordPad**: (Del = Delete; Ins = Insert)

<table>
<thead>
<tr>
<th>Shortcut</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt + F</td>
<td>Brings up file menu options</td>
</tr>
<tr>
<td>Alt + E</td>
<td>Brings up edit menu options</td>
</tr>
<tr>
<td>F1</td>
<td>Brings up help window</td>
</tr>
<tr>
<td>Ctrl + A</td>
<td>Select all text</td>
</tr>
<tr>
<td>Ctrl + X</td>
<td>Cut selected text</td>
</tr>
<tr>
<td>Shift + Del</td>
<td>Cut selected text</td>
</tr>
<tr>
<td>Ctrl + C</td>
<td>Copy selected text</td>
</tr>
<tr>
<td>Ctrl + Ins</td>
<td>Copy selected text</td>
</tr>
<tr>
<td>Ctrl + V</td>
<td>Paste</td>
</tr>
</tbody>
</table>
Shift + Ins  Paste  
Home  Goes to beginning of current line 
Ctrl + Home  Goes to beginning of document 
End  Goes to end of current line 
Ctrl + End  Goes to end of document 
Shift + Home  Highlights the current position to beginning of line 
Shift + End  Highlights the current position to end of line 
Ctrl + left arrow  Moves one word to left 
Ctrl + right arrow  Moves one word to right 

b) The following list of shortcuts are used on the desktop:
Alt + Tab  Switch between open applications 
Alt + Shift + Tab  Switch backwards between open applications 
Print Screen  Create a screen shot of entire desktop 
Alt + Print Screen  Create a screen shot only for current program 
Ctrl + Esc  Bring up Start Menu 
Alt + Esc  Switch between open applications on task bar 
F2  Renames selected icon 
F3  Brings up Search window from desktop 
Alt + F4  Closes current open program 
Ctrl + F4  Closes window in a program 
Alt + Enter  Opens properties window for selected icon or program 
Shift + F10  Simulates right click on selected item 
Shift + Del  Deletes programs/files without putting them in recycle bin 

The Tab key is a very useful shortcut key.

On the desktop, pressing tab will allow you cycle between:
  i)  The Start Button – press enter to bring up the start menu 
  ii) Windows tabs -  use arrow keys to traverse open tabs and enter key to launch 
  iii) System tray –  use arrow keys to traverse icons and enter key to launch 
  iv) Desktop icons –  use arrow keys to traverse and enter key to launch 

As well, you can use Tab on web pages to cycle through text fields, check boxes and buttons.  Tab is used to go from top to bottom and Shift + Tab is used to go from bottom to top.

Creating shortcut icons:  Shortcut icons provide a fast means of executing a program or opening a file.  There are two methods to create shortcut icons for a program or file:
  i) Right click on the icon of interest and select Create Shortcut from the menu.  This will create a shortcut icon in the current directory, which can then be moved to the desired location. 
  ii) Right click on the icon of interest and select Send To from the menu.  This will bring up a second menu that contains the option Desktop (create shortcut).  Selecting this option will automatically create a shortcut icon on the desktop.

IV)  Configure Desktop And Hardware
a) **The Desktop:** Right clicking on the desktop brings up a menu with options to alter the appearance of the desktop.

- **Arrange Icons By**, which brings up a second menu listing options for how to display your desktop icons. You can sort icons by name, size, type or have Windows auto arrange them. In addition, icons may be aligned to a grid to form straight lines.

- **The Themes** tab allows you set desktop themes, which consist of a background plus a set of sounds, icons, etc. Windows XP comes preloaded with a number of themes but they can also be downloaded or created.

- **The Desktop** tab allows you to select the background picture for your desktop.

- **The Screen Saver** tab enables you to set a screen saver for Windows and also lets you adjust your monitor power settings.

- **The Appearance** tab allows you to adjust the look of windows, buttons, fonts and colors.

- **The Settings** tab allows you to configure your monitor’s resolution, color and graphics.

**Start Menu and Taskbar**

Simply right click on the Start Button and select **Properties** from the menu.

The **Taskbar** tab *allows you to alter the appearance of the Taskbar.*

Selecting **Auto-hide the taskbar** hides the bar from view until you drag your mouse over the bottom of the screen.

The **Group similar taskbar buttons** option, when selected, will group together window tabs of the same type, as described above in Section I.

The **Start Menu** tab *allows you to configure the appearance of the Start Menu.* Clicking on the **Customize** button enables you to set the icon size in the menu and to display shortcuts to your favorite Internet browser and Email program.

Right clicking on the Taskbar and selecting **Toolbars** brings up a listing of toolbars that can be displayed. For example, selecting the **Links** toolbar places a list of websites on the taskbar. You can add links to this list simply by dragging a web site link or icon onto the Links menu. The Toolbars menu also gives you the option of creating your own toolbar for the Taskbar.

b) **System and Hardware:**

The **Control Panel** folder *contains many icons dealing with system and hardware configuration.*

The Control Panel may be accessed from the Start Menu.
Double clicking the **Automatic Updates** icon allows you to set up the updating process for Windows XP. It is very important to keep your operating system up to date. You have the option of having:

i) Automatic download and installation
ii) Automatic download with user option on when to install
iii) User option on downloading and installing
iv) No updating

The **Keyboard** and **Mouse** icons *allow you configure basic operating features.*

The **System** icon *provides a number of window tabs dealing with system and hardware information:*

**General:** Provides basic information about your computer, such as the type of operating system running, type of processor and the total amount of system RAM.

**Hardware:** Provides access to the **Device Manager** window, which gives a listing of all the hardware currently installed on your system. Clicking on the ‘+’ symbol beside the headings will bring up a listing of specific components (ex. Keyboards). Right clicking on a hardware component brings up an options menu that allows you to uninstall the hardware component, **update the hardware driver** or view hardware properties.

**System Restore:** Can track and reverse harmful changes to your computer. Provides a status window that indicates what part of the system can be restored (ex. C-drive). The user must allocate a set amount of system memory in order to provide restore points. The more memory allocated, the more restore points can be saved. This window also enables the user to turn the System Restore feature on or off.

**Advanced:** Can view and alter settings for overall system performance, such as memory usage and processor scheduling.

**Environment Variables** button allows you to view, *edit, create and delete user and system variables.* A common variable to alter is PATH, which provides a listing of directories that your operating system will look in order to run an application.

**Folders**

a) **My Computer**

The main file management tool on Windows is **My Computer**

Files and folders can be sorted according to parameters such as Name, Size and Type by selecting **Arrange Icons By** from the **Views** menu in the toolbar.

Clicking on the **Folders** button in the Toolbar brings up a file tree-like structure in the left-hand side of the My Computer window.
This view is essentially **Windows Explorer** found on previous Windows versions. This view allows you to see the entire file structure in one window pane and the contents of a particular directory in another.

b) **Master Folders**

Windows tries to group related types of user files into master folders. The following is a summary of master folders along with their file types:

- **My Documents** -> Word documents, Excel documents, etc
- **My Pictures** -> Image files (e.g. jpeg)
- **My Music** -> Music files (e.g. mp3)
- **My Videos** -> Video files (e.g. avi)
- **My Webs** -> user created web pages

5) **File Operations**

A **File** is a collection of related data with a file name and storage location in memory.

Types of files are:

(i) **Regular files** store data e.g text files which contain information readable by users, binary files and executable files containing information readable by the computer.

(ii) **Directories**: contains information used to access all types of other files. They do not contain actual data

(iii) **Special files** define devices for the system

The following describes how these operations can be carried out on the Windows desktop.

- **Create** – Right click on the desktop or in a folder directory and select **New** from the menu. This list gives the option of creating a new folder or a file from a common format (e.g. Text document, Word document, etc).

Files can also be created from within an application such as Word.

The **Save** and **Save As** options can be used to save a File.

- **Delete** – Can be achieved by right clicking on a folder or file and selecting **Delete** from the menu. This action will move the folder or file to the Recycle Bin. The Delete option can also be found under the File menu in **My Computer**.

Alternatively, you can simply drag a file or folder into the recycle bin.

- **Copy** – enables us to make a second copy of the same file or folder stored on the clipboard. Can be achieved by right clicking on a folder or file and selecting **Copy** from the menu. Next, traverse into the destination folder, right click the mouse and select **Paste** from the menu.
Alternatively, you can select your file or folder under My Computer and then select **Copy To Folder**.. from the Edit menu. From the resulting menu you can select the destination folder.

- **Move** - enables us to change the location of a file or folder. Can be achieved by right clicking on a folder or file and selecting **Cut** from the menu. Next, traverse into the destination folder, right click the mouse and select **Paste** from the menu.

Alternatively, you can select your file or folder under My Computer and then select **Move To Folder**.. from the Edit menu. From the resulting menu you can select the destination folder. Lastly, you can simply drag a file or folder from one location to another.

- **Rename** - enables us to change the name of the file or folder. Can be achieved by right clicking on a folder or file and selecting **Rename** from the menu. The Rename option can also be found under the File menu in My Computer.

- **Folder Options.** The Folder Options menu is accessible from the Control Panel.

- **View** tab allows you to perform such tasks as i) Displaying hidden files ii) Hiding the extension of known files or iii) Displaying protected operating system files.

- **File Types** tab allows you to view or alter the application used by default to open or execute a particular file type

  - .exe - executable
  - .doc - word document
  - .txt - text files
  - .xls - excel
  - .Mdb - access
  - .ppt - powerpoint

**File Compression**

File compression is used to maximize the number of files that can stored in a particular location and to speed up downloading over the Internet. One method of compressing text files is to use **Active Pattern Substitution.** Here, common patterns in text such as recurring words or “strings” are replaced or substituted with a shorter word.

Compression programs such as **WinZip** ([www.winzip.com](http://www.winzip.com)) use a dictionary to associate common patterns with shorter strings. Since compressed files contain shorter versions of strings, they cannot be executed or viewed without first decompressing them. A program such as Winzip can also be used for this purpose. The following describes how to compress and decompress files using the **Wizard** mode in WinZip.

a) **WinZip Compress**
At the Wizard menu, select **Create a new Zip file** and click the **Next** button. Now type in the name and select the destination folder of your new zip file and click **Next**. Finally, add file(s) or complete folders into the zip archive file and click **Zip Now**

**COMPUTER LABORATORY**

**Definition:** The computer laboratory is a place where computers and computer accessories are kept, and students learn practical uses for computers

The following factors must be considered when preparing computer laboratory.

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

**Computer literacy**

**Definition:** Computer literacy is defined as the knowledge and ability to use computers and related technology efficiently, with a range of skills covering levels from *elementary use* to *programming* and *advanced problem solving*.

Computer literacy can also refer to the comfort level someone has with using computer programs and other applications that are associated with computers.

**Computer skills**

Computer skills are the abilities to use the software and hardware of a computer.

**Computer skills include:**

(a) Basic computer skills
- Being able to power on the computer
- Being able to use a mouse to interact with elements on the screen
- Being able to use the computer keyboard
- Being able to shut down the computer properly after use

(b) Intermediate skills
- Functional knowledge of word processing
- How to use e-mail
- How to use the Internet
- Installing software
- Navigating a computer's file system

(c) Advanced skills include
1. Programming
2. Understanding the problems of data security
3. Use of a computer for scientific research
4. Fixing software conflicts
5. Repairing computer hardware

**Secure lab environment**

Computer Laboratory Security
This is the use of a combination of *physical* and *software-based* methods to ensure the safety and security of our users, software, and equipment and computer network.

Computer laboratory safety measures can be divided into three:

i. Those that are meant to protect the users.
ii. Those that are meant to protect computers
iii. Those that are meant to protect software

(i) Physical Security

All Information Technology computer labs are secured to ensure that only authorized persons are able to enter and use the labs during regularly scheduled hours

- Card-swipe
- Proximity locks, as well as scheduled electronic locks
- Employing a laboratory technician,
- Employing security personnels e.g. askaris
- Using closed circuit television cameras i.e. CCTV cameras,
- Engraving equipments
- Tying cables
- **Burglar proofing the room**: To deter forceful entry into the computer room.
- Installing an intrusion detection alarm system
- employing security guards also increases the level of security against theft of computers and their accessories,

**Installing fire prevention and control equipment**: extinguishers are the *gaseous type* and should be non-liquid/non-powder based as liquids may cause rusting and corrosion of computer components, powder particular may increase friction and wear off moving parts. The particles can also cause disks to crash.

- **Providing stable power supply**: by installing surge protectors, power extension cables, Uninterrupted Power Supply (UPS) for each computer and a power backup generator.
- Installing lightening arrestors on the computer room
- The room should be well laid out with enough space for movement. Computers should be placed on stable, wide enough desks to avoid accidentally knocking them down. Cables should be laid out in trucks away from user parts to avoid stumbling on them.
• Dust and dump proofing the computer room. Dust can be controlled by fitting good window curtains and air conditioning system that filters dust particles from the air entering the room. Also, the computers should be covered with dust covers when not in use. On the other hand, dampness or humidity in the laboratory can be controlled by using dehumidifiers. High humidity leads to rusting of the metallic parts of a computer.
• The users should not eat or drink in the computer laboratory. Food particles may fall in moving computer parts like the keyboard and clog them while liquids may pour into electrical circuits and cause short circuits.

(ii) Software Based Security and Prevention of Installation of Malicious Software

• Use standard anti-virus and anti-spyware software: To scan, detect and delete viruses or spy ware
• Through group policy, Authorized login: For authentication using user names and pass words (PIN, Secret codes)
• Encrypting the data: So that it is not understood by un authorized persons
• Use of firewalls: To stop information from untrusted sites from gaining to access to your network

(iii) Measures that protect the user

• All cables should be insulated to avoid the danger of electric shock to the users.
• Cables should be laid away from user paths to avoid tripping on them.
• Providing standard furniture to avoid poor posture during machine use which may lead to strain injury and limb fatigue.
• Providing antiglare screens (light filters) and adjustable screens to avoid eye strain and fatigue caused by over bright cathode ray tube (CRT) monitors.

However, modern flat panel displays such as the Liquid Crystal Display (LCD) do not strain the eye hence need not be fitted with antiglare screen.

• The room should be properly ventilated to avoid dizziness caused by lack of adequate oxygen and to allow the computers to cool.

• The walls of the computer room should not be painted with over bright reflection oil paints and the screens should face away from the window to avoid glare caused by bright backgrounds.

• Overcrowding in the computer room is not allowed. This may cause suffocation.

• Running and playing in the computer room is not allowed.
Behavior in the computer laboratory

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

DONTS

- Avoid smoking or exposing computers to dust. This is because smoke and dust contain small abrasive particles that can damage computer components and cause wearing of moving parts.
- Avoid carrying food and beverages to the computer room. Food may fall into the moving parts of the computer and damage them. Liquids may spill into computer causing rusting or electrical faults.
- Avoid unnecessary movements because you may accidentally knock down peripheral devices.
- Do not open up the metallic covers of computers or peripheral devices without permission and particularly when the computer’s power is still on.
- BAGS (back pack, hand bag, etc.) are not allowed inside the computer laboratory.
- No outdoor or indoor games should be played in the computer laboratory or computer room.
- Avoid using diskettes from other centers before running the virus scan.
- EXPLORING PORNOGRAPHIC SITES and saving porno images are not allowed.
- DON’T STEAL ANY COMPUTER PARTS, it’s a major offense.
- CHANGING COMPUTER DESKTOP setting is not allowed unless with authority of instructor.
- Do not move equipment or peripherals from one computer to another.
- Do not connect or disconnect any cables.
- Do not force diskettes in or out of floppy drives.

DOS

- Report problems to the consultant/ teacher.
- Please turn off your CELLPHONE, IPOD, MP3 PLAYER or any gadgets that can disturbed the class discussion inside the computer laboratory.
- Leave promptly when a class is announced or the laboratory is closing.
- Clean up the work area around your station when you leave.
- At all times follow the correct procedure for starting and shutting down the computer to avoid loss of data and damage to computer programs.
How to clean a computer laboratory

1. Shut down all the computers, and turn off any power strips that are still on to avoid the risk of electrical shock or damaging any components.

2. Wipe the keyboards with antimicrobial wipes. Use keyboard duster to remove crumbs and other particles from in between the keys.

3. Clean each mouse using the antimicrobial wipes to gently cleanse the computer mouse, but avoid getting it too wet.

4. Clean the tops of the computer desks using antimicrobial wipes to clean them at least once a day.

5. Wipe the buttons. There are several buttons on a computer tower as well as the monitor that are always being touched by new fingers. Clean them gently with antimicrobial wipes.

6. Dust the monitors. Use dryer sheets or blowers to remove any dust from the monitors.

7. Sweep the floors. The floor is likely to be riddled with crumbs and other bits of trash. Sweep the floor with a broom if you have a tile or hardwood floor. Use a sweeper or vacuum for carpeted floors.

8. Wipe down the chairs. About once a week, clean the chairs with some antimicrobial wipes, as these are another commonly overlooked home to bacteria.

CHAPTER 3

COMPUTER HARDWARE
These are the physical and tangible components of a computer system. They are components which can be seen, touched or felt.

**COMPONENTS OF COMPUTER HARDWARE**

These can generally be categorized as Input devices, output devices, storage devices and processing devices.

(a) **INPUT DEVICES (operation and usage)**

Input devices are devices that generate, and enter data and instructions to the computers. There are many input devices but the most common ones are the keyboard and the mouse. Examples of input devices include the following:

- 24) Keyboard
- 25) Mouse
- 26) Trackball
- 27) Touchpad
- 28) Joystick
- 29) Touch screen
- 30) Light pen
- 31) Stylus and Graphics Tablet
- 32) Digital Camera
- 33) Scanner
- 34) Optical Character Recognition Reader
- 35) Optical Mark Recognition Reader
- 36) Bar Code Reader
- 37) Magnetic Strips Reader
- 38) Magnetic Strips Reader
- 39) Microphone
- 40) Voice Recognition Device
- 41) MID Device
- 42) Digital Video Camera
- 43) PC Camera
- 44) Web Cam
- 45) Sensor and Remote Sensor
- 46) Terminal
1. **Input devices** can be classified into **manual input devices** and **automated input devices**.

   (a) Manual input devices provide more flexibility for data input. Examples of manual input devices include: *keyboard, mouse, touchpad, touch screen, and microphone.*

   (b) Automated input devices are quicker and usually generate fewer mistakes than manual input devices.

   Examples of automated input devices include: *bar code reader, OMR reader, OCR reader, MICR reader, scanner, and sensor.*

2. Input devices are further put into the following classification.

   **A. Pointing input hardware devices**
   Devices with which one can move or control a cursor or pointer in a GUI (*Graphical User Interface*).
   E.g. Mouse, Tracker ball, Touch screen, Touch pad, Pointing stick, Graphics, tablet, Stylus, Light pen, Cyber glove, Eye gaze/eye tracking

   **B. Text input hardware devices**
   Are devices with which one can enter text into a computer?
   E.g. Speech recognition, Chorded keyboard, GKOS keyboard, Optical character recognition, Handwriting recognition, Keyboard, Bar code readers, QR code Reader, MICR reader:

   **C. Gaming input hardware device:**
   A device with which one can play a game on personal computer.
   E.g. Joystick, Game pad (or joy pad)

   **E. Audio input devices**
   Are devices with which helps a user to record sound waves into a digital file on a computer.
   E.g. Microphone

   **D. Image, video input hardware devices**
   Are devices that are used to record video, images and other moving activities with one late downloads to the computer for storage, saving, copying onto media, or otherwise in any other form.
   E.g. Image scanner, 3D scanner, Digital camera, Digital camcorder, Webcam, Digital video recorder, Digital video cameras

   **Note:** Storage devices can be used as input devices.
1. **KEYBOARD**

This is a human touch input device, which needs the human hand to press the keys when entering data. It mostly captures text data. Physically, computer keyboards are an arrangement of rectangular or near-rectangular buttons, or "keys".

There are four general areas of the keyboard. These are:-

- The function keys that are labeled from F1 to F12
- The typewriter area in the QWERTY format
- The numeric keypad located on the far right side of the keyboard and the cursor motion and
- Control keys

**Advantages of using keyboards for data input include:**

- It is not necessary to buy additional equipment because most computer systems are normally supplied with keyboards.
- Entering data and instructions with keyboards is generally faster than other input methods such as voice input and optical character recognition.
- Keyboards are more reliable and usually produce fewer errors than other input methods such as voice input and optical character recognition.
- Reliable for data input of text and numbers.
- Specialized keyboards are available.

**Disadvantages:**

- Users may be slow or not very accurate typists.
- Slow for accessing menus etc. and difficult to use if you want to move objects around the screen.
- Difficult for people who are unable to use keyboards through paralysis or muscular disorder.
- Typing speeds are still very slow when compared with computer speeds.

**Keyboard special keys**

(a) **Alt key:**
The Alt-key combines with other keys to perform specific functions. In most window programs, the main menu Tabs have got underscored letters like File, Edit, View, Format, Tool, Table, Window and Help. Pressing Alt with the underlined letter will activate that menu. Alt + F4 = Exits a program.
(b) **Control (ctrl) key.**
Used with other keys to perform specific functions/operations e.g.
- Ctrl + F2         Print preview
- Ctrl + Alt        Adds a new page (Page Beak)
- Ctrl + Alt + F2   Gives ‘Open file dialogue box’
- Ctrl + Alt + Del  Initiates a reboot (warm boot)
- Ctrl + P          Initiate print dialog box
- Ctrl + B          Bolds a selection
- Ctrl + S          Saves a file
- Ctrl + Z          undo
- Ctrl + Y          redo
- Ctrl + C          copy
- Ctrl + V          Paste
- Ctrl + W          New file
- Ctrl + X          Cut
- Ctrl + Esc        Activates the startup menu.

(c) **Shift Key.**
Makes one alternate between lower and upper case characters during routine typesetting operations
It is also used for other short cut operations e.g.
- SHIFT + F3 :Alternates between lower and upper case characters, title case and sentence case.
- Shift + Arrows : used to select text
- Deactivate the auto-run while inserting a CD-ROM.

(d) **Windows key:** Activates the start-up menu for the computer user to run shutdown, Run, Help, Search, Settings, Documents, programs, Control panel, etc.
- Ctrl + Esc        Activates the startup menu too.

(e) **Enter key/Return:**
Used to enter/confirm commands or move the cursor/insertion point to a new line.

(f) **Tab key:**
In normal typesetting, tab keys help in having data in columns with smooth margins.
When working with tables it is used to move from field to field, and to add a field/Row in a table.
When the cursor is in the last bottom cell of the table, pressing tab key adds another row.
Shift + Tab take you back to the previous field.

(g) **Del + Backspace key.**

(h) **Escape (ESC) key** used to Exit / close a dialog box.

(i) **Cursor control Keys:**
- Home            Moves the cursor at the beginning of a line.
- End             Moves the cursor to the end of a line.
2. THE MOUSE (COMPUTER MICE)

It is a computer input pointing device used to move an arrow shaped pointer on the computer screen as it is gently moved onto the desk-top/mouse pad, to select items, move objects and confirm operations. The mouse translates the movement of the hand to the movement of an arrow, called the mouse pointer, on the screen.

Parts of a mouse piece.
- Primary button
- Secondary button
- Wheel button
- Rubber ball – roller for ball type mouse – signal movement
- Mouse housing which can be held in to your hand
- Cables connecting the mouse to system board
- An Interface connector to attach the mouse piece to the mouse board

There are three basic types of mice:

Mechanical
Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

Opto mechanical
Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

Optical
Uses a laser to detect the mouse's movement. One must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical and optomechanical mice, but they are also more expensive. Mice connect to PCs in one of several ways:
Types of mice interface

(1) Serial interface: Used by old computers with 9 -25 pin male connectors
(2) PS/2 mouse interface: i.e. on board mouse port
(3) USB interface: (input/output) this works through USB slots of the system board.

Mice Faults
Mouse pieces are usually disturbed by the following;
- Dirt accumulating on mouse rollers and wheel mechanism
- Bending pins.
- Interruption conflicts: The computer fails to recognize its mouse piece. Restart the computer or check mouse
- drivers/software

Mouse techniques

Using the mouse involve five techniques
1. Pointing: - Move the mouse to move the on-screen pointer.
2. Clicking: - Press and release the left mouse button once.
3. Double-clicking: - Press and release the left mouse button twice.
4. Dragging: - Hold down the left mouse button as you move the pointer.
5. Right-clicking: - Press and release the left mouse button.

Advantages of using a mouse include:
- A mouse is user-friendly for computer beginners.
- Ideal for use with desktop computers.
- Usually supplied with a computer so no additional cost.
- A mouse is easy and convenient to use with a graphical user interface.
- Using a mouse to select items or move a particular position on the screen is faster than using a Keyboard

Disadvantages of using a mouse include:
- It is not easy and convenient to input text with a mouse.
- Issuing commands by using a mouse is slower than by using a keyboard.
- It needs some practice in order to control a mouse properly.
- A mouse is not accurate enough for drawings that require high precision.
- A mouse usually requires a flat surface to operate.
• A mouse needs more desk space to operate when compared with a trackball or a touchpad.
• The mouse cannot easily be used with laptop, notebook or palmtop computers. (These need a tracker ball or a touch sensitive pad called a touch pad).

3. **TRACKBALL**
Is an input device where a finger is used to rotate a ball. A trackball is commonly used instead of a mouse on laptop and notebook computers.

**Advantages:**
• Does not need as much desk space as a mouse.
• Is not as tiring since less motion is needed

**Disadvantages:**
• Used on Standard and specialist keyboards.
• A trackball is usually not accurate as a mouse/
• It Requires fine control of the ball with just one finger or thumb.
• Repeated motions of the same muscles are stirring and can cause carpal tunnel syndrome.

4. **JOYSTICK**
A joystick is a computer peripheral pointing device with a vertical lever having buttons called triggers, which activate certain events when pressed.
The lever usually includes
Joysticks are mainly used for computer games and ultrasound scanners in hospitals.

**Advantage of using a joystick include**
A joystick allows fast interactions required in most games.

**Disadvantages of using a joystick include**

It is difficult to use a joystick to select objects accurately on the screen.

---

**5. SCANNER**

A **scanner** is a light-sensing input device that converts printed text and graphics into a digital form that can be further processed by the computer.

When you want to put your picture into the computer you need a scanner to capture it. The hand scanner is pulled over the image manually, whereas the table scanner is like a photocopier, and automatically pulls the sensors over the image.

Three popular types of scanners are:

1. A **flatbed scanner** works like a copy machine except that it creates a file of the document rather than a paper copy.
2. A **sheet feed scanner** has motorized rollers that can feed the source document across the scanning head during the scanning process.
3. A **handheld scanner** can be manually passed over the image to be scanned.

The quality of a scanner is determined by its resolution and color depth. **Optical resolution** is the actual scanner resolution.

Many scanners also include optical character recognition (OCR) software, which can convert an image of text onto a text file that can be edited.

**Advantages of a scanner include:**

- A scanner with appropriate OCR software can work as an OCR system.
- Flat-bed scanners are very accurate and can produce images with a far higher resolution than a digital camera

**Disadvantages of a scanner include:**
• A scanner is best for two-dimensional objects only.
• Scanned images usually take up a lot of storage space.

6. **LIGHT PEN**

This is an input pointing device with a light at its end used for making writing or drawing motions on a special pad. This is mostly used by Artists and Designers.

**Advantages of light pens include:**
- Using a light pen is more direct and precise than using a mouse.
- Light pen is also convenient for applications with limited desktop space.

**Disadvantage of light pen includes:**
- Light pens normally require a specially designed monitor to work with.

7. **TOUCH PAD**

It is a flat pad that the user can write on using a pen like structure known as the Stylus. All movements made on the pad by the stylus are translated into writing or drawings on the screen, because the pad is sensitive to the position of the stylus and the stylus is sensitive to the pressure applied by the user. It allows the user to sketch a design.

8. **TOUCH SCREEN**

This is an input device which sends signals whenever the user touches any position on the screen to execute a particular instruction. A finger or pen can be used as with map kiosks in shopping centres and pen-based computers respectively. Touch screens are used public areas, like ATMs

**Advantages of a touch screen include:**
- No extra peripherals are needed except the monitor.
- A touch screen allows easy access to commands, which are usually identified by words or symbols on the screen.
- Software can alter the screen while it is running making it more flexible than a printed overlay
- keyboard No extra peripherals are needed apart from the touch screen monitor itself

**Disadvantages of a touch screen include:**
- Touch screens are not suitable for inputting a large amount of data because they require a lot of arm movements.
- Only items already on the screen can be selected.
- Selecting detailed objects can be difficult with fingers
9. STYLUS AND GRAPHICS TABLET

A **stylus** is a pen-like pointing device, which uses pressure to write text and draw lines.

A **graphics tablet** is a flat, rectangular, electronic plastic board, on which a stylus writes or draws.

Each location on the graphics tablet corresponds to a specific location on the screen.

A graphics tablet can be used to digitize drawing with great accuracy. Stylus and graphics tablet area mainly used for computer-aided design and drafting by architects, mapmakers, artists, and designers.

**Advantage of stylus and graphics tablet include:**
- A stylus can be pointed to different positions on the table quickly.

**Disadvantages of stylus and graphic tablet include:**
- A stylus and a graphics tablet normally have to work together, and cannot work separately.

10. MICROPHONE

A microphone is an input device that translates sound into electric current, which the computer will then digitise. Initially this was designed as a special device for the handicapped and required special software. However, more and more Voice-Recognition software is becoming available, allowing users to “speak” text rather than type it in. Voice Recognition applications usually have to be “trained” to understand different voices.

Microphones are also becoming increasingly important as Internet tools, and the Voice Over Internet Protocol is allowing verbal conversations and Voice Messaging across computer networks.

Computers that are equipped with a microphone, sound card and speakers can be used for telephone network switching, and this is becoming increasingly important in large call centres.

**Advantage of microphone**
- Each function can have its own button making them very simple to use.

**Disadvantage of microphone include:**
- Only advanced models can be have the buttons reprogrammed so they cannot be used to control anything other than the device they were designed for.

11. BAR CODE READER
This device works in a similar way to the hand-held scanner, but in this case it reads a series of bars on a label, to identify an item or product in a shop. It gives a fast and reliable service to both the salesperson and the customer. By pointing at the bars on the item the price is displayed. These bars are made up of black and white stripes of different thickness to form a code number to identify the product.

Advantages of using bar codes and bar code readers include:

- The process of data entry is fast and accurate.
- Bar codes can be printed by normal printing methods.
- No need to write down or key in the name of the item or its actual price.
- They can be read even when they are on curved surfaces or upside down and a 'checksum' digit is included in the code to check if it has been read correctly.

Disadvantages of using bar codes and bar code readers include:

- Only numbers can be coded.
- Bar codes cannot be read directly by people.
- A bar code reader may misread a bar code if there is any dirt or mark on the code.

12. DIGITAL CAMERA

This is a special device used to capture images in digital form and stores the images on a floppy disk which are later downloaded onto a computer for editing and printing.

Advantages of digital cameras include:

- No film is needed and there are no film developing costs
- Unwanted images can be deleted straight away
- Images are already digital and can easily be transferred to a computer and edited or transferred over the Internet
- Images taken can be reviewed and even edited in the camera.
• Photographic images can be digitized directly without using a scanner.

• Digital cameras are best for three-dimensional objects while scanners are only best for two-dimensional objects.

**Disadvantages of a digital camera include:**

• Digital cameras are normally more expensive than ordinary films cameras with similar functions.

• Photo printing cost for digital cameras is generally higher than that for ordinary film cameras.

• Resolution is still not as good as film but is improving steadily

• Images often have to be compressed to avoid using up too much expensive memory

**13. DIGITAL VIDEO CAMERA**

A digital Video (DV) camera records Video as digital signals rather than analog signals.

Most DV cameras can also capture still frames.

**14. PC CAMERA**

A PC camera is a kind of DV camera that allows the user to record, edit and capture video and still images, and to make video phone calls on the Internet.

PC cameras can be set to take digital photographs at preset time intervals or whenever it detects motion.

**15. WEB CAM**

A web cam is a video camera whose output displays on a Web page.

**16. VIDEO DIGITISER**

This is a special device used to display video signals from a video camera or video recorder in a window on the computer screen. Still images can also be captured. This is usually used by video editors because it allows the user to select the best part or images of a tape.

**17. MAGNETIC INK CHARACTER RECOGNITION (MICR)**

This is mostly used by banks when processing cheques. The numbers printed at the bottom of the cheque have got magnetic particles on them. These can be easily read in a faster way.
Advantages of MICR readers include:

- MICR is difficult to forge hence provides a high level of security.
- Documents can still be read when folded or written on.

Disadvantages of MICR readers include:

- MICR readers and encoders are very expensive.
- The system can only accept a few different character sets.

18. MAGNETIC STRIPS OR STRIPES

These are thin strips of magnetic tape found at the back of most credit or debit cards or on key cards of some hotels. When the card is used data is read and processed and information is displayed on the screen.

The magnetic strips are used to withdraw money from cash dispenser machines popularly known as the ATM (Automated Teller Machines).

Most magnetic strips are read-only, and are used merely to identify the cardholder. However, some applications both read from and write to the magnetic strip.

Advantages of magnetic strips readers include:

- Reading is accurate and fast.

Disadvantages of magnetic strips reader include:

- The amount of data that can be stored on a strip is limited.
- The magnetic strips can be damaged easily by exposure to a strong magnetic field.

19. OPTICAL CHARACTER RECOGNITION READER (OCR)

Most OCR readers include a small optical scanner for reading characters and sophisticated OCR software for analyzing what is read. OCR readers are often used for turnaround documents (e.g. electricity bills).

Advantages of OCR readers include:

- Written data and printed data can be read at the same time.
- Hard copies of documents can be read directly into a computer without retyping.
- The characters converted can be edited by word processing software.
Disadvantages of OCR readers include:

- OCR readers often do not work well with handwritten characters or those in unusual fonts.

20. OPTICAL MARK RECOGNITION READER (OMR)

Optical mark recognition (OMR) can sense hand-drawn marks such as small circles or rectangular made on pre-printed forms in certain places.

The OMR reader first reads the answer key sheet to record the correct answers based on the patterns of light, and then reads the remaining documents and latches their patterns of light against the answer key sheet.

OMR readers are often used for marking multiple choice answer sheets, capturing data from questionnaires, enrolment forms, and lottery tickets.

Advantages of OMR readers include:

- OMR has a better recognition rate than OCR because fewer mistakes are made by machines to read marks than by reading handwritten characters.
- Large volumes of data can be collected quickly and easily without the need specially trained staff.
- The cost of inputting data and the chance of data input errors can be reduced because it is not necessary to type the details for data entry.

Disadvantages of OMR readers include:

- Documents for optical mark recognition are complicated to design.
- The OMR readers are needs to be reprogrammed for each new document design.
- OMR readers are relatively slow.
- The person putting marks on the documents must follow the instructions precisely.
Any folding or dirt on a form may prevent the form from being read correctly.

21. VOICE RECOGNITION DEVICE

Voice recognition, or speech recognition, is the computer’s capability to distinguish spoken words.

Voice recognition programs do not actually understand speech; they only recognize a vocabulary of pre-programmed words.

Advantages of Voice recognition include:
• No typing of data is necessary.
• The system can be used remotely by telephone or by people whose hands are occupied or disabled.
• Voice recognition systems are also ideal for blind or visually impaired users.

Disadvantages of voice recognition include:
• Error rate is still high at the moment.
• Recognition of words is slow.
• Words sound the same (e.g. see and sea) cannot be distinguished.
• The system is not suitable for use in noisy places.
• The software must be trained to recognize specialist or technical words.
• Many people find it difficult to speak in a ‘writing’ style.

22. MIDI DEVICE

MIDI (Musical instrument digital interface) is the electronic music industry’s standard that defines how sounds are represented electronically by digital musical devices.

MIDI devices are connected to the sound card of the computer.

Examples of MIDI devices include: electronic piano keyboard, synthesizer, or drum machine.

SENSOR AND REMOTE SENSOR

A Sensor is an input device that can detect external changes in an environment. Internal changes include levels of light, temperature, sound, position, PH value, humidity. The data received can be processed immediately to influence the output of the system.
Then the sensors are located at some distance from the computer system, they are known as the **remote sensors**.

Examples of sensor applications include freezers and chiller cabinets in supermarkets to monitor temperature.

**23. TERMINAL**

**Terminal** is a device having a monitor and a keyboard and used to send and receives computer signals.

Different kinds of terminals include:

**Dumb terminal** has no processing power, cannot act as a stand-alone computer, and must be connected to server to operate.

**Intelligent terminal** has memory and a processor so that it can perform the functions independent of the host computer.

**EPOS** (Electronic Point of Sale) terminal is used to record purchases at the place where the consumer purchases the product or services.

**EFTPOS** (Electronic Fund Transfer Point of Sale) terminals are able to transfer from the customer’s bank account directly to a retail outlet’s account after the customer’s debit card.

Automatic teller machine (ATM) is a self-service banking machine attached to the computer through a telephone.

**DOMESTIC DEVICES:**

These are computer controlled devices used in homes. Basically any device, which can be programmed by data input, which is then processed, stored and acted upon to provide some form of output. These are really self-contained microcomputers, called micro controllers.

They have input devices, output devices and processing chips all linked together and embedded inside them. The program used by the device is not loaded from disk like a normal computer but is permanently stored on an internal memory chip or ROM.

1. **Automatic Washing Machine**

**Inputs devices:** sensors for water flow, water level and temperature; door switch; selector knob or buttons for settings such as spin speed, temperature, load size and types of wash cycle required.

**Processing:** program to control all of the above settings

**Output devices:** switches to operate the water pump, inlet and outlet valves, heater and drum motor.
2. Central Heating Controller

**Inputs devices:** buttons or keypad; temperature sensors for hot water storage tank, room air and radiators; timer switches; water flow sensor.

**Processing:** keeping time and on/off settings.

**Output devices:** switches to operate the water pump, valves, and boiler; LCD screen display.

3. Burglar or Car Alarm

**Inputs devices:** door and window switches; infra-red sensors; buttons or keypad for setting password and for activating and deactivating the system

**Processing:** program to control all of the above settings and provide time to allow delayed activation of the system.

**Output devices:** buzzer; siren; bell; lights; telephone connection to security agency.

4. Video Cassette Recorder (VCR)

**Inputs devices:** control panel switches and infra-red detector for remote control; UHF channel sensor; sensor to read tape.

**Processing:** keep current time and date; respond to recording dates and times, scan and store channel settings; amplify and convert UHF signals

**Output devices:** LCD display; tape drive motors; recording to tape device; video and sound output to television.

5. Microwave Oven

**Inputs devices:** door switch; buttons or keypad for settings such as time and heat output.

**Processing:** program to control all of the above settings

**Output devices:** switches to operate the microwave generator, turntable motor, fan motor, interior light and warning bell; LCD screen display of inputs and current time.

6. Digital Watch

**Inputs devices:** button switches to set current time, alarm time and date.

**Processing:** program to keep an accurate calculation of the time and date and to control all of the above settings
**Output devices:** LCD display or motor to move hands; beeper; back light.

7. **Pocket Calculator**

**Inputs devices:** button switches or keypad

**Processing:** program to perform calculations

**Output devices:** LCD display; button clicks.

8. **Mobile Telephone**

**Inputs devices:** button switches or keypad

**Processing:** program to perform connection to telephone network and to dial numbers; PIN number identification; store and process menu options

**Output devices:** LCD display; button clicks; dialing and ringing tones; back light.

9. **Toys:**

**Inputs devices:** sensors for sound and light; pressure or feeler switches; selector knob or buttons for settings or infra-red sensor for remote control device

(b) **OUTPUT DEVICES**

These are devices that display or output work which is processed or stored in the computer to the users. These include the following:

- Monitors
- Printers
- Plotters
- Speakers
- projectors
- Actuators
- Facsimile machine
- Multifunction machine

**FORMS OF COMPUTER OUTPUT**

A computer outputs information in one or more of the following forms:

- Graphics and images
- Sound
- Characters (text, numbers and symbols)

The computer output devices are of two major types

(i) **Hardcopy output devices e.g. printers.** Plotters
• **Hardcopy** is the tangible output produced on print media like paper (it is in relatively permanent form)

(ii) Softcopy output devices e.g. projectors, speakers

**Softcopy** is the intangible output displayed on the screen (it is temporarily) e.g. temporary characters, images displayed on a monitor, sound produced by speakers etc

### COMPUTER OUTPUT DEVICES

#### MONITORS

These are sometimes called the screen or the VDU; These are the devices used in getting the processed data out of the computer to be displayed to the users.

Their display adapters can be a monochrome display adapter (MDA) or Colour graphics adapter (CGA)

a) **Mono-chrome adapter.** This type is capable of displaying only one colour using the white or green or umber (yellowish green) in the background and these are less popular today

b) **Colour video (visual) standard colour adapter** which display several colours.

- Color graphics adapter (CGA)
- Enhanced graphics adapter (EGA)
- VGA (Video Graphics Array) = 640 x 480 pixels
- SVGA (Super Video Graphics Array) = 800 x 600 pixels
- XGA (Extended Graphics Array) = 1024 x 768 pixels

**Functions of the monitor**

* It displays the progress or output of the user’s commands and this helps to decide on the next step.
* It makes a computer productive, interactive tool due to its instant visual feedback.
* It makes computing to be a continuous process due to its ability to provide constant visual feedback.

**Types of monitors**

a) Cathode ray tube monitors (CRT)
b) Liquid Crystal Display (flat panel)
c) Plasma screen
d) Touch screen
e) Organic Light Emitting Display (OLED)
a. **CATHODE RAY TUBE MONITORS (CRT)**
   This uses a cathode ray tube (CRT) to fire electrons at a coating of very tiny phosphor dots on the inside of the screen which causes the dots to glow.

   **Advantages**
   - Can produce fast and rich colour output
   - Images can be viewed from a wide angle
   - It is cheaper than LCD monitor

   **Disadvantages**
   - It emits higher electromagnetic radiations that cause eye defects
   - It consumes a lot of power than the LCD

b. **LIQUID CRYSTAL DISPLAY (flat panel) Monitor**
   This screen polarizes light by an electromagnetic field applied to a crystal which produces a liquid crystal display (LCD).

   **Advantages**
   - It consumes less power compared to CRT
   - It emits less radiation

   **Disadvantages**
   - It is more expensive than the CRT
   - Images are viewed from a narrow angel

**Screen size**
The screen size is measured in diagonal distance left to bottom right or top right to bottom left. The most common size is the 14-inch monitor (others include 17, 21, and 28)

**Antiglares**
These are rectangular glasses which reduce on the intensity of light and the flickering effect of the monitor screens.

**Terms**

**Resolution**
It refers to the sharpness and clearness of an image. The higher the resolution, the better the image. Often expressed in **dots per inch (dpi)**

**Dot pitch**
Refers to the vertical distance between each pixel on a monitor

**Pixel**
It is a single point in an electronic image

**Refresh rate**
This is the speed that the monitor redraws images on the screen, it is measured in hertz

**LIGHT-EMITTING DIODES (LEDS)**
These are small electronic components that emit light when a voltage is passed through them. They normally display hard disk and network activities and are also used to monitor the logic state of some control applications i.e. ON and OFF.

**PRINTERS**
A printer is an output device that prints characters, symbols, and perhaps graphics on physical media like paper, cloth, rubber, plastic etc

The two categories of printers are **Impact** and **non Impact printers**
Impact printers have contact with –print media while non impact printers do not have contact with print media.

(a) Impact printers
Impact printers form characters or images by a print head making direct contact with the print media. They use a **striking mechanism** such as a print hammer or wheel against an **inked ribbon**, leaving an image on paper.

An impact printer has mechanisms resembling those of a **typewriter**.

Examples of impact printer s include **Dot-matrix printers**, **Daisy wheel printers**, **drum printers**, **chain printers**, **line printers**, **Braille printers** etc

(i) **Dot-Matrix Printers**
Is a set of steel pins that strike an inked ribbon onto paper producing a sequence of dots.

Dot-matrix printers print about **40-300 characters per second (cps)** and can print some graphics, although the reproduction **quality is poor**.

(ii) **Daisy-Wheel Printer**
Like a typewriter but with the preformed letters on the ends of spokes to form a wheel. The letters strike an inked ribbon onto paper.

Advantages of impact printers

1. They are not very expensive
2. They can withstand dusty environments, vibrations and extreme temperatures
3. They can print through multipart forms, creating several copies of a page at the same time.
4. Print though several pages e.g. original, duplicate, triplicate
Disadvantages of impact printers

I. They are slow when printing
II. Cannot print graphics
III. The print quality is low
IV. They are very noisy because of the striking mechanism

(b) Non impact Printers

Non impact printers form characters and images without direct physical contact between the printing mechanism and the paper.

Examples of non impact printers include laser-Jet printers, ink-jet printers and thermal printers.

(i) Laser-Jet Printer:

A laser printer creates images with dots. However, as in a photocopying machine, these images are created on a drum, treated with a magnetically charged ink like toner (powder), and then transferred from drum to paper.

(ii) Ink-jet printer:

Ink-jet printers also form images with little dots. Ink-jet printers spray small, electrically charged droplets of ink from nozzles through holes in a matrix at high speed onto paper.

Ink-jet printers can print in colour and are quieter and much less expensive than a colour laser printer. However, they are slower and print in a somewhat lower resolution (300-720 dpi) than laser printers. Some new, expensive ink-jet printers print up 1200 or 1400 dpi.

(iii) PLOTTERS

Plotters are used in the scientific and engineering sectors for drawing building plans, machines and machine parts. Plotters can take A3 and A2 paper and come in different sizes and types. Some of them are as big as a small classroom.

Advantages of non impact printers

I. They are quite while printing
II. They are fast
III. They produce high quality output

**Disadvantages of non impact printers**

I. They are very expensive

II. They are delicate as they may not withstand dusty environments, extreme temperatures and vibrations

III. They can not print through multipart forms

**Common factors to consider while buying a printer**

I. Price of cartridge (toner)

II. The cost of the printer

III. Printing speed of the printer

IV. The purpose for which the printer is to be used e.g. printing on multipart forms like result slips

V. Availability of printer drivers

**d) ACTUATORS**

These are devices that can generate physical movements from signals sent by computers. These signals can be sent through wireless (remote) transmission or through cables.

**e) MOTORS**

These are driven by the output of the computer and this output is displayed by the turning of this motor. They give very precise movements and they are used on devices such as flatbed plotters or on robotic arms.

**f) SPEAKERS**

Computers with sound cards are able to translate digital sound into audible signals via speakers.

**g) PROJECTORS**

These are display devices that take characters from the computer screen and project them on a larger screen so that the large audience can see them clearly.

The three types of projectors are: -

- **Overhead projectors**
  These use a projection panel to display data. The data to be displayed is printed on transparencies (transparent paper) and then placed on the projectors glass

- **LCD (Liquid Crystal Display) projectors**
  These use crystal display technology and they directly attach to the computer. The projectors use their own source of light to display data on the screen
• DLP (Digital Light Processing) projectors

These use tiny mirrors to reflect light. They produce bright colourful images that remain that remain in focus and they can be clearly seen in a well lit room

Advantages of display devices

- Very fast in outputting data
- Outputs data silently
- Needs no extra costs of printing and print media

(C) COMPUTER STORAGE

Computer Storage refers to the ability of a computer to keep data or information. The computer stores data in two ways:

- Temporary storage
- Permanent storage

Temporary storage
This is the ability of a computer to store data or information for a short time as long as the computer is still on

Permanent storage
This is the ability of a computer to store data or information on a permanent computer storage medium. This Storage is also known as backing storage or secondary storage.

Memory
A MEMORY is an inner storage space area in the computer,
1. Primary memory
2. Secondary memory

(a) PRIMARY MEMORY

Primary storage (also called main storage, main memory, or internal storage) holds all instructions and data needed for processing

It consists of:
- RAM: Random Access Memory
- ROM: Read Only Memory

RANDOM ACCESS MEMORY
This is the memory or the temporary location which holds the software and other input data while the computer is working.

The contents of RAM can be altered, deleted, copied and read.
It is the main working memory of the computer i.e. the higher the RAM the better the personal computer.

**CHARACTERISTICS OF RAM**

1. It is volatile and therefore loses its contents when the computer is switched off.
2. It is read, copied, wrote, altered and deleted
3. The amount of data it can hold at a given time is highly limited
4. It is expensive compared to ROM.

Physically it is a chip with storage capacities in MBs. E.g. 64, 118, 128, 256, etc

**Types of RAM include:**
- DRAM Chips Dynamic RAM
- SRAM Static RAM. It’s faster, expensive and offers more space.

**Spooling:** This involves transferring data from one storage media to another. Without spooling data from input devices would be stored in the primary memory making it overloaded.

**READ ONLY MEMORY (ROM)**

A computer has a built up set of instructions (non volatile) it has to know what to do when switched on and those instructions are residents on ROM

The instructions in ROM are stored permanently; the computer can read or follow instructions in Rom but cannot change them.

Cannot write and thus called read only. A good example of ROM is POST (Power On Self Test), which initializes the computer when power is turned on.

**CHARACTERISTICS OF ROM**

1. It is non-volatile, meaning it does not lose contents when power is switched off.
2. The computer cannot write to it therefore programs or contents cannot be changed.
3. It cheaper compared to random access memory.

There are several subsets of ROM, which are:

- **PROM (for Programmable Read Only Memory).** This type of memory can be programmed by the user and the programmed data is held permanently once programmed.

- **EPROM (for Erasable Programmable Read Only Memory).** Just the same as the PROM but this has an advantage in that it can be erased and reprogrammed and for one to erase it the EPROM must be removed from the computer.
- **EAROM (for Electrical Alterable Read Only Memory).** This type of memory can be erased, read and re-programmed without removing the chip from the computer.

- **EEPROM (for Electrically Erasable Programmable Read Only Memory).**

**Other Memory Options:**

(1) **Virtual Memory:**
Storage space in the Hard disk used to expand/supplement RAM. It enables the computer user ran more programs than available RAM can handle.

(2) **Cache Memory:**
This is a special high speed memory area that the CPU can access quickly. It can be location in the CPU or on the system board/planner. To store frequently used programs.

(3) **Video Memory (VRAM)**
Used to storage display images for the monitor.

Its size depends on:-
- How fast images appear
- No of colour available

(4) **FLASH MEMORY:**
This is a special non–volatile RAM chip inserted into USB port to simulate and supplement the hand-disk.

**Memory size**

When data are entered into a computer through a device such as a keyboard, they are not in a form that the computer can interpret; computers cannot understand the complex symbols that humans use. Computers recognize only a code composed of 0s and 1s, known as machine language. Machine language suits the computer because electronic components and storage media represent two states: on/off, conducting/ non-conducting, or present/absent.

**EXPRESSION OF COMPUTER CAPACITY/DATA CONVERSION/CODING SYSTEM**

In a digital computer all characters are represented by either a byte or bytes depending on the coding system used. Bytes are derived from bits (0s and 1s) which are combined to represent letters, numbers, or special characters.

Hence computer capacity can be expressed as:

- A bit = A single 0 or 1 = the smallest unit of measurement.
- Byte = A group of 8 bits forming characters.
- Kilobytes (KB) = 1000byte = 8000 bits.
- Megabytes (MB) = 1, 048, 576bytes 1m byte
- Gigabyte (GB) = 1, 073, 74, 824 bytes 1b byte
- Terabyte (TB) = 1, 009, 511, 776 byte trillion bytes
Binary coding schemes/standards:-

- **EBCDIC**: Extended Binary Coded Decimal Interchange.
  Code used in mainframe computers.
- **ASCII**: America Standard Code for Information Interchange.
  Used in microcomputers

**Unicode**: A super set of ASCII using it byte (16bits) for each character

### CODES FOR LETTERS OF THE ALPHABET

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>EBCDIC</th>
<th>ASCII</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1100 0001</td>
<td>0100 0001</td>
</tr>
<tr>
<td>B</td>
<td>1100 0010</td>
<td>0100 0010</td>
</tr>
<tr>
<td>C</td>
<td>1100 0011</td>
<td>0100 0011</td>
</tr>
<tr>
<td>D</td>
<td>1100 0100</td>
<td>0100 0100</td>
</tr>
<tr>
<td>E</td>
<td>1100 0101</td>
<td>0100 0101</td>
</tr>
</tbody>
</table>

### CODES FOR NUMERIC FIGURES

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>EBCDIC</th>
<th>ASCII</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1111 0000</td>
<td>0011 0000</td>
</tr>
<tr>
<td>1</td>
<td>1111 0001</td>
<td>0011 0001</td>
</tr>
<tr>
<td>2</td>
<td>1111 0010</td>
<td>0011 0010</td>
</tr>
<tr>
<td>3</td>
<td>1111 0011</td>
<td>0011 0011</td>
</tr>
<tr>
<td>4</td>
<td>1111 0100</td>
<td>0011 0100</td>
</tr>
</tbody>
</table>

### CONVERSION/CODING/BINARY SYSTEM

Note: A computer has got its own language or codes by which it understands instructions.

Two digits of 0s and 1s are combined in codes of 8 digits to represent a character i.e. letters, numbers or special drawing like lines, triangles, circles, curves, etc.

Hence

One digit (0 or 1) = a bit

- 8 bits = 1 byte (B).
- \(2^{10}\) bits = \(1024\) bits = 1 Kilo byte (kb)
- \(2^{10}\) KB = \(1024\) KBs = 1 Megabyte (Mb)
- \(2^{10}\) MB = \(1020\) MB = 1 Gigabyte (GB)
- \(2^{10}\) GB = \(1024\) GB = 1 Terabyte (TB)

### (b) SECONDARY STORAGE DEVICES/MEMORY

Examples of devices that store information permanently and they are part of secondary memory include:
h) Hard Disks
i) Floppy Disks
j) Magnetic tapes
k) Zip Disk
l) Data Cartridges
m) Compact discs
n) DVDs

Storage media refers to the electronic equipment that is used to store the data

whereas

A storage device records and retrieves items to and from a storage medium.

Secondary storage devices/ media are of three types
1. Magnetic
2. Solid state
3. Optical devices

1. Magnetic
Secondary Magnetic Storage

<table>
<thead>
<tr>
<th>Storage</th>
<th>Size</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic Tape</td>
<td>20Gb - 200 Gb</td>
<td>Backing up the school network overnight</td>
</tr>
<tr>
<td>Hard Disk</td>
<td>40Gb - 250 Gb</td>
<td>Storing all of your software applications and documents</td>
</tr>
<tr>
<td>Floppy Disk</td>
<td>1.44 Mb</td>
<td>Storing a small file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unlikely to contain large images.</td>
</tr>
<tr>
<td>Zip Disk</td>
<td>100 Mb to 250 Mb</td>
<td>Transferring files between computers. Need a specialist drive. This storage media is not so commonly used nowadays.</td>
</tr>
</tbody>
</table>

(A) HARD DISK/ HARD DRIVE

It is a magnetic storage device that stores Data and information magnetically on the surface of a flat circular plate that rotates at a very high speed.
The hard disk is the most common form of secondary storage found in the System Unit.
It is usually designated as Drive C and D.
Hard disks differ in size from 20GB, 80GB etc
The hard disk holds the operating system, and other application programs
The hard disk also contains the disk heads which read and write information onto a disk. They are a type of direct access storage device since each sector containing data can be addressed directly and, because of this, access is extremely fast.

**Advantages**
- It has more data storage space.
- It offers faster data access
  - *Seek time*: Refers to the time it takes the read/write head to locate the correct track.
  - *Latency*: Refers to the time it takes the read/write head to locate the correct sector.
  - *Access time*: is the summation of seek time and latency.
- Supplements RAM. Facilitate backup.
- Stores data permanently.
- Have a long life span

**Disadvantages**
- Relatively expensive.
- Relatively heavy.
- Virus prone.
- Can clash leading to information loss.

**(B) FLOPPY DISKS (FDD)**
It is a magnetic storage device that stores Data and information magnetically on a magnet ribbon. These are the removable part of secondary storage. They are used with floppy drives and there are two types of floppy disks, the 3.5-inch (holds 1.44MB of data) and the 5.25-inch. The 3.5-inch is used with drive A and the 5.25-inch is used with Drive B. A drive is the unit into which the disk is inserted.

**Advantages of Floppy Diskettes**
- They are cheaper than Hard disks and CD-ROMs.
- They are portable hence used to transfer data or information from one computer to another.
- They offer direct access and they are faster than magnetic tapes.
- Facilitate data transfer.
- Easily edited and formatted.

**Disadvantages of Floppy Diskettes**
- They are difficult and delicate to handle
- They can easily be corrupted
- They have a relatively short life span
They hold relatively small amounts of data

**Care and handling of a floppy diskette**

- Don’t put the diskette near any magnetic fields.
- Don’t expose the diskette to direct sunshine or heat.
- Store the diskette in a cool dry dust-free environment.
- Don’t spill liquid onto the diskette.
- Don’t bend or fold a diskette.
- Don’t touch the magnetic surface

**Graphical examples of Floppy Diskettes**

2. **Optical Storage media**

An optical storage device is an electro-mechanical unit that can save and retrieve (write and read) information on a special disc medium using a laser light.

<table>
<thead>
<tr>
<th>Storage</th>
<th>Size</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>650 Mb -700Mb</td>
<td>Storing general software applications. Copying fairly large files to transfer from home to school.</td>
</tr>
<tr>
<td>DVD</td>
<td>4.7 Gb (single) 9.7 Gb (double)</td>
<td>Storing a large computer game or a movie</td>
</tr>
</tbody>
</table>
COMPACT disks e.g CD-ROM, CD-R, CD-RW

These are the common means of distributing software to computers. They look exactly like the musical CD’s that are played on your radio. They store large amounts of information up to 650MB (which is equivalent to 325 000 pages) in the form of text, sound, still pictures, animation and video clips. A laser beam reads the information. CDs can be found in four different forms, that is the CD-ROMs, CD-Rs, CD-RWs and finally the DVDs.

(i) CD-ROMS

These letters stand for Compact Disc Read Only Memory, which means you can only read but can not change anything either by deleting or adding new information. Although it’s a storage device it can not be considered to be a backing store since the user can not write onto it. They are used to distribute programs, such as encyclopedias, dictionaries, bibles, multimedia programs, educational programs and games.

Advantages of using a CD – Rom:

I. Much faster to access than a floppy but currently slower than a hard disk (single-speed 15 KB per second so a 40X speed CD-ROM drive is 40 times faster, and they are getting faster).
II. Can hold up to 650 MB (megabytes) of data.
III. Useful for the distribution of today’s large programs and information libraries, which you can then copy (all or in part) onto your hard disk.
IV. Also widely used by the music industry as they give better quality sound and do not wear out like audiocassette tape.
V. It is the safest form of storage, provided that you don’t attack it with a sharp or heavy object.

(ii) CD-Rs

These are blank CDs that the user can write on, once only, using a CD writer which can be either external or internal.

(iii) CD-RWs

These are re-writable CDs which means the user can read and write many times as if using a hard disk.

• DVDs e.g DVD-ROM, DVD+RW, DVD-R, DVD-RAM

Digital Versatile Discs use the same principle as CD-ROMs but store more information. They store information on both sides and they can take up to 17 Gigabytes. DVDs are becoming widely used for distribution of films and video material. They first appeared in 1996 with the concept of Videos on CDs. To play DVDs you must have DVD Drive which will also play CD-ROMs.

(i) DVD-ROM

A DVD-ROM (Digital Video Disc-ROM) is an extremely high capacity compact disc capable
of storing from 4.7 GB to 17 GB.

A **DVD-ROM drive** or **DVD player** is required to read a DVD-ROM.

Although the size and shape of a DVD-ROM and a CD-ROM are similar, a DVD-ROM uses one of the following three storage techniques to increase its storage capacity:

   I. The first technique involves making the disc denser by packing the pits closer together.
   II. A second technique involves using two layers of pits, which doubles the capacity of the disc.
   III. Finally, some DVD-ROMs are double-sided, which means that they can be removed and turned over to read the other side.

   (ii) **DVD-RAM**

**DVD-RAM** is the recordable and rewritable versions of DVD-ROM, which allows items to be erased and recorded on it multiple times.

   (iii) **DVD-R**

**DVD-R** is the recordable versions of DVD-ROM, which can be written once and read (play) for many times.

   (iv) **DVD+RW**

**DVD+RW** is the recordable and rewritable versions of DVD-ROM, which can be written and read (play) for many times. A **DVD+RW** is similar to a CD-RW, except it has storage capacities up to 4.7 GB.

**Advantages of compact disc over hard disk include**

A compact disc is more portable than a hard disk.

**Advantages of compact disc over floppy disk include**

- The storage capacity of a compact disc is very much larger than that of a floppy disk.
- The average access time of a compact disc is faster than that of a floppy disk.

**Disadvantages of compact disc include**

Some kinds of compact discs are read only (CD-ROM and DVD-ROM).
The average access time of a compact disc is slower than that of a hard disk.

**PhotoCD**

A **PhotoCD** is a type of CD that contains digital photographic images saved in the PhotoCD format developed **Eastman Kodak**.

**3. Solid state e.g flash disks, memory cards, smart card**

Solid state storage (SSS)/ flash memory: is a type of computer storage media that is made from silicon microchips and stores data electronically using electrons that shuttle through the device’s circuit.

The devices have no moving mechanical parts. This allows the drives to consume less power.
than traditional magnetic drives and to retrieve data faster.

**Memory Stick:** The ultimate (and latest) replacement for the floppy disk. High memory capacity on microchip therefore no moving parts and instant access, it plugs directly into the USB port on any computer

**Smart Card**

Contains a processing microchip to provide it with intelligence as well as memory it is really a tiny computer, e.g. The SIM card used in a mobile phone identifies you through a PIN number, identifies and connects to your service provider and provides a menu of options, as well as storing phone numbers and phone settings.

A smart card, which is similar in size to a credit card or ATM card, stores data on a thin microprocessor embedded in the card.

When the smart card is inserted into a specialized card reader, the information on the smart card is read and, if necessary, updated.

An **intelligent smart card** contains a CPU and has input, process, output and storage capabilities.

**Applications of smart cards include**

* Storing a prepaid dollar amount (e.g., a prepaid telephone calling card).
* Storing patient records and other health-care information.
* Tracking information of customers and employees.

**Data Logger**

A remote input/output device, which stores data received from sensors that can then be input into a computer at another time or place. It can be left alone to collect data over a long period of time and in hostile places, such as on a satellite, at the bottom of the ocean or at the South Pole.

**Microchip**

There are many chips inside a computer, some perform all the processing tasks (e.g. the Intel Pentium CPU), and some are used for the storage of data as internal memory. They have the fastest access of all storage media. Because of this, all files read from the hard disk into memory are also copied into a separate memory "cache" and the next time you attempt to load them from the hard disk, the computer will look in the cache first. There are two types of internal memory:

**Major difference between primary and secondary memory**

<table>
<thead>
<tr>
<th>PRIMARY</th>
<th>SECONDARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data can be processed directly from storage</td>
<td>Data cannot be processed directly but must be moved into main memory</td>
</tr>
<tr>
<td>Located on the mother board</td>
<td>Located outside the mother board</td>
</tr>
<tr>
<td>More expensive</td>
<td>Less expensive</td>
</tr>
</tbody>
</table>
Lower storage capacity | Higher storage capacity
---|---
Faster access time | Slow access time
Volatile | Non volatile

**PROCESSING DEVICES**

**THE SYSTEM UNIT**
This is a metallic/plastic casing housing the electronic components of the computer. It contains the following components.

(v) **Power supply unit:** Picks Ac power from the mains converts it to DC power to run the computer.
(vi) **Floppy disk drive**
(vii) **CD – ROM drives.**
(viii) **Hard/ local disk.**
(ix) **System Power Switch.**

(x) **Central Processing Unit** The CPU is the brain of the computer
(xi) **System Speakers.**

(xii) **System Board/mother board/or main system board.** It is the main circuit board which houses the CPU, primary memory and expansion slots. The System Board determines the computer system

**System Board in Details**
- **CPU Socket.**
- **RAM Memory sockets**
- **ROM Bios containing POST program, Bootstrap Loader, System board drivers, system setup program called CMOS setup.** This can also determine and control how first operations can take place in the Pc.
- **Data Buses**
- **Peripheral Ports**
- **Integrated Disk Electronic (IDE) Connectors**
- **USB Ports/PCI Slots**
- **Jumpers**
- **Network Adopter Card and NIC slots**
- **Video Adaptor Cards/VGA Cards**
- **Sound cards**
- **Television and Frequency media/modulation cards**
• **Buses**: These are electrical channels that allow the various devices inside and attached to the system unit to communicate. Buses transfer data between the different components in the computer system. Data is transported and processed in series of electronic bits.

There are two types of buses i.e. **Expansion** buses which allows the CPU to communicate with the Peripheral devices, and the **System buses** that connects the CPU to Memory.

The two parts of buses are **Data buses** which transfer the actual data, and the **Address buses** that transfer the information about where the data should go in memory.

• **Expansion slots**: These are sockets on the mother board into which expansion cards are plugged. The card that is plugged into the expansion slot to add capability to the computer are referred to as adapter cards or interface cards. Examples include Video cards, network interface cards (NIC), sound cards,

• **Ports**: These are sockets outside the system unit that connect to the expansion board on the inside of the system unit. They are also the interface or point of attachment to the system unit. The connectors are usually used to connect external devices to the system unit via ports. The different types of ports include serial port, parallel port, USB (universal Serial Bus) port, SCSI (Small Computer System Interface) port, MIDI (musical Instrument Digital Interface) port, IrDA (Infrared Data Association) port, 1394 port, Games port

  - **Serial port**: Transmits only one bit of data at a time. They are usually used to connect devices that do not require fast data transmission. E.g. keyboards’ mouse or modem. Serial ports conform to either RS-232 or RS-422 standard which specifies the number of pins used on the port connector. Connectors used are male 25 pin connector or male 9 pin connector.

  - **Parallel port**: Capable of transmitting more than one bit of data at a time. Many printers connect to the system unit using parallel ports that can transmit 8 bits of data simultaneously through 8 separate lines in a single cable with a 25 pin female connector.

  - **USB (universal Serial Bus) port**: The port can connect 127 different peripheral devices chained to one general purpose port. USB port supports **hot plugging** (ability to add and remove devices while the computer is running), and **plug and play** (computers capability of recognizing any new device and assisting in its installation by loading the necessary drivers automatically and checking for conflicts with other devices). Examples of devices that can connect using USB port include mouse, keyboard, printer, projector, modem, digital camera, scanner etc.

  - **SCSI (Small Computer System Interface) port**: This is a special high speed parallel port that can transmit up to 32 bits of data at a time and they are used to connect devices like printers and disk drives.

  - **MIDI (musical Instrument Digital Interface) port**: It is designed to connect the system unit to the musical instrument like electronic keyboard, guitar etc. A system unit with a MIDI port has the capability of recording sounds that have been created by the synthesizer and processing the sounds to create new sounds.

  - **IrDA (Infrared Data Association) port**: Allows wireless devices to transmit data via Infrared light waves. Examples include mouse, keyboard.

  - **1394 port, Games port**: connects multiple types of devices that require faster data transmission.
(d) PROCESSING HARDWARE

This is composed of the **Central Processing Unit** (CPU). This is the area which is responsible for the control and execution of all the computer operations. For instance, it accesses data from memory, carries out intended operations and stores the result into memory again.

The CPU is the brain of the computer. Physically the CPU is identified as a micro processor **chip** or multi processor **chip**. It is made up of a numbered of circuits and buses and compacted as a chip.

**STRUCTURE OF THE CENTRAL PROCESSING UNIT**

![Diagram of Central Processing Unit](image)

The CPU is composed of three main parts i.e.

4. **Arithmetic Logic Unit**
5. **The control unit**
6. **Registers/Accumulators**

1. **Arithmetic Logic Unit** (ALU) i.e. works on data to be subjected to mathematical operations/calculations and logic.

Arithmetic involves fundamental math operations of -, +, *, /, etc.

Logical Operations involve comparison of phenomena e.g. passed/failed, yes or no, present or absent, =, >, <, on/of, etc.

2. **Control Unit (CU)**

The CU performs the following functions;

- Fetches and sends commands to system devices and Peripherals
- Interprets commands i.e. it’s is the intermediary between the user and the computer
- Controls and times all tasks by the CPU (typical of Multi-tasking where processor time is shared amongst competing tasks)
- Directs the movements of electronics signals between the CPU, input, memory and output devices. Hence the CPU acting as a data traffic warden

3. **Registers**: Are additional high speed storage locations in the CPU which hold data and instructions temporarily during processing. Examples of register include the program counter, instruction register, instruction decoder, accumulator and status register

4. **The system clock**: It controls how fast the operations in the computer take place. It is measured in Megahertz

**Examples of processor on the market include;**
- Intel 8085, 8085
- Intel Pentium I, II, III, and IV. (Double layer)
- Intel Celeron – Single layer, Heats up very fast, and they are cheaper if compared to double layer processor chips.
- Pentium Dual-Core
- Cyrix
- Motorola 68040, 68030
- Motorola G3 and G4. They are relatively expensive and can work for months and months without heating up. They are usually used in servers systems

**COMPUTER HARDWARE PROBLEMS**

1) Excessively low/high temperature causing: - Circuit/bus cracks, Connection breaks, and Chip crapes small movement\dislocation.
2) Effects of dust: Dust builds thick coatings in slots, ports, internal chips, etc. Dust coating can cause unnecessary heat, data and electric insulation.
3) Effects of corrosion: Hardware comes into contact with atmospheric chemicals, food, human body, water etc causing rust.
4) Magnetic Field: - They cause magnetic inductions, which disturb computer data movements and processing.
5) Electrical Noise. This can be in form of; Electronic static discharge causing short circuits, Electromagnetic interference, or Electromagnetic redactions traveling in space
6) Electrical power Variations. This causes the following, Blackouts, Power transit i.e. excessive low voltage, Brown out. Lowered power from the mains