

Unit - 18

Information and Communication Technology

Students Learning Outcomes (SLOs)

After learning this unit students should be able to

- > Describe the components of information technology.
- > Explain briefly the transmission of
 - o electric signals through wires
 - o radiowaves through air
 - o light signals through optical fibres
- > Describe function and use of fax machine, cell phone, photo phone and computer.
- > Make a list of the use of E-mail and internet.
- > Describe the use of information storage devices such as audio cassettes, video cassettes, hard discs, floppy, compact discs and flash drive.
- > Identify the functions of word processing, data managing, monitoring and controlling.

We are in the era of ICT. There was a time when the telephone was the only way of communication.

Nowadays, people communicate with one another by mobile phone, fax, computer, and the internet. These sources have reduced distances and linked the whole world together in a single network. In this chapter, we will look at some of the fundamental phenomena and technologies that are employed in today's information and communication technology (ICT) systems.



18.1 INFORMATION AND COMMUNICATION TECHNOLOGY

Processed data is termed information in computers. A computer analyses data and extracts information. Sound, image, and digital data are used to communicate this information to remote locations. An electronic-based system for transmitting, receiving, processing, and retrieving information is known as Information and Communication Technology (ICT). Telecommunications and information technology have been merged to become ICT. The above terms can be defined separately as:

1. Information technology is the scientific approach for storing information, organizing it for optimal use, and communicating it to others.
2. The process of transmitting information over long distances is known as telecommunication.

ICT refers to the scientific techniques and tools to store, process, and transport large volumes of information in a matter of seconds using electronic devices.

18.2 COMPONENTS OF COMPUTER BASED INFORMATION SYSTEM (CBIS)

Five components must come together to create a CBIS (see Fig.18.1). Now we will briefly discuss them.



Do You Know!

Input hardware:

The devices that are used to command the data to the computer are known as input hardware devices like: mouse, joy stick, keyboard.

Output hardware:

The devices that are used to display processed data are known as output hardware like as loudspeaker, screen, printer

1. **Hardware is machinery.** This comprises the CPU and its supporting hardware. Input/output, storage, and communication devices are examples of essential equipment.
2. **Software:** Software includes computer applications. They tell the CBIS's hardware how to process data and turn it into meaningful information. Programs are usually saved on a chips or tape.
3. **Data:** Programs utilize data to provide helpful information. It might be a phrase, picture, or figure that has special significance. Data, like programmes, are usually saved on chips or tape until needed by the computer.



4. **Procedures:** The guidelines for creating and using information systems. These are in user manuals and papers. From time to time, these rules or techniques may be revised. In order to accommodate these adjustments, the information system must be adaptable.



Fig: 18.1 Components of CBIS

5. **People:** A CBIS is useless without individuals who can impact the success or failure of information systems. People develop and maintain the software, enter data, and construct the hardware that makes a CBIS work. People write the processes and ultimately decide the CBIS's effectiveness.

18.3 FLOW OF INFORMATION

Electronic and optical equipment can be used to transfer information from one place to another place, which is called flow of information. When you use a phone, electrical impulses are used to transmit data via cables. Radio, television, and mobile phones provide information by electromagnetic waves or light via optical fibers. As radio waves move through different layers of the Earth's atmosphere, they keep getting bent. As a result, the signal gets weaker, making it hard for people to get it from a long distance away. Microwaves are not refracted in the same

Do You Know!

System software:

System software is a type of computer program that is designed to run a computer's hardware and application programs.

Application software:

Application software is a type of computer program that performs a specific personal, educational, and business function.



Do You Know!

Transducer is a device that convert one form of energy into other form of energy



Fig: 18.3 (a)
First telephone

Bell's telephone transmitter (microphone) consisted of a single permanently magnetized bar magnet having a small coil or bobbin of fine wire surrounding one pole, in front of which a thin disc of iron was fixed in a circular.



Fig: 18.3 (b)
Telephone

way as radio waves. It is because they are used to communicate with satellites.

Figure 18.2 shows a communication system. The transmitter, transmission channel, and receiver are three of the most important parts of any communication system.

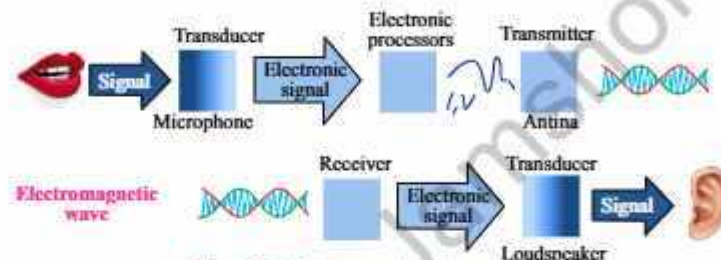


Fig: 18.2 Communication system

The input signal is processed by the transmitter. The transmission channel is the medium used to transmit the signal. Wires or coaxial cables may be used in the same way as radio-wave and optical fiber cables. In other words, the signal power gets weaker as you get farther away from the source. The transducer receives the output signal from the receiver after it has been processed. To compensate for transmission loss, the receiver may amplify the input signal.

18.4 TRANSMISSION OF ELECTRICAL SIGNAL THROUGH WIRES

In 1876, Alexander Graham Bell created a simple and basic telephone system to transmit audio as an electrical signal. An electric coil is attached to a vibrating diaphragm which is made of metal. Diaphragms are used in modern telephones to convert voice into electrical signals for transmission. The mouthpiece and the earpiece are two elements of the telephone system; Fig.18.3.

A thin metal diaphragm and carbon granules are found in the mouthpiece and receiver, respectively. The diaphragm vibrates as we speak through the mouthpiece. An electrical current may travel through the wire because the diaphragm vibrates slightly, compressing the carbon.

At the opposite end of the line, the receiver reverse this procedure. An electromagnet in the receiver generates a



changing magnetic field as a result of the electrical current. As a result of the receiver's thin metal diaphragm vibrating due to the magnetic field, sound is produced.

18.5 TRANSMISSIONS OF RADIOWAVES THROUGH SPACE

Cables or radiowaves may be used to transmit electrical signals representing data from a microphone, TV camera, or computer. Audio frequency (AF) signals may be used to send data directly via wire. Electromagnetic waves, on the other hand, must be used to transmit information over a long distance.

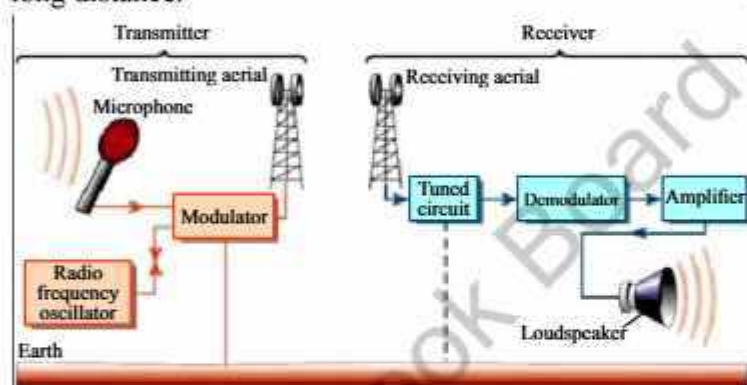


Fig. 18.4: Radio transmission and receiving system

The microphone converts the radio station's sound waves into electrical impulses. The transmission aerial consists of two metal rods, and these signals are subsequently fed into the antenna. Electromagnetic radiowaves are produced when the charges on the transmission antenna vibrate in response to electrical signals.

The modulated signal is selected and amplified by the receiver at the other end. In order to get at the information signal, we need to use the demodulator, which extracts it. In Fig. 18.5, we see a radio broadcast and reception system in action.

Fax machine

A fax machine; Fig. 18.6 is a need for many enterprises across the globe. There are two essential functions in the use of fax machines: scanning the page and transmitting the resulting electronic signals over telephone line.



Fig: 18.5 Radio



Fig: 18.6
Fax machine



An internal printer on the receiving system is used to print out a copy of the transmitted message once it has been converted by the software.

Cell phone

In mobile phones, radio technology is used; Fig. 18.7. It's a sort of radio that allows for two-way communication between users. There are radio transmitters and receivers built inside the mobile phone's internal components. To communicate, it uses radio waves to transmit and receive.



Fig: 18.7
Mobile phone

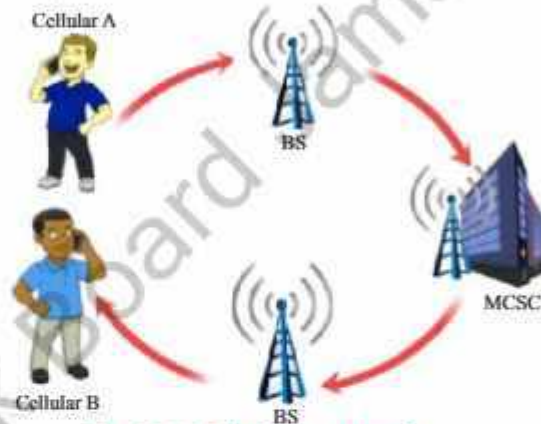


Fig: 18.8. Cell phone network

When a mobile phone user makes a phone call, the sound waves of the caller are transformed into radiowaves. As soon as this signal is received, it is routed to the caller's local base station and given a unique radio frequency. The receiver's base station receives this signal through mobile switching center (MSC), which transmits it to the transmitter. Afterwards, the caller's mobile phone is connected to the call. The radiowaves are converted into sound once again by the mobile receiver as shown in figure 18.8.

Photo phone

Figure 18.9 depicts a more modern form of a photo or video phone. It is possible for users to view each other's faces, unlike the traditional phone. To contact our friends or family members, we just hit the pad with their picture and their phone number. As a result, we are able to connect with our family and friends through camera phone with their actual appearances.



Fig: 18.9
Photo phone



18.6 TRANSMISSION OF LIGHT SIGNALS THROUGH OPTICAL FIBRES

Visible light waves are substantially higher in frequency than radio waves. This implies that light beams can convey information faster than radiowaves or microwaves. An optical fibre was employed as a transmission path. A low-refractive-index optical fibre is a tiny strand of high-quality glass that absorbs less light. A bundle of optical fibres of human hair-thick glass fibres.

Light entering the core of an optical fibre travels straight and meets the inner wall (cladding). If the cladding incidence angle is below the critical angle, some light escapes the fibre optics and is lost; Fig. 18.10. A critical angle of incidence is one where all light is reflected into the fibre optics. It then proceeds in a straight path until it meets the inner wall again, and so on.

The benefit of optical fibre is that it can be used to transmit very large amounts of data across great distances with little loss of quality. This characteristic of fibre optics separates it from wire-based systems. Whenever electrical signals are transferred across wires, the signal loss rises in direct proportion to the increase in data rate delivered. As a result, the signal's range is reduced.



Do You Know?

(One common misconception is that most of our information is transmitted through satellites, but fiber optic cables actually form the backbone of the internet, transmitting about 99% of all data.) Today, there are **over 420** submarine cables in service, stretching over 700,000 miles (1.1 million km) around the world.

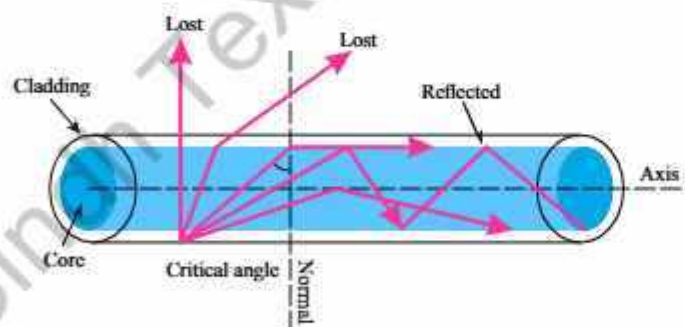


Fig: 18.10.

Light entering a glass rod at greater than the critical angle is trapped inside the glass



Do You Know?

Supercomputer is a computer that performs at or near the highest operational rate for computers. Traditionally, supercomputers have been used for scientific and engineering applications that must handle massive databases, do a great amount of computation or both.



Do You Know?

ENIAC, in full Electronic Numerical Integrator and Computer, the first programmable general-purpose electronic digital computer, built during World War II by the United States. American physicist John Mauchly, American engineer J.



When compared to single-mode cables, the thickness of each optical fibre in a multi-mode cable is about 10 times greater. The term "multiple-mode" comes from the fact that light beams may flow through the core in several ways. Multi-mode cables can only transmit data over small distances and are used to connect computer networks together.

Computer

A computer processes, stores, and displays data. Hardware and software are two components that are fundamental to the operation of a computer. "Hardware" is a physical component of computer. CPU, monitor, keyboard, and mouse are a few examples. CPU, a microprocessor, is the most important component of hardware. It is the "brain" of computer the unit that processes instructions and calculates results. Software informs hardware what to do. A word processing program enables you type letters. The operating system (OS) is the software that governs the functioning of your computer and any other connected devices. Windows and Linux are well-known operating systems.

Today, computers are employed in almost every field, including medicine, engineering, weather forecasting, transportation, and shopping malls. Most individuals now use laptops; Fig 18.11. It is easy to carry a laptop with you when you need to work on a computer since they're compact and light.



Fig: 18.11
Laptop

Fig: 18.12. Parts of a computer



18.7 INFORMATION STORAGE DEVICES

Storage device is a device that can be used to store information in a computer. Storage devices use electronics, magnetism, and laser technology in different ways to store information.

Primary Memory

Primary memory is made up of integrated circuits (ICs) that a processor or computer can access immediately. Random Access Memory (RAM) is a region in the memory where running programmes and services may be accessed by the CPU. Whenever you turn off your computer, you lose all of your RAM's data. The second part of memory is called read-only memory (ROM), which is a type of storage medium that stores data on personal computers (PCs) and other electronic devices in a way that doesn't change it. Among its many functions, it handles the majority of a computer's input and output and stores any program or software instructions that are loaded during bootup.



Do You Know?

Primary memory is also known as primary storage or the main memory.

Secondary Storage Devices

They are usually the secondary storage memory, it can also be used to store other types of data. It is used to keep the data in the computer for a long time. When we open a software, data is transferred from secondary to main storage. Audio-video cassettes, hard discs, USBs, memory cards are the few examples of secondary storage devices.



Do You Know?

The magnetic fields weaken the data will also be lost.

Audio And Video Cassettes

These devices are based on magnetism. Audio cassettes consist of a tape of magnetic material on which sound is recorded in a particular pattern of a magnetic field; Fig 18.13 For this purpose, microphone changes sound waves into electric pulses, which are amplified by an amplifier. Magnetic tape is moved across the head of audio cassette recorder which is in fact an electromagnet; Fig 18.13.



Fig: 18.13
Audio cassette



Do You Know!

In 1877 Thomas Edison, invented the phonograph. It was beginning of sound recording and reproduction.



Phonograph

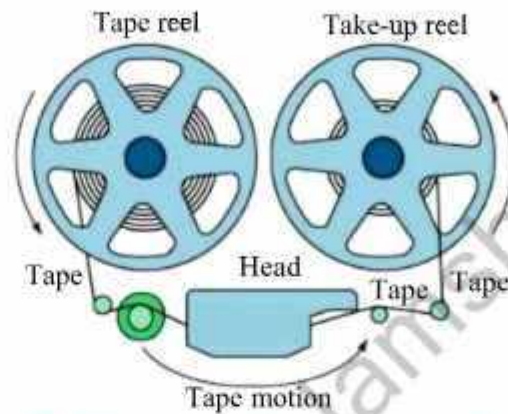


Fig: 18.14. A magnetic tape storage mechanism



**Fig: 18.15
Video cassette**

Thus, magnetic tape is magnetized in a particular pattern according to rise and fall of current. In this way, sound is stored in a specific magnetic pattern on this tape.

To produce the sound again, the tape is moved past the play back head. Changes in magnetic field on the tape induce alternating current signals in the coil wound on the head.

These signals are amplified and sent to the loudspeakers which reproduce the recorded sound. In video tape/cassettes; Fig.18.15, pictures are recorded along with sound.

Magnetic Disks

There are different types of magnetic disks coated with a layer of some magnetic material. The read/write head of disks are similar to the record replay head on a tape recorder. It magnetizes parts of the surface to record information. The difference is that a disk is a digital medium— binary numbers are written and read.

A floppy disc; Fig.18.16 is a small magnetically sensitive, flexible plastic wafer housed in a plastic case. It is coated with a magnetic oxide similar to the material used to coat cassettes and video tapes. Most personal computers include at least one disk drive that allows the computer to write it and read from floppy disk.

Hard Disk

Most users rely on hard disks as their primary storage devices. A hard disk is a rigid, magnetically sensitive disk



**Fig: 18.16
Floppy disk**



**Fig: 18.17
Hard disk**



that spins rapidly and continuously inside the computer chassis or in a separate box connected to the computer housing; Fig.18.17. This type of hard disk is never removed by the user. A typical hard disk consists of several platters, each accessed via a read/write head on a moveable arm.

Compact Disc (CDs)

It's a moulded plastic disc with tiny "pits" and "lands" that store digital data. Pits are CD's spiral tracks and lands lie between them ;Fig. 18.18 (a, b) A laser beam scans the disc to read data. CD pits and lands reflect laser light differently. This pattern of pit and land light reflection is transformed to binary data. Pits signify '1' and '0'. CDs can contain 680 MB of data. A DVD can contain 17GB of data, the same as a CD.

Flash Drive

It is an electronics device and has Integrated circuits (ICs) that store data. A flash drive may transfer data between computers; Fig 18.19. Many of these little devices can hold a year's load of schoolwork. We may connect one to our key chain, collar, or book bag. Because of flash derive; we don't need to bring a hard drive or laptop with us when we move around the world.

18.8 Word Processing, Data Management and Control

Word processing is such a use of computer through which we can write a letter, article, book or prepare a report. Word processing is a computer program. Using this program we can develop any document, see it on the screen after typing. We can edit the document, add some new text or delete the previous text or make amendments in it. We can move text from one page to another, even from one document to another. Document can be stored in memory and its print can also be taken. By means of modern word processing, we can write it in different styles and in different colours. We can also use graphics.

Some other features of word processing are shown below in the icon of word processing:



Fig: 18.18 (a)
Compact disk

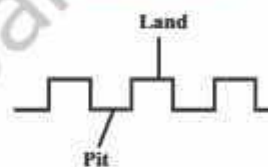


Fig: 18.18 (b)



Fig: 18.19
Flash drive

Do You Know!

In 1956, IBM's Data Processing Division in southern San Jose, Ca transported the first hard-drive that only held a whopping 5 megabytes of storage.





Do You Know?

National Database and Registration Authority (NADRA),

biggest data managing authority of Pakistan was established on 10 March 2000. That manage the data of citizens through the internet by issuing computerized identity card and Form B.



Fig: 18.20
Barcode scanning



Data Management – Monitoring And Control

To collect all information regarding a subject for any purpose and to store them in the computer in more than one inter linked files which may help when needed, is called 'data managing'.

The educational institutions, libraries, hospitals and industries store the concerned information by data management. Additions and deletions are made in the data according to the requirement, which help in the improvement of the management of the institutions.

In big departmental stores and super markets, optical scanners are used to read, with the help of a Laser Beam, the barcodes of a product which indicate the number at which this product is recorded in the register; Fig.18.20. In this way, the detail about its price is obtained. The central computer monitors the bills and the related record of the sold goods. It also helps placing the order of goods being sold in a large quantity and to decide about less selling goods.

18.9 Internet

When many computer networks of the world were connected together, with the objective of communicating with each other, Internet was formed. In other words, we can say that Internet is a network of networks, which spreads all across the globe. Initially, the size of Internet was small. Soon, people became aware of its utility and advantages and within short span of time, numerous computers and networks got themselves



connected to Internet. Its size has increased multi folds within few years. Today Internet comprises of several million computers. There is hardly any country of the world and important city of the country, where Internet is not available.

A conceptual diagram of Internet is illustrated in Fig.18.21.



Fig: 18.21. Schematic diagram of internet

Internet is basically a large computers network, which extends all across the globe. In Internet, millions of computers remain connected together through well-laid communication system.

Recall that telephone communication system is well-defined, time proven system. Internet makes use of this system and many other systems to connect all the computers. Thus like a telephone connection, any computer of any city can establish a connection with any other computer of any other city and exchange data or messages with it.

Internet Services

The main services used on the internet include:

- Web browsing - this function allows users to view webpages.
- E-mail - Allows people to send and receive text messages.

Browsers

A browser is an application which provides a window to the Web. All browsers are designed to display the pages of information located at Web sites around the world. The

Do You Know!

January 1, 1983 is considered the official birthday of the Internet. Prior to this, the various computer networks did not have a standard way to communicate with each other. A new communications protocol was established called Transfer Control Protocol/Internetwork Protocol (TCP/IP).

Do You Know!

HTTP, in full **Hyper Text Transfer Protocol**, standard application-level protocol used for exchanging files on the World Wide Web.



Internet explorer



Google Chrome



Mozilla Firefox

Fig: 18.22.
Icons of different web
browsers



Fig: 18.23.
Icons of Electronic mail

most popular browsers on the market today include Internet Explorer, The World, Opera, Safari, Mozilla Firefox, Chrome, etc; Fig. 18.22.

We can search anything through search engine like Google Chrome, Internet Explorer, Mozilla Firefox, etc.

Electronic Mail

One of the most widely used application of internet is electronic mail (or e-mail), which provides very fast delivery of messages to any enabled site on the Internet. Communication through e-mail is quicker and more reliable. Through our e-mail, we can communicate with our friends and institution with more ease and pace. Some advantages of e-mail are as follows:

Fast Communication:

We can send messages anywhere in the world instantly.

Cost Free Service:

If we have an internet access, then we can avail the e-mail service free of cost.

Simple to Use:

After initial set up of e-mail account, it is easy to use.

More Efficient:

We can send our message to many friends or people only in one action.

Pictures or other files can also be sent through e-mail. Internet has proved to be very beneficial to us. Here is the list of use of internet.

- i. Faster Communication
- ii. Big Source of Information
- iii. Source of Entertainment
- iv. Access to social media
- v. Access to Online Services
- vi. E-commerce
- vii. E-Learning



SUMMARY

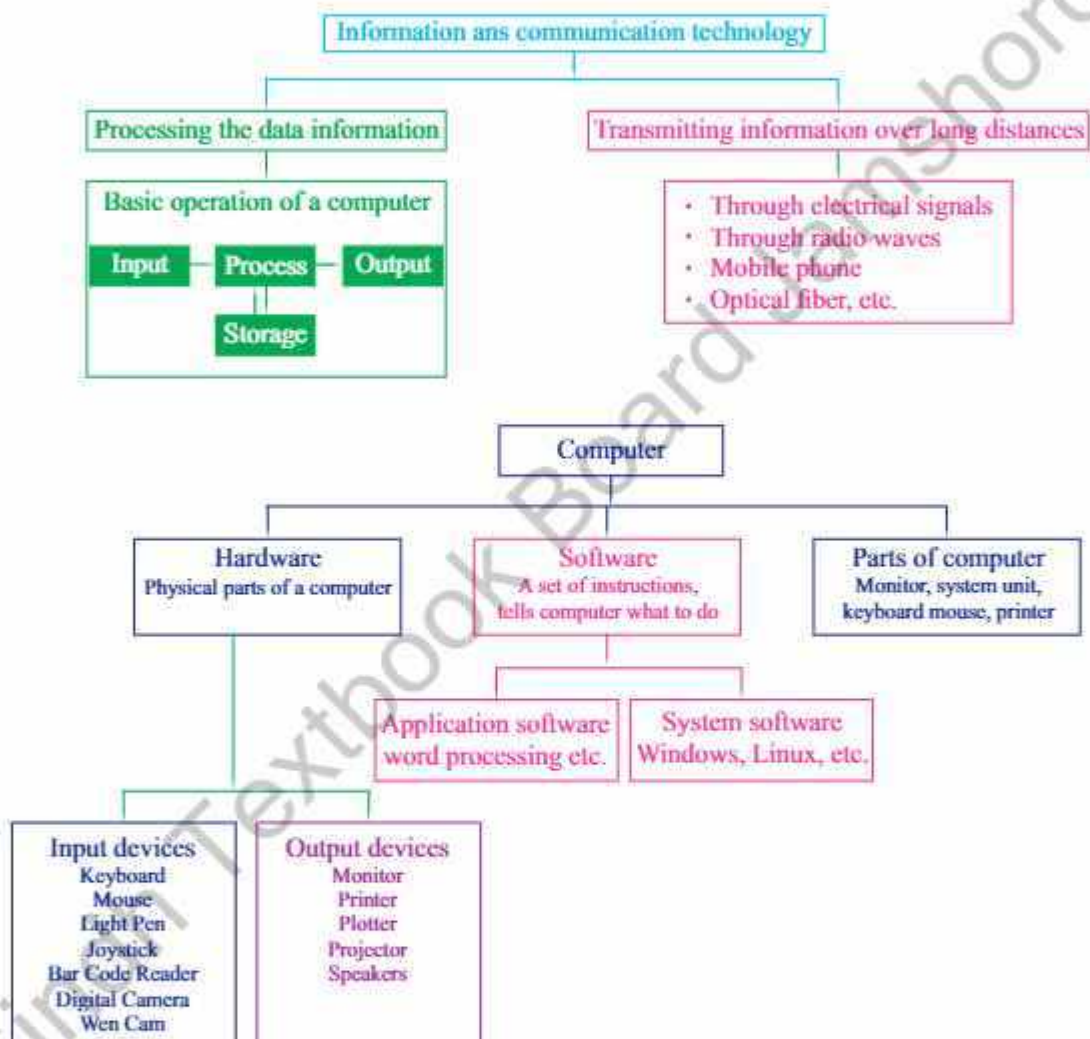
- The scientific method used to store information, to arrange it for proper use and to communicate it to others is called information technology.
- The methods and means that are used to communicate information to distant places instantly is called telecommunication.
- Information and Communication Technology (ICT) is defined as the scientific methods and means to store, process and transmit vast amounts of information in seconds with the help of electronic equipment.
- Flow of information means the transfer of the information from one place to another through different electronic and optical equipments.
- In telephone, information can be sent through wires in the form of electrical signals. In radio, television and cell phone information can be sent either through space in the form of electromagnetic waves or it can be sent through optical fibres in the form of light signals.
- There are five parts that must come together in order to produce a Computer-Based Information System (CBIS). These are called the components of information technology. These are: hardware, software, data, procedures and people.
- Information storing devices store the information for later use and benefits. These include audio cassettes, video tapes, compact discs, laser disks, floppy disks, and hard disks.
- Telephone changes sound into electrical signals and sends these signals to the receiver. The receiver changes the electrical signals again to sound by a system fitted in the receiver.
- Mobile phone is a sort of radio with two-way communication. It sends and receives the message in the form of radiowaves.
- Fax machine is the means to send the copy of documents from one place to another through telephone lines.
- Radio is an instrument which transmits the sound waves to us.
- Computer is an electronic computing machine that is used for adding, subtracting and multiplying.
- Hardware refers to the parts of a computer that we can see and touch i.e., key board, monitor, printer, scanner, mouse, etc.



- The most important piece of hardware is the central processing unit (CPU). It is the “brain” of computer—the part that translates instructions and performs arithmetic calculations.
- Software refers to the instructions, or programs, that are installed in the hardware to perform different tasks. Window and Linux Operating Systems (OS) are examples of softwares.
- Word processing is such a use of computer through which we can write a letter, prepare reports and books. By means of this, we can develop any document and see it on the screen after typing.
- To collect information for a special purpose and to store it in a computer in a file form, which may help at times when needed, is called data managing.
- Internet is a network of large number of computers which is major source of information and world communication.



CONCEPT MAP





Section (A) Multiple Choice Questions (MCQs)

1. Another name for a supercomputer is a:
a) High-performance computer b) Maxi computer
c) Mainframe computer d) None
2. Input, processing, output, and storage are collectively referred to as:
a) Information processing cycle. b) Software life cycle.
c) Hardware life cycle. d) Information technology.
3. _____ is the output from a computer that ranks from processing input data
a) Data b) Information
c) Computer d) Mouse
4. Which one of the following is not considered as a system software?
a) Assembler b) Interpreter
c) Compiler d) Tally
5. Which of the following is suitable for connecting different computers in an organized manner within an office building?
a) MAN b) WAN
c) ANN d) LAN
6. A computer program that translates one program instruction at a time into machine language is called?
a) Interpreter b) CPU
c) Compiler d) Simulator
7. The name given to a sequence of instructions in a computer language, to get the desired result is?
a) Program b) Decision table
c) Pseudo code d) Algorithm
8. USB stands for
a) Ultra Serial Bus b) Unlimited Structured Bit
c) Universal Serial Bus d) Unified Status Bus
9. Which is the extension not suitable to an ms-word file
a) .doc b) .docx
c) .rtf d) .jpeg
10. ICT stands for
a) Information and Communications Technology
b) Integrated Circular Technology
c) Intensive Computer Techniques
d) Interfacing Computer Theories



Section (B) Structured Questions

1. What is difference between data and information?
2. What do you understand by Information and Communication Technology (ICT)?
3. What are the components of information technology? Clearly indicate the function of each component.
4. Differentiate between the primary memory and the secondary memory.
5. Name different information storage devices and describe their uses.
6. Explain briefly the transmission of radiowaves through space.
7. How light signals are sent through optical fibre?
8. What is computer? What is the role of computer in everyday life?
9. What is the difference between hardware and software? Name different softwares.
10. What do you understand by the term word processing and data managing?
11. What is Internet? Internet is a useful source of knowledge and information. Discuss.
12. Discuss the role of information technology in school education.
13. Why optical fibre is more useful tool for the communication process?
14. Which is more reliable floppy disk or a hard disk?
15. What is the difference between RAM and ROM memories?

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