DIGITAL LITERACY NOTES

ICT stands for **Information and Communication Technology.** It is a broad term that refers to the use of technology to manage, store, process, and transmit information. It is a field that is fast growing, and new technologies are constantly being created and embraced. It is seen as a significant contributor to economic expansion and a crucial tool for businesses to use in achieving their goals. This covers a broad range of gadgets and technology, such as laptops, Smartphone's, the internet, and software programs.

Examples of ICT:

1. Instant messaging and email for communication.
2. Social media sites for connecting and exchanging information.
3. Online buying and banking for e-commerce.
4. Cloud computing for data storage and sharing.
5. GPS and other location-based tools for tracking and navigation.

ICT Technologies:

It includes a wide range of technologies such as:

1. **Computer hardware and software:** Personal computers, servers, storage devices, networking equipment, and software applications.
2. **Internet and web technologies:** Web browsers, search engines, email, instant messaging, and social media.
3. **Telecommunications:** Telephone systems, mobile phones, and satellite communications.
4. **Multimedia:** Video, audio, and graphics.
5. **Cyber security:** Firewalls, antivirus software, and intrusion detection systems.

History of Information and Communication Technology (ICT)

Information and communication technology (ICT) has a long history that dates back to the printing press's creation in the fifteenth century. The mass manufacturing of books and other printed materials made possible by the printing press increased access to and publication of information. The telegraph and telephone were created in the 19th century, revolutionizing communication. While the telephone allowed for real-time communication, the telegraph allowed for the long-distance transmission of communications.

ICT experienced tremendous developments during the 20th century, including the creation of computers, the internet, and other digital technologies. The first electronic computers were created in the 1940s, which significantly accelerated and improved data processing. The **Advanced Research Projects Agency Network** (ARPANET), which served as the forerunner to the contemporary internet, was created in the 1960s. In the 1990s, the public was given access to the internet, substantially expanding communication and access to information. Access to ICT has also significantly grown as a result of the development of personal computers, mobile phones, etc. The way we communicate and receive information has been completely transformed by the internet and mobile devices.

The evolution of big data, cloud computing, and artificial intelligence in recent years has increased the complexity of the ICT landscape. The way businesses are run and how people use technology are both being altered by these innovations. In general, substantial technological improvements have impacted communication, information access, and productivity throughout ICT's history. The future of how we interact with technology and how it impacts our lives will continue to be shaped by the development of ICT.

Benefits of Information and Communication Technology (ICT)

1. **Connectivity:** It has the ability to connect people, things, and systems that allows communication and information sharing. It unites people through tools like email, instant messaging, and video conferencing. As a result, decisions may be made more quickly, and teamwork can be improved.
2. **Automation:** It can automate monotonous jobs and procedures, which is helpful in, boosting productivity, cost savings, and efficiency.
3. **Data storage and management:** It offers a variety of systems and methods for storing, managing, and analyzing massive amounts of data.

4. **Remote access:** It enables people to work and contribute from any location by enabling remote access to information and resources.

5. **Multimedia:** It facilitates the production, dissemination, and consumption of a variety of multimedia formats, including text, images, audio, and video.

6. **Security and privacy:** It offers a range of technologies and security measures to guard against unauthorized access to, modification of, and destruction of information and systems.

7. **Mobile and Wireless:** It enables the use of mobile and wireless devices.

8. **Better customer service:** It is possible because of the usage of ICT tools, which can automate customer service procedures and offer customers self-service choices. This helps in increased efficiency and better customer satisfaction.

9. **Increased competitiveness:** Access to new markets, clients, and business models offered by ICT can provide firms with a competitive edge.

Applications of Information and Communication Technology (ICT)

ICT (Information and Communication Technology) has a wide range of applications across various fields, including:

1. **Business:** It is utilized for customer relationship management, internet marketing, and e-commerce. It can also set up virtual teams and permit remote working. Organizations may be better able to adapt to changes in the business environment.

2. **Education:** It enables remote learning, gives access to educational resources, and improves the learning process through e-learning, online classes, educational films, etc.

3. **Healthcare:** In the healthcare industry it can maintain patient information, provide telemedicine, and enhance interprofessional communication and collaboration.

4. **Entertainment:** It is helpful to produce digital material, distribute it, sell it, and interact with audiences.

5. **Transportation:** It controls traffic, assists with navigation, and boosts the effectiveness of transportation systems.

6. **Government:** It enables e-governance and enhances coordination and cooperation among departments.

7. **Agriculture:** Crop management, precision farming, and agricultural system efficiency are all improved by the use of ICT.

8. **Banking and finance:** ICT is used in the banking and finance sector to manage and secure financial data, support online banking, and automate financial transactions.

Career Opportunities after the Information and Communication Technology (ICT) Course

Individuals having a background in information and communications technology have a wide range of professional options some of which are as follows:

1. **Software developers:** They help in developing and maintaining software systems and applications.
2. **Systems Analysts:** They analyze the issues of an organization and then accordingly design a system that gives a practicable solution.
3. **Software Tester:** They test if the made software is appropriate or not for the purpose specified.
4. **Network engineers:** Designing, implementing and managing computer networks.
5. **IT project manager:** Planning and directing the delivery of IT projects.
6. **Business analyst:** Enhancing decision-making and business processes with technology.

WHAT IS COMPUTER?

A computer *is an electronic device that is capable of carrying out a variety of tasks, such as storing, retrieving, and processing data*. Additionally, it may be trained to carry out difficult tasks like decision-making, speech and picture recognition, and more.

-Desktop, laptop, tablet, and Smartphone PCs are the most popular models. Every computer has a central processing unit (CPU), which serves as the "brain" and executes instructions, and memory, which stores data.

A computer is made up of several hardware components, each with a specific function. Some of the most important parts of a computer include:

1. **CPU**: The CPU, often known as the processor, is the "brain" of the computer. It is in charge of carrying out calculations and carrying out orders. On the motherboard is a tiny, square chip that serves as the CPU.

2. **Memory (RAM)**: The computer's short-term memory is called Random Access Memory (RAM). It keeps the information that the CPU needs to operate. A computer can store more data and perform tasks more quickly the more RAM it has.

3. **Storage (HDD/SSD)**: Data is permanently kept in a computer's storage (HDD or SSD). The two most popular types of computer storage are hard disc drives (HDD) and solid-state drives (SSD). SSD is faster and more expensive, while HDD is slower but less expensive.

4. **Motherboard**: The main circuit board in a computer is called the motherboard. Along with other components, it houses the CPU and RAM. Additionally, it links the various components of the computer together so they may communicate with one another.

5. **Graphics Card**: A graphics card, often known as a graphics processing unit (GPU), is a specialized processor that is used to render images and videos. Additionally, it is utilized for professional tasks like video editing and 3D rendering as well as gaming.

6. **Input/Output Devices:** A keyboard and mouse are examples of input devices that let users interact with computers. The computer can show or print data via output devices like a monitor or printer.

7. **Network interface card (NIC)**: A computer can connect to a network via a network interface card (NIC), whether it's a wide area network (WAN) like the internet or a local area network (LAN).

Who Invented the Computer?

The first mechanical computer was invented by **Charles Babbage** in the early **19th century**. He designed the "Difference Engine," which was intended to perform mathematical calculations automatically. However, the machine was never built during his lifetime.

HISTORY OF COMPUTER

The earliest known civilizations utilized simple counting instruments like the abacus to make mathematical calculations, which can be used to trace the origins of computers. However, through a series of technological developments, the modern idea of a computer has changed through time into a device that can carry out a wide range of tasks, including storing, retrieving, and processing data.

Charles Babbage created the "Difference Engine" in the 19th century with the goal of creating a mechanical computer that could carry out calculations automatically. The device, however, was never created while he was alive. Alan Turing created the idea of the "universal machine"

in the 1930s, which served as the basis for contemporary computers. The UNIVAC I, the first commercial computer, was utilized for business applications in the 1950s. Computers continued to develop and get smaller, quicker, and more potent during the 1950s and 1960s.

The first personal computers, such as the Altair 8800 and the Apple I, were released in the 1970s and increased accessibility to computers for the general population. The personal computer revolution and the widespread use of computers in offices and households were sparked by Intel Corporation's creation of the microprocessor in the 1970s. This led to the development of smaller, more cost-effective and more powerful computers.

The personal computer industry boomed in the 1980s and 1990s, and computers became increasingly powerful and accessible. During this time, the World Wide Web was created, making it simple for anyone to access and exchange information online. The internet also started to emerge as a significant force. The invention of Smartphone's and tablets has increased the portability and accessibility of computers in the twenty-first century, and cloud computing has made it feasible for users to access their data and programs from any location. Almost every area of modern life depends on computers nowadays, and they are always evolving and getting better thanks to new technologies.

ACHIEVEMENTS OF COMPUTER

Computers have achieved a wide range of milestones and advancements over the years. Some of the most notable achievements include:

1. **The development of the first electronic computer:** The Electronic Numerical Integrator and Computer (ENIAC), which was created in the 1940s, was the first electronic computer. This development ushered in the current era of computing.
2. **The creation of the first computer program:** Ada Lovelace, a mathematician, and author who is regarded as the world's first computer programmer, wrote the first computer program in the middle of the 19th century.
3. **The invention of the first computer mouse:** Douglas Engelbart created the first computer mouse in 1963, which was a significant milestone in the creation of graphical user interfaces that are easy to use.
4. **The development of the first personal computer:** The development of the Altair 8800, the first personal computer, in 1975 signaled the start of the personal computer revolution.

5. **The creation of the first computer virus:** The era of cyber security began in 1971 with the development of the Creeper computer virus.

6. **The launch of the first website:** Tim Berners-Lee, one of the creators of the World Wide Web, established the first website, which was merely a text page, in 1991.

7. **The development of the first search engine:** In 1990, Archie, the first search engine, was created. It opened the path for the creation of more advanced search engines like Google and Bing.

8. **The development of the first robot:** The robot age began with the creation of the first robot, UNIMATE, in the early 1960s.

ADVANTAGES OF COMPUTER

1. **Speed**: Computers are suitable for jobs like data analysis, image and video processing, and simulations because they can process massive volumes of data rapidly and effectively.

2. **Storage**: Computers can hold a lot of data, including papers, music, and films, thanks to their high storage capacities.

3. **Accuracy**: Compared to manual techniques, computers are highly accurate when performing complex computations and operations, which lowers the margin of error.

4. **Connectivity**: Users can communicate, share information, and access a wide range of online resources and services by connecting their computers to the internet.

5. **Automation**: By automating routine operations, computers give up time for more involved and innovative work.

6. **Multitasking**: Computers have the ability to run numerous programs at once, enabling users to multitask and boost productivity.

7. **Access to Information**: Through the internet, computers have easy access to a wealth of knowledge that can be used for a variety of tasks, including learning and research.

8. **Amusement**: Playing games, viewing movies, and listening to music are all forms of entertainment you can enjoy on a computer.

CLASSIFICATION OF COMPUTERS

The computer systems can be classified on the following basis:

1. On the basis of size.

2. On the basis of functionality.

3. On the basis of data handling.

Classification on the basis of :

1. **Super computers:** The super computers are the highest performing system. A supercomputer is a computer with a high level of performance compared to a general-purpose computer. The actual Performance of a supercomputer is measured in FLOPS instead of MIPS. All of the world's fastest 500 supercomputers run Linux-based operating systems. Additional research is being conducted in China, the US, the EU, Taiwan and Japan to build even faster, more high performing and more technologically superior supercomputers. Supercomputers actually play an important role in the field of computation, and are used for intensive computation tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modeling, and physical simulations. and also Throughout the history, supercomputers have been essential in the field of the cryptanalysis.
eg: PARAM, jaguar, roadrunner.

2. **Mainframe computers :** These are commonly called as big iron, they are usually used by big organizations for bulk data processing such as statistics, census data processing, transaction processing and are widely used as the servers as these systems has a higher processing capability as compared to the other classes of computers, most of these mainframe architectures were established in 1960s, the research and development worked continuously over the years and the mainframes of today are far more better than the earlier ones, in size, capacity and efficiency.
Eg: IBM z Series, System z9 and System z10 servers.

3. **Mini computers :** These computers came into the market in mid 1960s and were sold at a much cheaper price than the main frames, they were actually designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping, later they became very popular for personal uses with evolution.
In the 60s to describe the smaller computers that became possible with the use of transistors and core memory technologies, minimal instructions sets and less expensive peripherals such

as the ubiquitous Teletype Model 33 ASR.They usually took up one or a few inch rack cabinets, compared with the large mainframes that could fill a room, there was a new term "MINICOMPUTERS" coined

Eg: Personal Laptop, PC etc.

4. **Micro computers :** A microcomputer is a small, relatively inexpensive computer with a microprocessor as its CPU. It includes a microprocessor, memory, and minimal I/O circuitry mounted on a single printed circuit board.The previous to these computers, mainframes and minicomputers, were comparatively much larger, hard to maintain and more expensive. They actually formed the foundation for present day microcomputers and smart gadgets that we use in day to day life.

Eg: Tablets, Smartwatches.

Classification on the basis of functionality

1. **Servers:** Servers are nothing but dedicated computers which are set-up to offer some services to the clients. They are named depending on the type of service they offered. Eg: security server, database server.

2. **Workstation:** Those are the computers designed to primarily to be used by single user at a time. They run multi-user operating systems. They are the ones which we use for our day to day personal / commercial work.

3. **Information Appliances:** They are the portable devices which are designed to perform a limited set of tasks like basic calculations, playing multimedia, browsing internet etc. They are generally referred as the mobile devices. They have very limited memory and flexibility and generally run on "as-is" basis.

4. **Embedded computers:** They are the computing devices which are used in other machines to serve limited set of requirements. They follow instructions from the non-volatile memory and they are not required to execute reboot or reset. The processing units used in such device work to those basic requirements only and are different from the ones that are used in personal computers- better known as workstations.

Classification on the basis of data hand

1. **Analog:** An analog computer is a form of computer that uses the continuously-changeable aspects of physical fact such as electrical, mechanical, or hydraulic quantities to model the problem being solved. Anything that is variable with respect to time and continuous can be claimed as analog just like an analog clock measures time by means of the distance traveled for the spokes of the clock around the circular dial.

2. **Digital :** A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system of "0" and "1", "Computer capable of solving problems by processing information expressed in discrete form. from manipulation of the combinations of the binary digits, it can perform mathematical calculations, organize and analyze data, control industrial and other processes, and simulate dynamic systems such as global weather patterns.

3. **Hybrid:** A computer that processes both analog and digital data, Hybrid computer is a digital computer that accepts analog signals, converts them to digital and processes them in digital form.

COMPUTER SYSTEM

Definition: Is a collection of entities (hardware, software and live ware) that are designed to receive process, manage and present information in a meaningful format.

COMPONENTS OF COMPUTER SYSTEM

- **Computer hardware -** Are physical parts/ intangible parts of a computer. eg Input devices, output devices, central processing unit and storage devices
- **Computer software** - also known as programs or applications. They are classified into two classes namely - system software and application software
- **Liveware -** is the computer user. Also kwon as orgware or the human ware. The user commands the computer system to execute on instructions.

a) COMPUTER HARDWARE

Hardware refers to the physical, tangible computer equipment and devices, which provide support for major functions such as input, processing (internal storage, computation and control), output, secondary storage (for data and programs), and communication.

COMPUTER

SPEAKERS
Used to produce audio output.

MONITOR
An output device that lets you see your work as you go.

CD/DVD DRIVE
Reads CD/DVD discs.

SYSTEM UNIT
The case that contains the CPU, memory, the power supply, disk drives, and all other hardware—such as a modem—that are in an internal format.

PRINTER
Produces printed copies of computer output.

MICROPHONE
Used to get spoken input.

FLOPPY DISKS
Used for storing small amounts of data for backup or to transport data to another PC.

KEYBOARD
The principal input device; used to type instructions into the computer.

CD/DVD DISCS
Commonly used to deliver programs and store large multimedia files.

MOUSE
A pointing device used to make on-screen selections.

FLOPPY DISK DRIVE
Reads from and writes to floppy disks.

HARD DRIVE
Located inside the system unit and used to store programs and most data.

FLASH MEMORY CARD READER
Used to read flash memory cards.

FIGURE 1-7
Typical computer hardware.

HARDWARE CATEGORIES (Functional Parts)

A computer system is a set of integrated devices that input, output, process, and store data and information. Computer systems are currently built around at least one digital processing device.

There are five main hardware components in a computer system: Input, Processing, Storage, Output and Communication devices.

1. **INPUT DEVICES**

Are devices used for entering data or instructions to the central processing unit?

Are classified according to the method they use to enter data.

a) KEYING DEVICES
Are devices used to enter data into the computer using a set of Keys eg Keyboard, key-to-storage and keypad.

i) The keyboard

Keyboard (similar to a typewriter) is the main input device of a computer. It contains three types of keys-- alphanumeric keys, special keys and function keys.

i) **Alphanumeric keys** are used to type all alphabets, numbers and special symbols like $, %, @, A etc.

ii)**Special keys** such as <Shift>, <Ctrl>, <Alt>, <Home>, <Scroll Lock> etc. are used for special functions.

iii) **Function keys** such as <Fl>, <F2>, <F3> etc. are used to give special commands depending upon the software used e.g.F5 reloads a page of an internet browser.

How the keys are organized

The keys on your keyboard can be divided into several groups based on function:

- **Typing (alphanumeric) keys.** These keys include the same letter, number, punctuation, and symbol keys found on a traditional typewriter.
- **Special (Control) keys.** These keys are used alone or in combination with other keys to perform certain actions. The most frequently used control keys are CTRL, ALT, the Windows key, and ESC.
- **Function keys.** The function keys are used to perform specific tasks. They are labeled as F1, F2, F3, and so on, up to F12. The functionality of these keys differs from program to program.
- **Cursor Movement (Navigation) keys.** These keys are used for moving around in documents or WebPages and editing text. They include the arrow keys, HOME, END, PAGE UP, PAGE DOWN, DELETE, and INSERT and ARROW KEYS.
- **Numeric keypad.** The numeric keypad is handy for entering numbers quickly. The keys are grouped together in a block like a conventional calculator or adding machine.

B. POINTING DEVICES
Are devices that enter data and instructions into the computer using a pointer that appears on the screen. The items to be entered are selected by either pointing to or clicking on them.e.g mice, joystick, touch sensitive screen, trackballs

i) THE MOUSE
A mouse is a small device used to point to and select items on your computer screen.

Although mice come in many shapes, the typical mouse does look a bit like an actual mouse. It's small, oblong, and connected to the system unit by a long wire that resembles a tail and the connector which can either be PS/2 or USB. Some newer mice are wireless.

A mouse usually **has two buttons:** a primary button (usually the left button) and a secondary button. Many mice also have a wheel between the two buttons, which allows you to scroll smoothly through screens of information.

When you move the mouse with your hand, a pointer on your screen moves in the same direction. (The pointer's appearance might change depending on where it's positioned on your screen.) When you want to select an item, you point to the item and then click (press and release) the primary button. Pointing and clicking with your mouse is the main way to interact with your computer. There are several types of mice: Mechanical mouse, optical mouse, optical-mechanical mouse and laser mouse.

Basic parts

A mouse typically has two buttons: a primary button (usually the left button) and a secondary button (usually the right button). The primary button is the one you will use most often. Most mice also include a scroll wheel between the buttons to help you scroll through documents and WebPages more easily. On some mice, the scroll wheel can be pressed to act as a third button. Advanced mice might have additional buttons that can perform other functions.

Holding and moving the mouse

Place your mouse beside your keyboard on a clean, smooth surface, such as a mouse pad. Hold the mouse gently with your index finger resting on the primary button and you thumb resting on the side. To move the mouse, slide it slowly in any direction. Don't twist it—keep the front of the mouse aimed away from you. As you move the mouse, a pointer (see picture) on your screen moves in the same direction. If you run out of room to move your mouse on your desk or mouse pad, just pick up the mouse and bring it back closer to you.

Palm on base of mouse

Thumb on side of mouse

Middle finger on right mouse buttom

Pointer on left mouse button
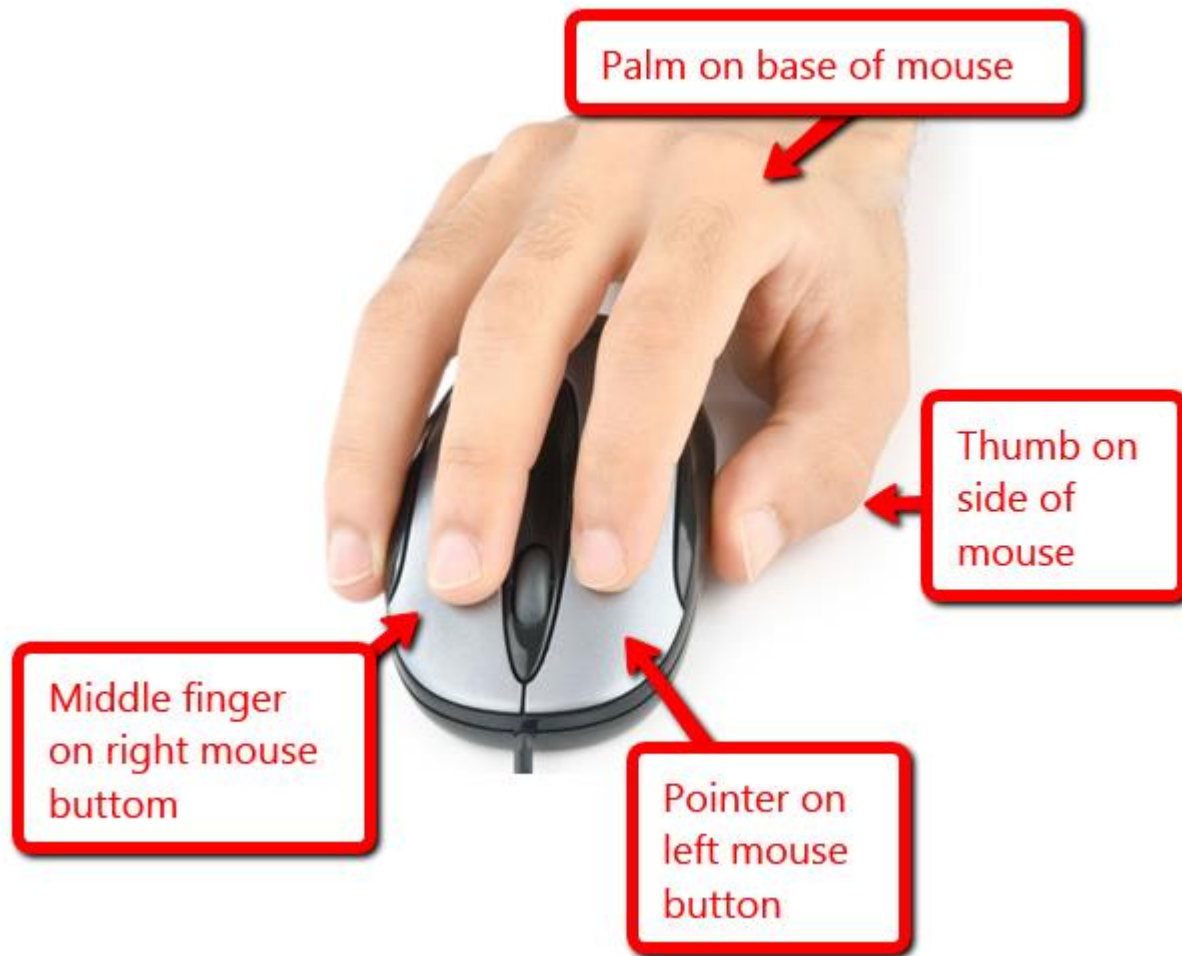
Pointing to an object often reveals a descriptive message about it.The pointer can change depending on what you're pointing at. For example, when you point to a link in your web browser, the pointer changes from an arrow to a hand with a pointing finger .

Most **mouse actions** combine pointing with pressing one of the mouse buttons. There are four basic ways to use your mouse buttons: clicking, double-clicking, right-clicking, and dragging.

Clicking (single-clicking)

To click an item, point to the item on the screen, and then press and release the primary button (usually the left button).

Clicking is most often used to select (mark) an item or open a menu. This is sometimes called single-clicking or left-clicking.

Double-clicking

To double-click an item, point to the item on the screen, and then click twice quickly. If the two clicks are spaced too far apart, they might be interpreted as two individual clicks rather than as one double-click.

Double-clicking is most often used to open items on your desktop. For example, you can start a program or open a folder by double-clicking its icon on the desktop.

Right-clicking

To right-click an item, point to the item on the screen, and then press and release the secondary button (usually the right button).

Right-clicking an item usually displays a list of things you can do with the item. For example, when you right-click the Recycle Bin on your desktop, Windows displays a menu allowing you to open it, empty it, delete it, or see its properties. If you are unsure of what to do with something, right-click it.

C) SCANNING DEVICES
Are devices that capture an object or a document directly from the source. They are classified according to the technology used to capture data e.g. Scanners and Document readers.
i) Scanners
Used to capture a source document and converts it into an electronic form.
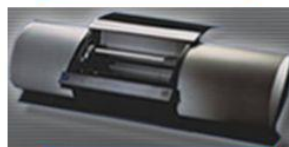Example are - Flatbed and Handheld scanners.

Types of Scanners

- Scanners convert printed data or images into an electronic data format that a computer can store or process as required.
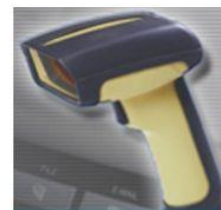 - A scanned image can be saved, modified, and even e-mailed as you would with any other file.

All-in-one scanner

Flatbed scanner

Drum scanner*

Handheld scanner

ii) Document readers

Are documents that reads data directly from source document and convey them as input in the form of electronic signal. e

Types of Document Readers

i) Optical Mar Reader (OMR)

ii) Barcode readers

iii) Optical Character Readers

b) Magnetic Readers

Reads data using magnetic ink.t uses principle of magnetism to sense data which have been written using magnetised ink.
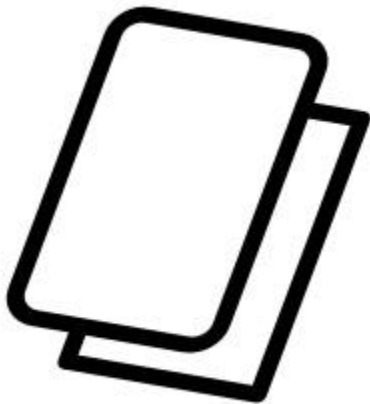
Magnetic ink character recognition

Image from Wikipedia.org, licensing details available at wikipedia.org/wiki/File:CanadianChequeSamplePAR.png

THE CENTRAL PROCESSING UNIT (C P U)

Is the brain or the heart of a computer. Is also known as processor and consist of three units namely -
i) Control Unit (C U)
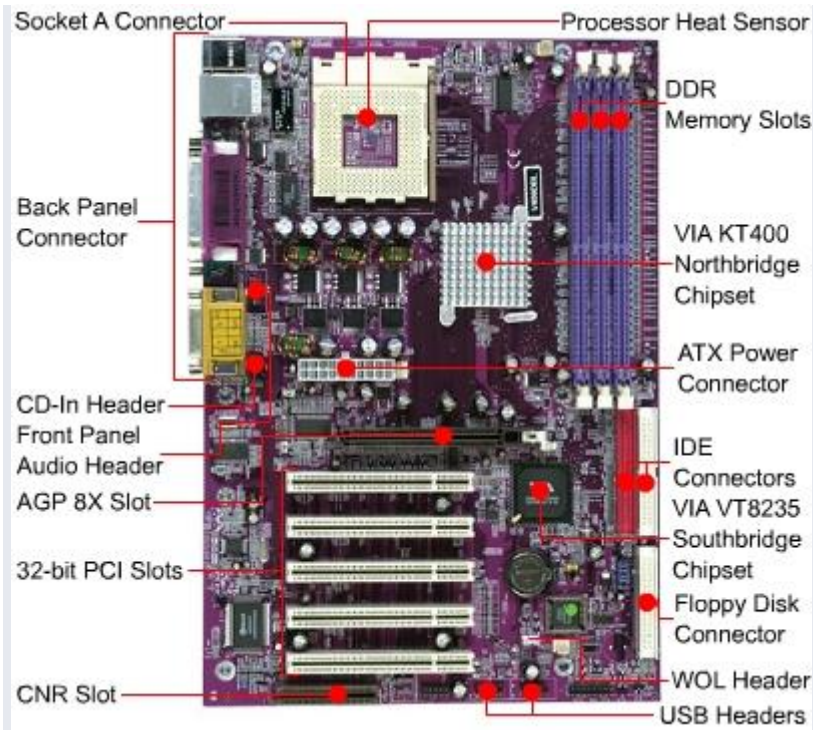ii) Arithmetic logic Unit (A L U)
iii) Main Memory unit (M M U)

The system unit is the core of a computer system. Usually it's a rectangular box placed on or underneath your desk. Inside this box are many electronic components that process data. The most important of these components is the central processing unit (CPU), or microprocessor, which acts as the "brain" of your computer. Another component is random access memory (RAM), which temporarily stores information that the CPU uses while the computer is on. The information stored in RAM is erased when the computer is turned off.

Almost every other part of your computer connects to the system unit using cables. The cables plug into specific ports (openings), typically on the back of the system unit. Hardware that is not part of the system unit is sometimes called a **peripheral device.** Peripheral devices can be **external** such as a mouse, keyboard, printer, monitor, external Zip drive or scanner or **internal**, such as a CD-ROM drive, CD-R drive or internal modem. Internal peripheral devices are often referred to as ***integrated peripherals***. There are two types according to shape: **tower** and **desktop**.

Tower System Unit Desktop System Unit

A **motherboard** (**mainboard**, **system board**, **planar board** or **logic board**) is the main printed circuit board found in computers and other expandable systems. It holds many of the crucial electronic components of the system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.

Socket A Connector — Processor Heat Sensor
DDR Memory Slots
Back Panel Connector
VIA KT400 Northbridge Chipset
ATX Power Connector
CD-In Header
Front Panel Audio Header
IDE Connectors
VIA VT8235 Southbridge Chipset
AGP 8X Slot
32-bit PCI Slots
Floppy Disk Connector
WOL Header
CNR Slot
USB Headers

Motherboard

TYPES OF PROCESSORS
I) Comples Instruction Set Computers (CISC)
ii) Reduced Instruction Set Computers (RISC)

FUNCTIONS OF CENTRAL PROCESSING UNIT
- Process data
- Control sequence of operaions within the computers
- It gives command to all parts of a computer
- It control the use of the main memory in storing of data and instructions
- it provides temporary storage (RAM) and permanent storage(ROM) of data

THE CONTROL UNIT
Is the center of operations for the computer system, it directs the activities of the computer system.
Functions of Control Unit

COMPUTER STORAGE
What is a storage device? Definition, types, examples

The storage unit is a part of the computer system which is employed to store the information and instructions to be processed.

- A storage device is an integral part of the computer hardware which stores information/data to process the result of any computational work. Without a storage device, a computer would not be able to run or even boot up.

-a storage device is hardware that is used for storing, porting, or extracting data files. It can also store information/data both temporarily and permanently.

Types of Computer Memory

1. Primary Memory
2. Secondary Memory

1. Primary Memory: It is also known as internal memory and main memory. This is a section of the CPU that holds program instructions, input data, and intermediate results. It is generally smaller in size. RAM (Random Access Memory) and ROM (Read Only Memory) are examples of primary storage.

2. Secondary Memory: Secondary storage is a memory that is stored external to the computer. It is mainly used for the permanent and long-term storage of programs and data.

(Hard Disks, CDs, DVDs, Pen/Flash drives, SSD, etc,) are examples of secondary storage.

Types of Computer Storage Devices

Some of the commonly used storage devices are:

1. Primary Storage Devices
2. Magnetic Storage Devices
3. Flash memory Devices
4. Optical Storage Devices
5. Cloud and Virtual Storage

1. Primary Storage Devices

i) RAM: It stands for **Random Access Memory.**

-It is used to store information that is used immediately or we can say that it is a temporary memory.

Computers bring the software installed on a hard disk to RAM to process it and to be used by the user. With the help of RAM, computers can perform multiple tasks like loading applications, browsing the web, editing a spreadsheet, experiencing the newest game, etc. It allows you to modify quickly among these tasks, remembering where you're in one task once you switch to a different task. It is also used to load and run applications, like your spreadsheet program, answers commands, like all edits you made within the spreadsheet, or toggle between multiple programs, like once you left the spreadsheet to see the email. Memory is nearly always actively employed by your computer. It ranges from 1GB – 32GB/64GB depending upon the specifications. There are different types of RAM, and although they all serve the same purpose, the most common ones are:

- **SRAM:** It stands for **Static Random Access Memory**. It consists of circuits that retain stored information as long as the power supply is on. It is also known as volatile memory. It is used to build Cache memory. The access time of SRAM is lower and it is much faster as compared to DRAM but in terms of cost, it is costly as compared to DRAM.

- **DRAM:** It stands for **Dynamic Random Access Memory**. It is used to store binary bits in the form of electrical charges that are applied to capacitors. The access time of DRAM is slower as compared to SRAM but it is cheaper than SRAM and has a high packaging density.

- **SDRAM:** It stands for **Synchronous Dynamic Random Access Memory**. It is faster than DRAM. It is widely used in computers and others. After SDRAM was introduced, the upgraded version of double data rate RAM, i.e., DDR1, DDR2, DDR3, and DDR4 was entered into the market and widely used in home/office desktops and laptops.

ii) ROM: It stands for **Read-Only Memory**. The data written or stored in these devices are non-volatile, i.e, once the data is stored in the memory cannot be modified or deleted. The memory from which will only read but cannot write it. This type of memory is non-volatile. The

information is stored permanently during manufacture only once. ROM stores instructions that are used to start a computer. This operation is referred to as bootstrap. It is also used in other electronic items like washers and microwaves. ROM chips can only store a few megabytes (MB) of data, which ranges between 4 and 8 MB per ROM chip. There are two types of ROM:

- **PROM:** PROM is Programmable Read-Only Memory. These are ROMs that can be programmed. A special PROM programmer is employed to enter the program on the PROM. Once the chip has been programmed, information on the PROM can't be altered. PROM is non-volatile, that is data is not lost when power is switched off.
- **EPROM:** Another sort of memory is the Erasable Programmable Read-Only Memory. It is possible to erase the info which has been previously stored on an EPROM and write new data onto the chip.
- **EEPROM:** EEPROM is Electrically erasable programmable read-only memory. Here, data can be erased without using ultraviolet light, with the use of just applying the electric field.
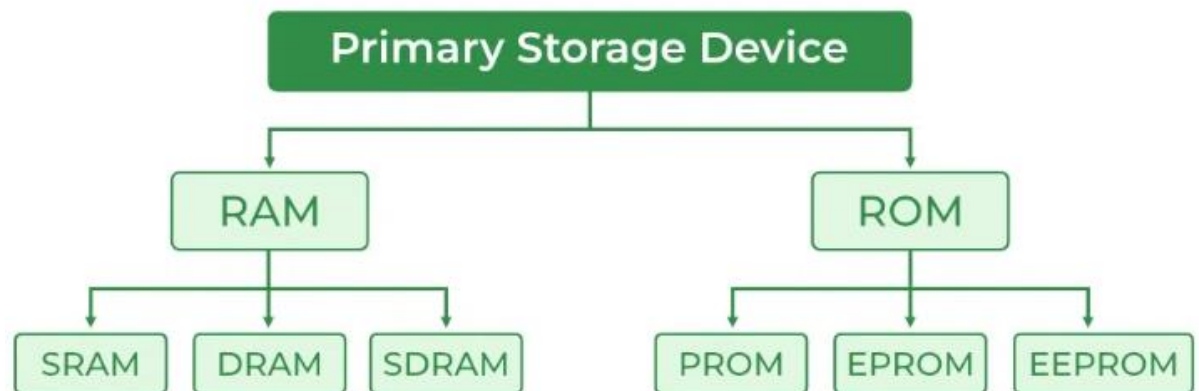
Primary Storage Devices

2. Magnetic Storage Devices

- **Floppy Disk:** Floppy Disk is also known as a floppy diskette. It is generally used on a personal computer to store data externally. A Floppy disk is made up of a plastic cartridge and secured with a protective case. Nowadays floppy disk is replaced by new and effective storage devices like USB, etc.

- **Hard Disk**: **Hard Disk** is a storage device (HDD) that stores and retrieves data using magnetic storage. It is a non-volatile storage device that can be modified or deleted n number of times without any problem. Most computers and laptops have HDDs as their secondary storage device. It is actually a set of stacked disks, just like phonograph records. In every hard disk, the data is recorded electromagnetically in concentric circles or we can say track present on the hard disk, and with the help of a head just like a phonograph arm(but fixed in a position) to read the information present on the track. The read-write speed of HDDs is not so fast but decent. It ranges from a few GBs to a few and more TB.

- **Magnetic Card:** It is a card in which data is stored by modifying or rearranging the magnetism of tiny iron-based magnetic particles present on the band of the card. It is also known as a swipe card. It is used like a passcode(to enter the house or hotel room), credit card, identity card, etc.

- **Tape Cassette:** It is also known as a music cassette. It is a rectangular flat container in which the data is stored in an analog magnetic tape. It is generally used to store audio recordings.

- **Super Disk:** It is also called LS-240 and LS-120. It is introduced by Imation Corporation and it is popular with OEM computers. It can store data up to 240 MB.


Magnetic Storage Devices

3. Flash Memory Devices

It is a cheaper and more portable storage device. It is the most commonly used device to store data because is more reliable and efficient as compared to other storage devices. Some of the commonly used flash memory devices are:

- **Pen Drive:** It is also known as a USB flash drive that includes flash memory with an integrated USB interface. We can directly connect these devices to our computers and laptops and read/write data into them in a much faster and more efficient way. These devices are very portable. It ranges from 1GB to 256GB generally.

- **SSD:** It stands for **Solid State Drive**, a mass storage device like HDD. It is more durable because it does not contain optical disks inside like hard disks. It needs less power as compared to hard disks, is lightweight, and has 10x faster read and writes speed as compared to hard disks. But, these are costly as well. While SSDs serve an equivalent function as hard drives, their internal components are much different. Unlike hard drives, SSDs don't have any moving parts and thus they're called solid-state drives. Instead of storing data on magnetic platters, SSDs store data using non-volatile storage. Since SSDs haven't any moving parts, they do not need to "spin up". It ranges from 150GB to a few more TB.

- **SD Card:** It is known as a Secure Digital Card. It is generally used with electronic devices like phones, digital cameras, etc. to store larger data. It is portable and the size of the SD card is also small so that it can easily fit into electronic devices. It is available in different sizes like 2GB, 4GB, 8GB, etc.

- **Memory Card:** It is generally used in digital cameras. Printers, game consoles, etc. It is also used to store large amounts of data and is available in different sizes. To run a memory card on a computer you require a separate memory card reader.

- **Multimedia Card:** It is also known as MMC. It is an integrated circuit that is generally used in-car radios, digital cameras, etc. It is an external device to store data/information.
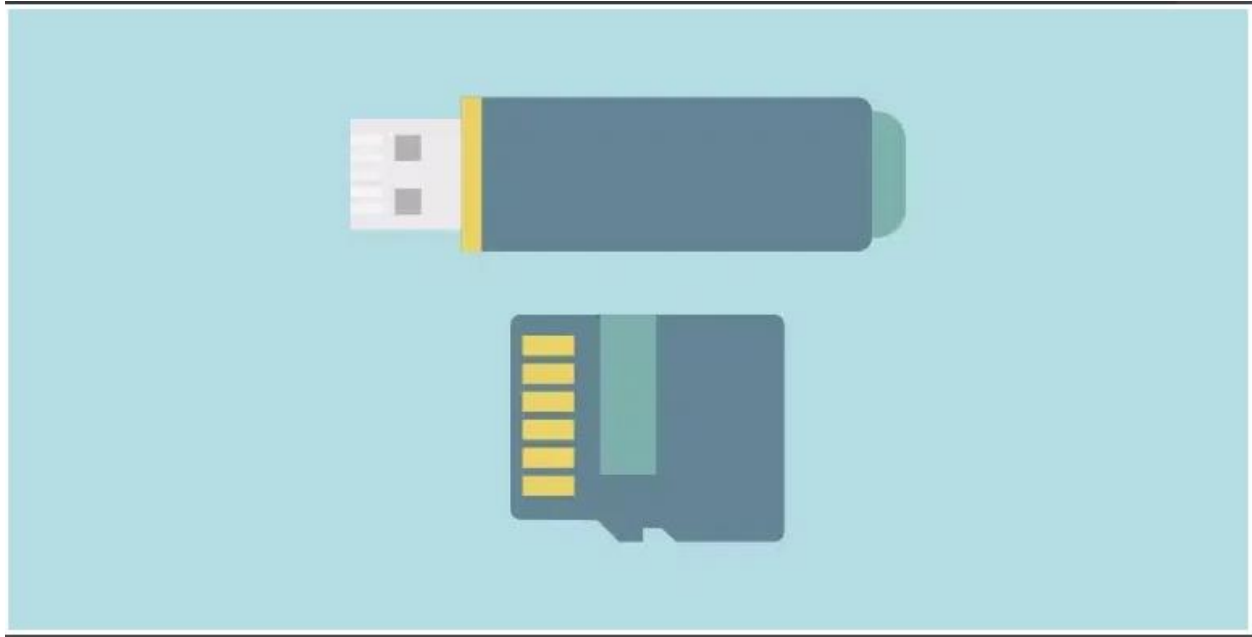
4. Optical Storage Devices

Optical Storage Devices is also secondary storage device. It is a removable storage device. Following are some optical storage devices:

- **CD:** It is known as [Compact Disc](). It contains tracks and sectors on its surface to store data. It is made up of polycarbonate plastic and is circular in shape. CD can store data up to 700MB. It is of two types:
    - **CD-R:** It stands for Compact Disc read-only. In this type of CD, once the data is written can not be erased. It is read-only.
    - **CD-RW:** It stands for Compact Disc Read Write. In this type of CD, you can easily write or erase data multiple times.
- **DVD:** It is known as [Digital Versatile Disc](). DVDs are circular flat optical discs used to store data. It comes in two different sizes one is 4.7GB single-layer discs and another one is 8.5GB double-layer discs. DVDs look like CDs but the storage capacity of DVDs is more than as compared to CDs. It is of two types:
    - **DVD-R:** It stands for Digital Versatile Disc read-only. In this type of DVD, once the data is written can not be erased. It is read-only. It is generally used to write movies, etc.

- **DVD-RW:** It stands for Digital Versatile Disc Read Write. In this type of DVD, you can easily write or erase data multiple times.
- **Blu-ray Disc:** It is just like CD and DVD but the storage capacity of blu ray is up to 25GB. To run a Blu-ray disc you need a separate Blu-ray reader. This Blu-ray technology is used to read a disc from a blue-violet laser due to which the information is stored in greater density with a longer wavelength.

5. Cloud and Virtual Storage

Nowadays, secondary memory has been upgraded to virtual or cloud storage devices. We can store our files and other stuff in the cloud and the data is stored for as long as we pay for the cloud storage. There are many companies that provide cloud services largely Google, Amazon, Microsoft, etc. We can pay the rent for the amount of space we need and we get multiple benefits out of it. Though it is actually being stored in a physical device located in the data centers of the service provider, the user doesn't interact with the physical device and its maintenance. For example, Amazon Web Services offers AWS S3 as a type of storage where users can store data virtually instead of being stored in physical hard drive devices. These sorts of innovations represent the frontier of where storage media goes.

Characteristics of Computer Storage Devices

- Data stored in the Memory can be changed or replaced in case of a requirement, because of the mobility of the storage devices.
- Storage Devices validate that saved data can be replaced or deleted as per the requirements because the storage devices are easily readable, writeable, and rewritable.
- Storage Devices are easy and convenient to access because they do not require much skill set to handle these resources.
- The storage capacity of these devices is an extra advantage to the system.
- Storage Devices have better performance and data can be easily transferred from one device to another.

FAQs

1. What is a computer storage device?

Computer storage device gives a way to the user to store data and safely access it on a computer system. There are various types of storage devices.

2. What are examples of Optic storage devices?

Examples of optic devices are ***CD-ROMs, DVDs, Blu-Disc***, etc.`

3. Is online cloud storage a device?

Online cloud storage is not a device, it is simply a tool where we can store our data files, images, etc. and these data are stored over the internet.

OUTPUT DEVICES

What are Different Output Devices?
Output Devices are those devices which show us the result after giving the input data to a computer system. Output can be in different forms like image, graphic audio, video, etc.

What is an Output Device?
Any <u>peripheral</u> that accepts data from a <u>computer</u> and prints, projects, or reproduces it is known as an output device.
-The output may be audio, video, hard copy – printed paper, etc. Output devices convert the computer <u>data</u> to human understandable form.

Different Types of Output Devices
The various output devices are as below:
1. Monitor
A computer's principal output device is a monitor, often known as a <u>visual display unit (VDU)</u>. It displays the processed data like text, images, videos, audios, etc. It makes images by arranging microscopic dots in a rectangular pattern, known as pixels. The sharpness of an image is determined by the number of pixels. There are two types of monitor viewing screens:

- **Cathode-Ray Tube (CRT):** This type of monitor is based on a cathode ray tube. In which the cathode ray tube generates a beam of electrons with the help of electron guns they strike on the inner surface of phosphorescent of the screen to generate images. The <u>CRT monitor</u> holds millions of phosphorus dotes in three different colors, i.e., red, blue, and green. These dots glow when the beam struck on them and create an image. The main parts of the CRT monitor are the electron gun, fluorescent screen, glass envelope, deflection plate assembly, and base.
- **Display on a Flat Panel Monitor with a Cathode-Ray Tube (CRT):** A flat-panel display is a type of video display with less volume, weight, and power consumption than a CRT. They can be put on the wrist or hang on the wall. Calculators, video games, monitors, laptop, and graphical displays all use flat-panel displays.

- **Plasma Monitor:** It is also a flat panel display but it is based on plasma display technology. In a plasma monitor, a small cell is present in between two glass surfaces and these cells contain a solution of noble gases and mercury. So when the electricity supply on the gas present in the cell converts into plasma and produces UV light that creates an image. It is much better than an LCD monitor. The resolution of this monitor is also high up to 1920 x 1920. It has a good contrast ratio, high refresh rate, etc.

Characteristics of Monitor:
- **Resolution pixels:** Pixels are the smallest element of any image
- **Size:** The size of the monitor is diagonal measurement of a desktop screen is typically 14 to 25 inches.
- **Refresh Rate:** Total number of times per second that an image on a display is repainted or refreshed.

Monitor

2. Printer

Printers are information output devices that allow you to print data on paper. Or in other words, it is an output device that creates a hard copy of the processed data or information. Printers are divided into two categories:

- **Impact Printer:** In impact printers, characters are printed on the ribbon, which is then smashed on the paper. Or we can say that such type of printer uses a print head or hammer to print the data on the paper. Here to print the paper the hammer or print head strikes an ink ribbon against the paper and the character starts printing. Some of the types of impact printers are:
    - Dot matrix printer
    - Daisy wheel printer
    - Line printer
    - Chain printer
- **Impact printers have the following characteristics:**
    - Extremely low consumable costs.
    - Fairly noisy
    - It's perfect for large-scale printing because of its inexpensive cost.
    - Physical contact with the paper is required to form an image.

- **Non-Impact Printers:** Non-impact printers print characters without the use of a ribbon. These printers are often known as page printers because they print a full page at a time. Some of the types of non-impact printers are:
    - Laser printer
    - Inkjet printer
- **Non-impact printers have the following characteristics:**
    - Quicker.
    - They don't produce much noise.
    - Superior quality.
    - Supports a wide range of fonts and character sizes.

Printer

3. Plotter
A plotter is a device that prints high-quality graphics in a variety of color formats. It works in a similar way to a printer, although it has more advanced features.
- It is used to print large maps, architectural drawings, large-format printing, and create pictures, 3D postcards, advertising signs, charts, and various designs of the internal structure of building machines, as well as create pictures, 3D postcards, advertising signs, charts, and various designs of the internal structure of building machines.

Characteristics of Plotter:
- Large size prints can be taken via plotters.
- It is slow and expensive.

Plotter

4. Projector

A projector is a device that allows users to project their output onto a large area, such as a screen or a wall. It can be used to project the output of a computer and other devices onto a screen. It magnifies texts, photos, and movies using light and lenses. As a result, it's an excellent output device for giving presentations or teaching big groups of people.

Characteristics of Projector:

- They are lightweight, and one person can easily take them out of the box, connect them, and hang an image on the wall.
- Projectors can be the most cost-effective option for large-screen video in your home.
- A small projector mounted on a back shelf or bookcase, or mounted on the ceiling, takes up no area on the floor. It is barely visible when it is not in use.

Projector

5. Speakers

Speakers are connected to computers to allow sound to be output. For the working of speakers, sound cards are required. From simple two-speaker output devices to surround-sound multi-

channel sets, speakers come in a variety of shapes and sizes. They take audio input from the computer's sound card and output sound waves as audio output.

Characteristics of Speakers:

- Speakers are available in a wide range of qualities and prices.
- Small, plastic computer speakers with low sound quality are often included with computer systems.

Speaker

6. Headphones

To hear the sound, use earbuds with your computer, laptop, or **Smartphone**. It enables you to hear the sound without causing any inconvenience to others.

-To translate electronic signals into sounds without causing inconvenience to others. They can be wired or wireless and can be connected to computers, laptops, **mobile phones**, etc. They are connected with the devices via Bluetooth.

Characteristics of Headphones:

- Stereo phones and headsets are other names for them.
- Earphones or earbuds are the names for the in-ear variants.
- The term headset denotes a combination of headphones and a microphone used for two-way communication, such as using a telephone.

Heaphone

7. Sound Card

Sound cards are computer output devices that are inserted into the computer. A sound card, either external or internal, is required to produce sound on any computer (built-in). An external sound card enables for better overall sound generation and is required for wide and clear sound recording, as well as sound without noise and interference.

Characteristics of Sound Card:

- To listen speakers or headphones, to play games, watch movies, listen to music, or use audio and video conferencing, we use an internal sound card.
- Frequency is a sound card parameter that represents the number of signals the card processes per unit of time. The frequency is expressed in hertz. The frequency of most sound cards is 96 or 192 kHz.
- Synthesizers and a variety of electronic musical instruments, such as drums and keyboards, can be connected to your computer using a sound card with standard musical instrument digital interface (MIDI) connections.
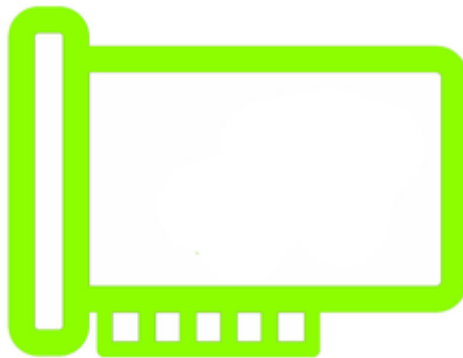
Sound Card

8. Video Card

An extension card via which a computer can transfer graphical data to a video display device like a TV, or monitor. It processes photos and video, as well as other functions that the CPU generally does. As they have a good processing capability and video RAM, Gamers utilize video cards.

Characteristics of Video Card:

- Heat sinks are required for video cards with high performance as they generate a lot of heat.
- Also known as graphics card and require software installation in addition to the hardware.
- When working with huge files, video cards supply a significant quantity of video-only memory that frees up CPU resources, allowing the system to run more effectively.

Video Card

9. Speech Synthesizer

A speech synthesizer is a computerized device that takes in data, interprets it, and generates audible words. It might be a computer card, a box connected by a cable, or software that works with the computer's sound card.

Characteristics of speech synthesizer:

- Any text, predetermined input can be translated into audible speech.
- For people who are unable to talk or have impaired vision, it can provide digital verbal communication.
- It takes in data, interprets it, and generates sound output.

10. GPS

The **Global Positioning System (GPS)** is a radio-based satellite navigation system that uses radio signals to pinpoint a specific position. The sender sends a radio signal to satellites, which collect data such as time, location, speed, and other variables and deliver it to the reception computer for analysis. Because this processed data can be evaluated to obtain information, it is considered as an output device.

Characteristics of GPS:

- GPS satellites constantly communicate their position and time.
- **Solar storms**, high storm cover, and other factors impair GPS equipment.
- The Global Positioning System (GPS) is based on the mathematical idea of trilateration.

- The GPS works independently of telephonic or internet reception and does not need the user to send any data, however, to improve accuracy both technologies can be used.

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GPS

FAQs on Output Devices
Q.1: What is the importance of an output device?
Answer:
Computer's output devices obtain information from the computer and send data that has been processed by the computer to the user. Output devices transfer data in human readable forms, like audio, visual, and hard copy media.
Q.2: Name some devices which works as both Output and Input Device?
Answer:
Below devices are worked as both input and output devices.
- *Modem: A **modem** transfer and receives information over cables.*
- *Touch Screen: **Touch screens** gets input from touch and shows the output on the screen.*
- *Network Card (NIC): A **network card (NIC)** works as expansion card for a device that allows the device to connect to the internet.*
Q.3: Which device gives us hard copy as output?
Answer:
Printer is a device that gives us the hard copy as output.
Q.4: What is difference between hard copy and soft copy?
Answer:
*The main difference between **hard copy and soft copy** is term hard copy refers to something that is printed on paper, or any printing material. The unprinted e-copy of the data that is saved in digital form in the system is known as soft copy.*