

UNIT 17

INFORMATION AND

COMMUNICATION

TECHNOLOGY

After studying this unit, the students will be able to:

- a. Describe the components of information technology.
- b. explain briefly the transmission of
 - 1) Electric signals through wires.
 - 2) radio waves through air.
 - 3) Light signals through optical fibres.
- c. Describe function and use of fax machine, cell phone, photo phone and computer.
- d. Make a list of the use of E-mail and internet.
- e. Describe the use of information storage devices such as audio cassettes, video cassettes, hard discs, floppy, compact discs and flash drive.
- f. Identify the functions of word processing, data managing, monitoring and controlling.

Q.1 What do you understand by information and communication technology?**Answer**

Information and communication technology (ICT)

"Information and communication technology (ICT) is defined as the scientific methods to store, process and transmit vast amounts of information in seconds with the help of electronic equipments."

In computer terminology, processed data is, called information. Computer processes the Microwaves are used for mobile data and converts it imp useful information. This information is

For your information

All modern telecommunications use some form of electromagnetic radiation. Radiowaves carry information to local radio and TV. Microwaves are used for mobile phones, radar and transmission to satellites in space. Infrared rays are used to send digital information along fibre optic cables.

transmitted to distant places satellites in Space Infrared rays are in the form of sound, picture and computerized used to semi digital information data.

Information and communication technology (ICT) is basically an electronic based system of information transmission, reception, processing and retrieval.

ICT is blend of two fields: information technology and communication. The two term are defined as follows:

1) Information technology:

The scientific method used to store information to arrange It for proper use and to communicate it to others is called Information technology.

2) Telecommunication:

The method that is used to communicate information to far off places Instantly IS called telecommunication.

Q.2 What are the components of computer-based information system?

Answer

Computer based information system (CBIS):

There are five parts that must come together in order to produce a computer-based information system (CBIS) as shown in the fig 17.1. These are called the components of information technology, discussed below.

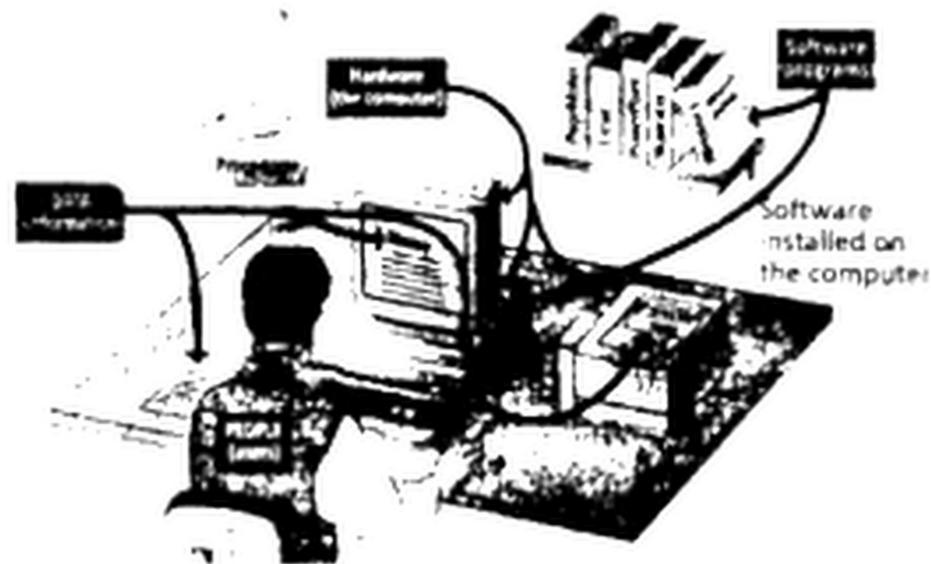


Fig. 17.1. Components of CBIS

1) Hardware

The term hardware refers to machinery. This includes the central processing unit (CPU) and all of its support equipments. Among the support equipments are input and output devices storage devices and communication devices.

2) Software

The term software refers to computer programmes and the manuals that support them. Computer programs are machine readable instructions that direct the circuitry within the hardware parts of the CBIS to produce useful information from data. Programmes are generally stored on some input/output medium, after a disk or tape.

3) Data

Data are facts that are used by programmes to produce useful information. it may be in the form of text, graphic or figure that can be recorded and that have specific meaning.

Like programs, data are generally stored in machine-readable form on disk or tape until the computer needs them.

4) Procedures

These are set of instructions and rules to design and use information system. These are written in manuals and documents for use. These rules or methods may change from time to time. The information system must be flexible to incorporate these changes.

5) People

Every CBIS needs people if it is to be useful, who influence the success or failure of information systems.

People design and operate the software, they feed input data, build the hardware for the smooth running of any CBIS. People write the procedures and it is ultimately people who determine the success or failure of a CBIS.

Q.3 What do you mean by the process of flow of information?

Answer

Flow of information

Flow, of information means the transfer of information from one place to another through different electronic and optical equipments.

In telephone, information is sent through wires in the form of electrical signals.

In radio, television and cell phone information is sent either, through space in the form of electromagnetic waves, or through optical fibres in the form of light.

Radio waves are refracted by different layers in the earth atmosphere. This leads to weaken the Signal, making difficult to be received over long distances. Unlike radio waves, microwaves are not refracted. They are used for satellite communications.

Fig. 17.2 shows the elements of a communication system. There are three essential parts of any communication system, transmitter, transmission channel and receiver.

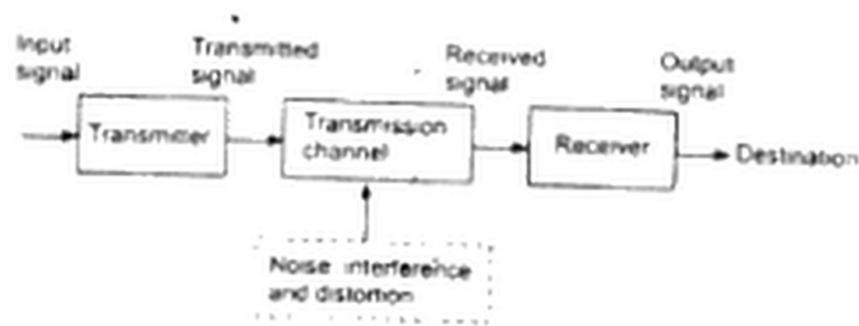


Fig 17.2

- 1) The transmitter processes the input signal.
- 2) The transmission channel is the medium which sends the signal from source to destination. It may be a pair of wires, a coaxial cable, a radio wave or optical fibre cable. So, the signal power progressively decreases with increasing distance.
- 3) The receiver takes the output signal from the transmission channel and delivers it to the transducer after processing it.

The receiver may amplify the input signal to compensate for transmission loss.

Q.4 Write about the transmission of electrical signal through wires? How radio waves are waves are transmitted through space?



Answer

Transmission of electrical signal through wires

Alexander Graham Bell in 1876 made a simple telephone model to send voice in the form of electrical signal from one place to another. It consists of a metal reed, an electric coil and a vibrating diaphragm.

Modern telephone also uses diaphragms to turn voices into electrical signal that are transmitted over phone lines. Telephone system has two parts: mouth piece and the ear piece.

The mouth piece and receiver contain carbon granules and a thin metal diaphragm. When we speak into the earpiece the sound vibrations also vibrate the diaphragm. A slight vibration of the diaphragm compresses the carbon and thus an electrical current can flow through the wire. The process is reversed at the other end of the line by the receiver. The electrical current the receiver may amplify the input signal to compensate for transmission loss, flowing through an electromagnet in the receiver produces a varying magnetic field. This magnetic field attracts the thin metal diaphragm in the receiver, causing it to vibrate. This vibration of the diaphragm produces sound-waves.

Transmission of radio waves through space

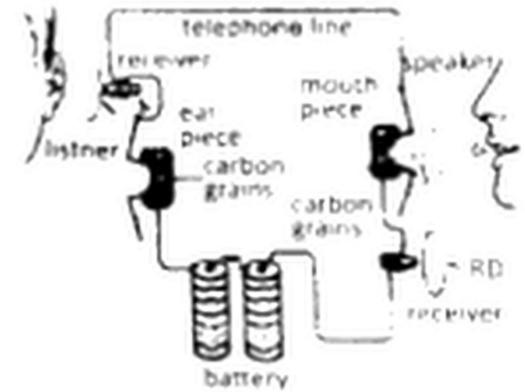


Fig. 17.3: Telephone diagram

Do you know?

Radiowaves are electromagnetic waves and they travel with the speed of light. Marconi has the distinction that he transmitted the first radio signal through the space.

Interesting Information

The speed of sound in air is just 1246 km per hour and it cannot go far away from its source. Therefore, it is converted into electromagnetic waves so that they can be sent to far off areas with the speed of light.

Electrical signals representing information from a microphone, a TV camera, or a computer can be sent from one place to another place using either cables or radio waves.

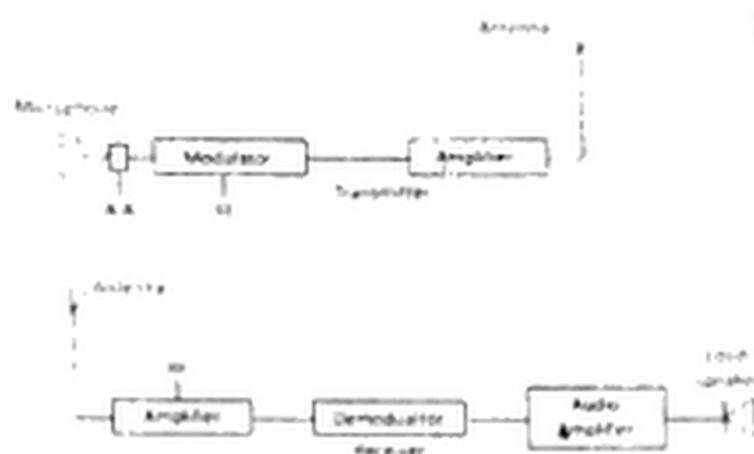


Fig. 17.4 Radio transmission and receiving system

For your information

Radio tuning circuit consists of coils of fine wire wound on a rod which is connected to the antenna. The coils are connected to variable capacitors. The tuned circuit selects signals of only particular frequency. It does not amplify the signals from transmitter with slightly lower or higher frequencies. The voltage rises and falls as the frequency of the received signal increases or decreases relative to the constant frequency of the oscillator.

Information in the form of audio frequency (AF) signals may be transmitted directly by cable.

However, in order to send information over a long distance it has to be super imposed on electromagnetic waves.

Sound waves produced at the radio station are changed into electrical signals through microphone. These electrical signals are then introduced into the transmission antenna which consists of two metal rods. Signals falling on the transmission antenna oscillate the charges which then emit these electrical signals in the form of electromagnetic radiowaves.

At the receiving end, the receiver selects and amplifies the modulated signal. The demodulator then extracts the information signal and delivers it to the receptor. Radio transmission and receiving system is shown in the fig. 17.4.

Q5 What is the process of transmission of signals in the following devices?

a) Fax Machine b) Cellphone c) Photo phone

Answer

a) Fax Machine:

Telefacsimile's or Fax machines are must for many businesses around the world. A fax machine basically scans a page to convert its text and graphic into electronics signals and transmits it to another fax machine through telephone line. The receiving machine converts the signal and uses a printer to create the copy of the message that was sent.



Fig. 17.5 Fax machine

b) Cell phone:

Radio technology is applied in mobile phone. It is a type of radio having two-way communications. A cell phone carries a radio transmitter and a receiver inside it, it sends and receives the message in the form of radio waves.



Fig. 17.6 Cell phone

Cell phone network system consists of cells and Base stations (BS) and mobile Switching centre (MSC).

1) A base station is a wireless communications station set up at a particular geographical location. The geographical area, covered by a single base station is known as cell.

Do you know?

A mobile phone sends text messages and takes and transmits images. The new 3G technology will make video phones common place.

The group of cells form a cluster.

2) All 835 within a cluster are connected to a MSC using land lines. The MSC stores information about the subscribers located within the cluster and is responsible for directing calls to them.

3) When a caller calls another cell phone, sound waves of the caller are converted into radio waves signal. This radio signal of particular frequency is sent to the local base station of the caller where the signal is assigned a specific radio frequency. This signal is then sent to the base station of the receiver through MSC. Then the call is transferred to the cell phone of the receiver. Mobile receiver again changes the radio waves into sound.

Do you know?



Cell phone transmissions are made with microwaves.



How mobile networks work

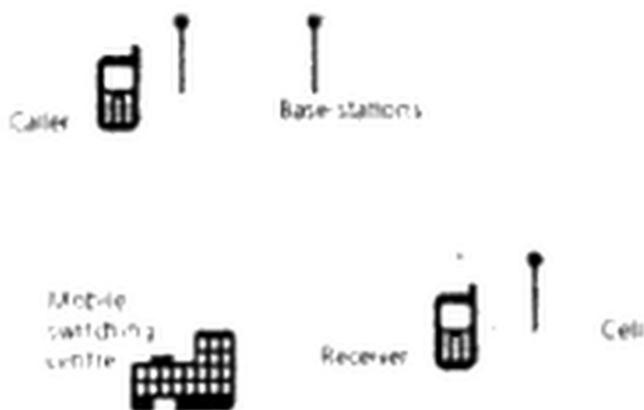


Fig. 17.7: Cell phone network

c) Photo phone:

Modern version of photo phone or video phone is shown in the figure 17.8.

Contrary to a common telephone, speakers can see the pictures of each other.

By using the photo and phone numbers of our friends or family members on this telephone you can call them by pressing the pad with their photos. Thus, we

can communicate with our relatives or friends on photo phone with the physical appearance of each other.

Q.6 Write about the transmission of light signals through optical fibres?

Answer

Optical fibre: -

An optical fibre with a coating of lower refractive index is a thin strand of high quality glass that absorbs very little light.

An optical fibre cable is a bundle of glass fibres with thickness of human hair. Signals are transmitted through optical fibres with the speed of light, ie $3 \times 10^8 \text{ ms}^{-1}$.

Waves of visible light have a much higher frequency than that of radio waves. This means, rate of sending information with light beams is larger than that with radio waves or microwaves. An optical fibre has been used as equipment for this purpose.

Signal transmission through optical fibres:

Light that enters the core at one end of the optical fibre goes straight and hits the inner wall (the cladding) of fibre optics. If the angle of incidence transmits digital Signals across with cladding is less than the critical angle, some of the light will escape the fibre optics and is lost as shown in the figure 17.9.

However, if the angle of incidence is greater than the critical angle light is totally reflected into the fibre optics.

For your Information
Microwave, digital and optical fibre technologies are combined to give us today's telecommunications systems. Microwaves travel in straight lines through the space and give a very strong signal. We can connect to the other side of the world in milliseconds. Communication satellites including INTELSAT and SATCOM are geostationary satellites that stay over the same position above and receive and transmit digital signals across



Most of the data transmitted across the Internet is also carried by light. A network of fibre-optic cables across the country carrying data from one computer to another

Then the totally reflected beam of light travels in a straight line, until it hits the inner wall again and so on. The advantage of optical fibre is that it can be used for sending very high data rates over long distances.

When electrical signals are transmitted through wires, the signal loss increases with increasing data rate. This decreases the range of the signal.

Each optical fibre in a multimode cable is about 10 times bigger than fibre optics used in a signal mode cable.

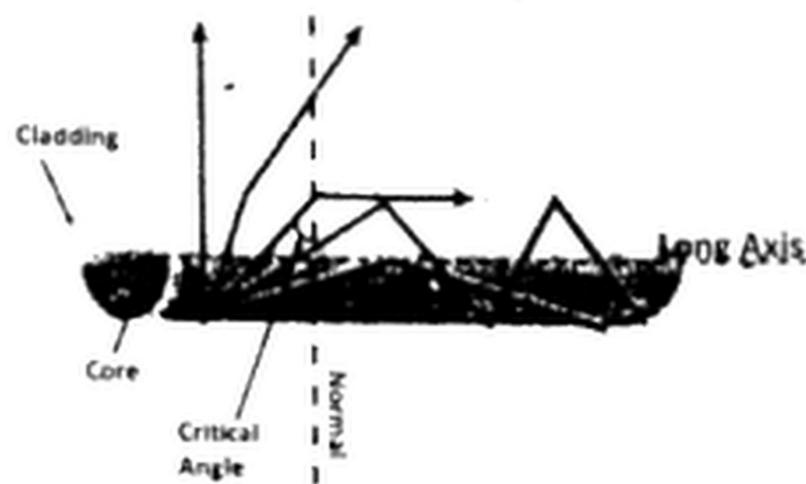


Fig. 17.9: Light entering a glass rod at greater than the critical angle is trapped inside the glass

Q7 What is a computer? Write its uses?

Answer

Computer

Computer, as shown in the figure 17 10, is an electrical computing machine used for adding, subtracting or multiplying. Computers work through an interaction of hardware and software.

Interesting information

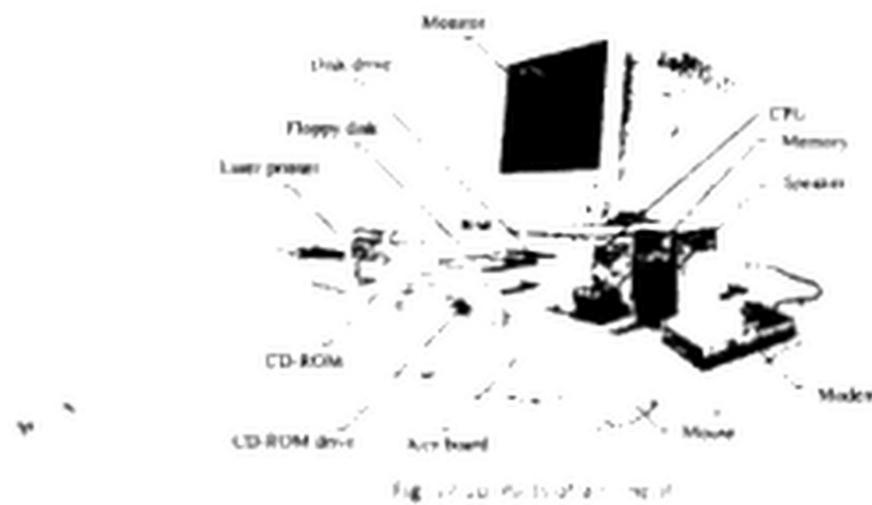
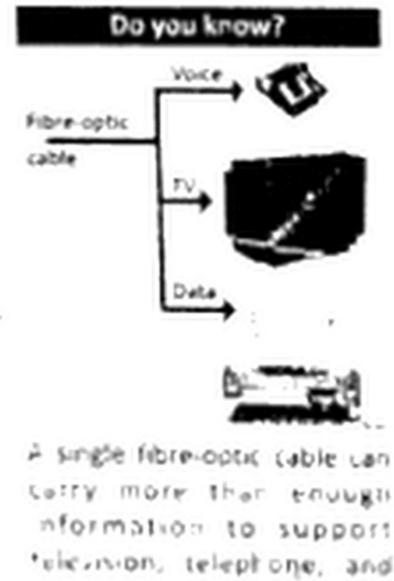
The most powerful and swift computer which can send an information in one thousand billionth part of a second is called super computer. It contains many processors.

Parts of computer

Hardware refers to the parts of a computer that you can see and touch. These include CPU, monitor, keyboard, mouse, monitor, printer etc. The most important piece of hardware is the central processing unit (CPU) that contains a tiny rectangular chip called microprocessor.

It is the “brain” of computer the part that translates instructions and performs calculations.

Software refers to the instructions, or programs, that tell the hardware what to do. A word processing program that you can use to write letters on your computer is a type of software. The operating system (OS) is software that



manages your computer and the devices connected to it.

Two well-known operating systems are windows and Linux operating system.

Uses of computers in daily life

- 1) In offices, computers are used for preparing letters, documents and reports.
- 2) In hotels, computers are used for advance booking of rooms, preparing bills and providing enquiry services.
- 3) In railways, computers are used for rail reservation, printing of tickets and preparation of reservation charts.

- 4) Doctors use computer for diagnosing illness and treatment of diseases.
- 5) Architects use them for building, designing and city planning.
- 6) In meteorology department, computers are used for weather forecasting.

**Q.8 Differentiate between the primary memory and the secondary memory?
How data is sorted & used in audio/video cassettes?**

Answer

Information storage devices

A Storage device is a device designed to store information in computer. Storage devices work on different principles using electronics, magnetism and laser technology.

1) Primary memory

It is based on electronics and consists of integrated circuits (ICs). It is a random-access memory (RAM). It vanishes when the computer is switched off.

2) Secondary memory

The data storage devices are generally the secondary memory of the computer. It is used to store the data permanently in the computer. When we open a program, data is moved from the secondary storage into the primary storage.

The secondary storage devices are audio-video cassettes and hard disk.

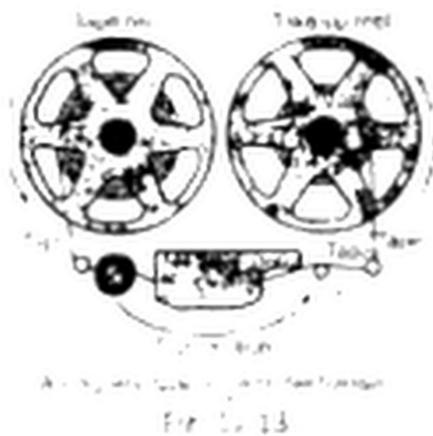
For your information
Computers use data in binary form, i.e. in the form of 1s and 0s. A bit is a single numeric value, either '1' or '0', that encodes a single unit of digital information. A byte is equal to eight bits. Larger units of digital data are kilobytes (kB), megabyte (MB) and gigabyte (GB). These are defined as below:
1kB = 1024 bytes
1MB = 1024 kilobytes
1GB = 1024 megabyte



Fig. 17.11 Laptop

Audio and video cassettes

These devices are based on magnetism. Audio cassettes consists of a tape of magnetic material on which sound is recorded in a particular form of a magnetic field. For this purpose, microphone change sound waves into electric pulses which are made by an amplifier. Magnetic tape is moved across the head of audio cassette recorder which is in fact an electromagnet. Change of current in the electromagnet causes a change in the linked magnetic field.



Thus magnetic tape is magnetized in a particular form 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 the magnetic field on the tape induce alternating current signals in the coil wound on the head. These signals are amplified and sent to the loud speakers which reproduce sound. In video tape/cassettes pictures are recorded along with sound.

Q.9 What are magnetic disks? Why hard disk is preferred more for data storage than floppies?

Answer

Magnetic

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 play 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.

Floppy disk

A floppy disk is a small magnetically sensitive flexible, plastic wafer housed in 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.

1) Floppies are inexpensive, convenient and reliable, but they lack the storage capacity and drive speed for many large jobs.

2) Data stored on floppy disks is also subject to loss as a result of stray magnetic fields.

3) As for as floppy disks are concerned, they are reliable only for short term storage and cannot be used longer and no attempts should be made to save the data for a longer time.

Hard disk

Hard disks are considered more reliable as primary storage devices. A hard disk is a rigid, magnetically sensitive disk that spins rapidly and continuously inside the computer chassis or in a separate box connected to the computer housing. 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. While a typical floppy has a storage



Fig 17.15 Floppy disk



For your information
A computer hard drive. Each platter has a magnetizable coating on each side. The spindle motor turns the platters at several thousand revolutions per minute (rpm). There is one read-write head on each surface of each platter.

capacity of between 1 and 3MB, a hard disk might hold hundreds or thousands of megabytes of information.

Information can be transferred quickly to and from a hard disk much faster than with a floppy. '



Fig 17.16 Hard disk

Q.10 Distinguish between compact disc and flash drive?

Answer

Compact disc

This is based on laser technology. It is a molded plastic disc on which digital data is stored in the form of microscopic reflecting and non reflecting spots which are called "pits" and "lands" respectively.

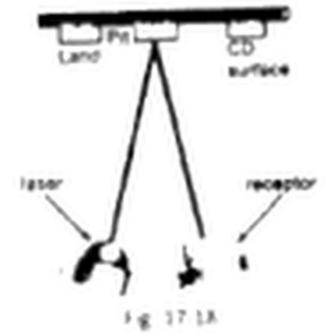
Pits are the spiral tracks encoded on the top surface of CD and lands are the areas between pits as shown in the diagram 17.18.



Fig 17.17 Compact disc (CD)

A fine laser beam scans the surface of the rotating disk to read the data. Pits and lands reflect different amount of the laser light falling on the surface of CD. This pattern of different amount of the light reflected by the pits and the lands is converted into binary data.

The presence of pit indicates '1' and absence of pit indicates '0'. Because data stored on CD can only be read but cannot be altered or erased therefore, CD memory is called read only memory (ROM). A CD can store 680 megabytes of computer data.



Flash drive

It is also an electronic based device and consists of data storage i.e. A flash drive is a small storage device that can be used to transport files from one computer to another. They are slightly larger than a stick of gum, yet many of these devices can carry all your home work for an entire year.

A flash drive is easy to use. Once we have created a paper or other works, we can simply plug our flash drive into a USB port.

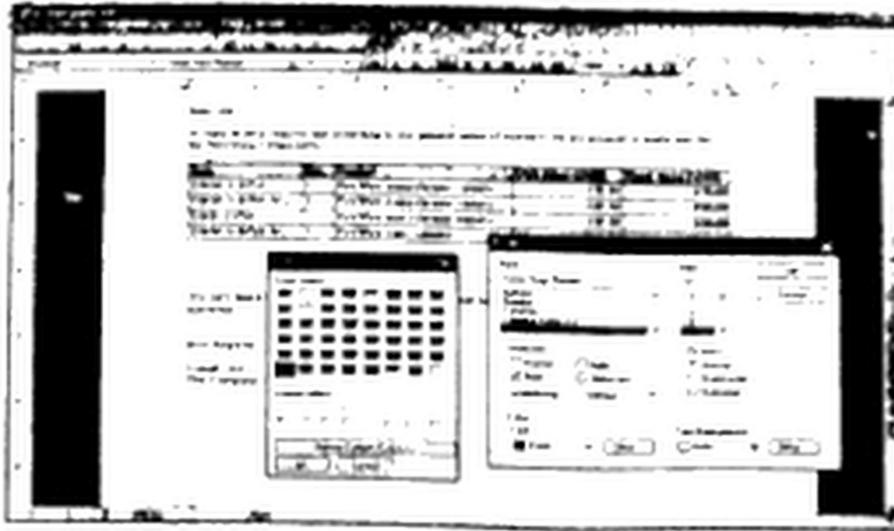


Q.11 What do you understand by the term word processing and data management?

Answer

Word processing

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. 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 in the diagram in the icon of word processing.

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 indicates the number at which this product is recorded in the register.



Fig. 17.20: Bar code scanning

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 fewer selling goods.

Q.12 What is "Internet"? Discuss in detail.

Answer

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 computer 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 increased manifold within a 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. 17.21. Internet is basically a large computer network, which extends all across the globe.

In internet, millions of computers remain connected together through well-laid communication systems. 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.



Fig. 17.21 Schematic diagram of Internet



Q.13 What do you know about “Web browsing” and “E—mail”?

Answer

Web browsing

A browsing 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 most popular browsers on the market today include, “Internet explorer, The world, Opera, Safari. Mozilla firefox, chrome etc.”



How to search the web

We can search anything through search engine like google chrome, internet—explorer, Mozilla firefox etc..

The procedure of searching the web in google chrome is as under:

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

For your information
 Access of internet to people is increasing day by day. Internet is a useful source of information and knowledge. With broadband you can download information in seconds. E-mail transmits and receives your messages almost instantaneously. You can talk to your friends and relatives across the continents. A web-cam enables us to hear and see the person you are speaking to.

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:

1) Fast communication

We can send messages anywhere in the world instantly.

2) Cost free service

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

3) Simple to use

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

4) More efficient

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

5) Versatile

Pictures or other files can also be sent through e-mail.

Q.14 Write a few uses of internet? What are the risks of ICT to society and the environment?

Answer

Uses 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.

Risks of ICT to society and the environment

- 1) Over use of computer is dangerous for our health.
- 2) Computer crimes are also very common these days. Computer crime is defined as any crime accomplished through knowledge or use of computer technology.
- 3) There is also a world theft. Theft is the most common form of crime. Computers are used to steal money, goods, information's and computer resources.

For your information

E-commerce is the way of doing business on the web. You can order your favourite book or any other items on line. For instance, Amazon.com has been selling books, music and video successfully for years. As time passes on, supermarkets and trading companies will be selling more of their goods on line.

- 4) Piracy is another issue of importance which is common on computer. It is the illegal duplication of copy write material like books, papers and software etc..

- 5) Hacking is still another illegal activity which is committed on computers. It is an unauthorized access to computer systems of other persons.

Computer hackers can damage some organization by stealing their credit cards and valuable information.

How these risks can be reduced

One way to reduce the risk of security breaches is to make sure that only authorized person has access to computer equipment. We may be granted access to computer based on some passwords as described below:

We can use a key, an ID card with photo, an ID number, a lock combination, our voice print or finger print as password to secure our computer.

