

We are living in the age of information and communication technology. It is not long ago when the telephone was the only device of communication within the country or abroad. Now-a-days, in addition to telephone, mobile phone, fax machine, computer and internet are the main sources of contact. These sources have shortened the distances and have brought in contact the whole world. In this chapter, we will study some basic phenomena and devices which are used in modern day information and communication technology. But before going ahead we should know what this information and telecommunication technology is.

### 17.1 INFORMATION AND COMMUNICATION TECHNOLOGY

In computer terminology, processed data is called information. Computer processes the data and converts it into useful information. This information is transmitted to distant places in the form of sound, picture and computerized data.

Information and Communication Technology (ICT) is basically an electronic based system of information transmission, reception, processing and retrieval. ICT is a blend of two fields: information technology and telecommunication. The two terms are defined as follows:

1. The scientific method used to store information, to arrange it for proper use and to communicate it to others is called information technology.
2. The method that is used to communicate information to far off 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 equipments.*

### 17.2 COMPONENTS OF COMPUTER BASED INFORMATION SYSTEM (CBIS)

There are five parts that must come together in order to produce

#### 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.

## INFORMATION TECHNOLOGY

a Computer-Based Information System (CBIS) as shown in Fig.17.1. These are called the components of information technology. Now we discuss these components briefly.

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

**2. Software:** The term software refers to computer programs 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. Programs are generally stored on some input / output medium, often a disk or tape.

**3. Data:** Data are facts and figures that are used by programs 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.

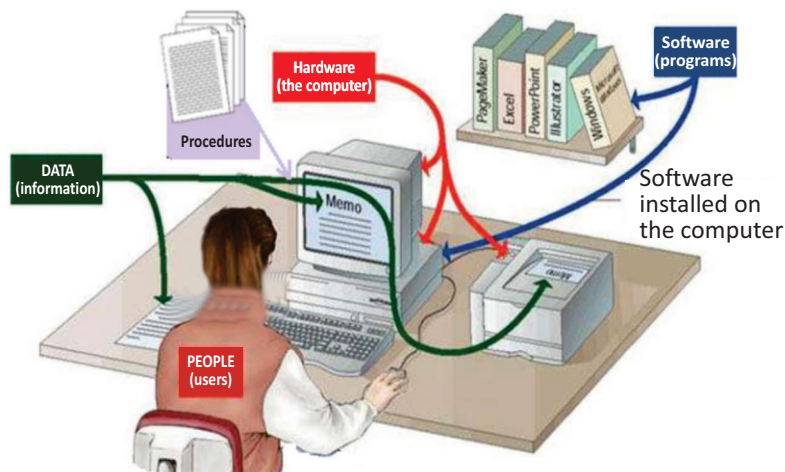


Fig. 17.1: Components of CBIS

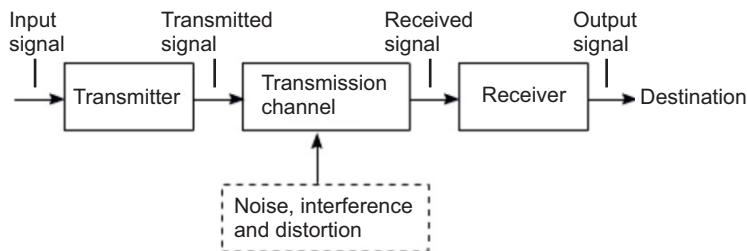
**4. Procedures:** These are set of instructions and rules to design and use information system. These are written in manuals and documents for use. These rules or methods may change from time to time. The Information System must be flexible to incorporate these changes.

**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.

### 17.3 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. Radiowaves are continuously refracted by different layers in the Earth's atmosphere. This leads to weaken the signal, making it difficult to be received over long distances. Unlike radiowaves, microwaves are not refracted. They are used for satellite communication.

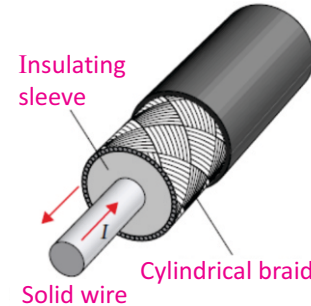
Fig. 17.2 shows the elements of a communication system. There are three essential parts of any communication system: transmitter, transmission channel, and receiver.



**Fig. 17.2**

The transmitter processes the input signal. 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. 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.

#### For your information



Coaxial cable wires are used to transmit electric signals such as cable TV to our homes. To prevent electric and magnetic interference from outside, a covering of conducting material surrounds the coaxial wires.

**17.4 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: the mouthpiece and the earpiece (Fig.17.3).

The mouthpiece and receiver contain carbon granules and a thin metal diaphragm. When we speak into the mouthpiece, 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.

This process is reversed at the other end of the line by the receiver. The electrical current 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.



**Fig.17.3: Telephone diagram**

**17.5 TRANSMISSIONS OF RADIOWAVES THROUGH SPACE**

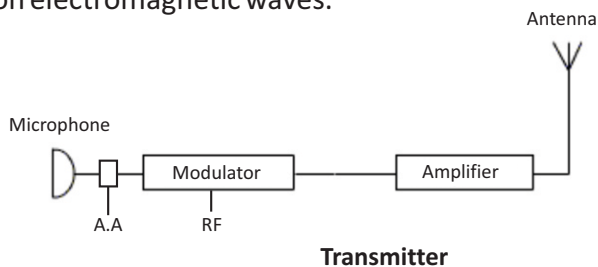
Electrical signals representing information from a microphone, a TV camera, or a computer can be sent from one place to another place using either cables or radiowaves. Information in the form of audio frequency (AF) signals may be transmitted directly by cable. However, in order to send information over a long distance, it has to be superimposed on electromagnetic waves.

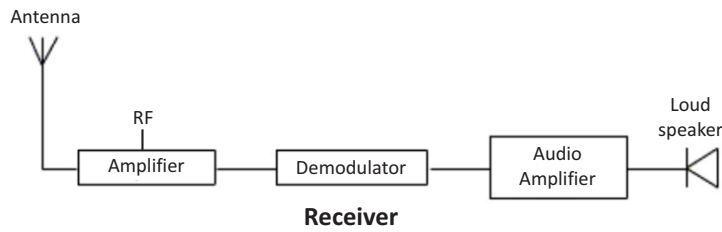
**Interesting information**

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 wave so that they can be sent to far off areas with the speed of light.

**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 air.





**Fig. 17.4: Radio transmission and receiving system**

Sound waves produced at the radio station are changed into electrical signals through microphone. These electric signals are then fed 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 Fig. 17.4.

### FAX MACHINE

Telefacsimile's or Fax machines (Fig. 17.5) are must for many businesses around the world. A fax machine basically scans a page to convert its text and graphic into electronic signals and transmits it to another fax machine through telephone line. The receiving machine converts the signals and uses a printer (usually built in) to create the copy of the message that was sent.

### CELL PHONE

Radio technology is applied in mobile phone (Fig. 17.6). 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 radiowaves.



**Fig. 17.7: Cell phone network**



**Radio**

### 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 transmitters 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.



**Fig.17.5: Fax machine**



**Fig. 17.6: Cell phone**

Cell phone network system consists of cells and **Base Stations (BSs)** and **Mobile Switching Centre (MSC)** ( Fig. 17.7). A base station is a wireless communication station set up at a particular geographical location. The geographical area covered by a single base station is known as a cell. The group of cells forms a cluster. All BSs 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. When a caller calls another cell phone, sound waves of the caller are converted into radiowaves 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 radiowaves into sound.

### PHOTO PHONE

Modern version of photo phone or video phone is shown in Fig 17.8. Contrary to a common telephone, users can see the pictures of each other. By using the photo and phone numbers of our friends or family members on this telephone, we 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.



Fig.17.8: Photo phone

## 17.6 TRANSMISSION OF LIGHT SIGNALS THROUGH OPTICAL FIBRES

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

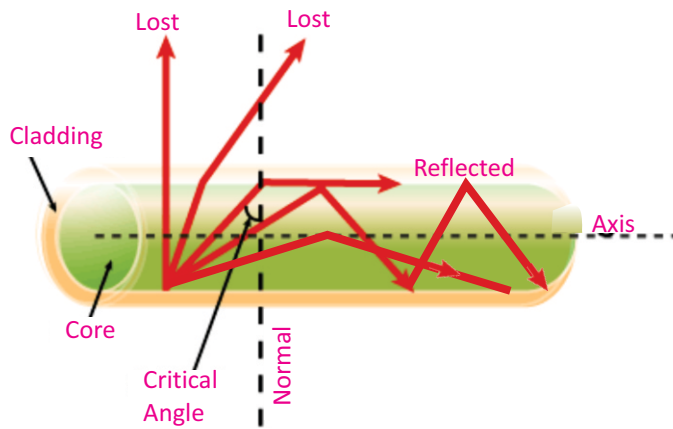
### Do you know?

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



of glass fibres with thickness of a human hair.

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 with cladding is less than the critical angle, some of the light will escape the fibre optics and is lost (Fig. 17.9). However, if the angle of incidence is greater than the critical angle, light is totally reflected into the fibre optics. 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. This feature of fibre optics distinguishes it from wires. When electrical signals are transmitted through wires, the signal lost increases with increasing data rate. This decreases the range of the signal.



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

Each optical fibre in a multi-mode cable is about 10 times thicker than fibre optics used in a single-mode cable. This means light beams can travel through the core by following different paths, hence the name multiple-mode. Multi-mode cables can send information only over relatively short distances and are used to link computer networks together.

### COMPUTER

Computer (Fig. 17.10) is an electronic computing machine used for adding, subtracting or multiplying. Computers work through an interaction of hardware and software. Hardware

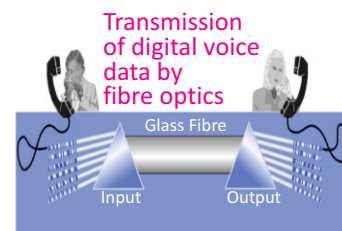
### For your information

Microwave, digital and optical fibre technologies are combined to give us today's telecommunication 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 the Earth surface and receive and transmit digital signals across the world.

### Do you know?



Cell phone transmissions are made with microwaves.



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.

refers to the parts of a computer that you can see and touch. These include CPU, monitor, keyboard, mouse, 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.

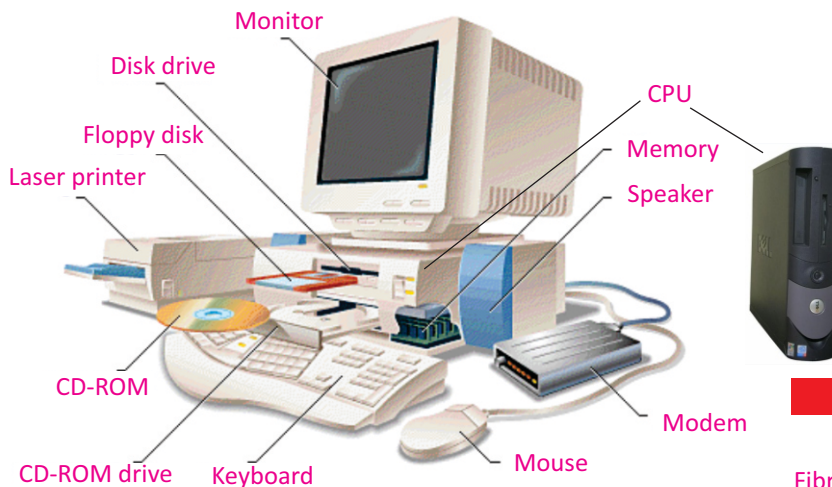
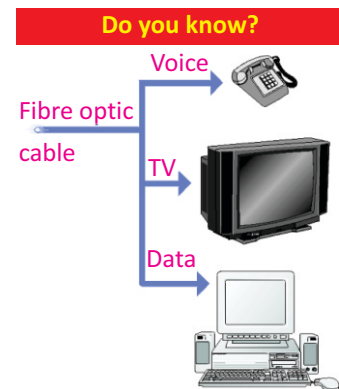


Fig. 17.10: Parts of a computer

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.

Computer plays an important role in our daily life. In offices, computers are used for preparing letters, documents and reports. In hotels, computers are used for advance booking of rooms, preparing bills and providing enquiry services. In railways, computers are used for rail reservation, printing of tickets and preparation of reservation charts. Doctors use computers for diagnosing illness and treatment of diseases. Architects use them for building designing and city planning. In meteorology department, computers are used for weather forecasting. Now usual desktop computers have been replaced by laptops to a great extent. Laptops (Fig 17.11) are



A single fibre optic cable can carry more than enough information to support television, telephone, and computer data.



Fig. 17.11: Laptop



more compact and hence are portable.

### 17.7 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.

#### PRIMARY MEMORY

It is based on electronics and consists of integrated circuits (ICs). It consists of two parts; Read only memory (ROM), which starts the computer and Random access memory (RAM), which is used in computer as temporary memory. RAM vanishes when the computer is switched off.

#### SECONDARY STORAGE DEVICES

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 etc.

#### 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. 17.12). 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 17.13).

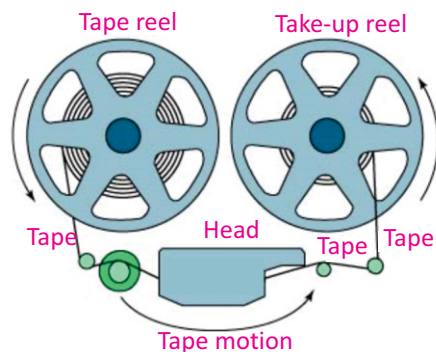


Fig. 17.13: A magnetic tape storage mechanism

#### For your information

Computers use data in binary from i.e., in the form of 0's and 1's. 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:

1 kB = 1024 bytes

1 MB = 1024 kilobytes

1 GB = 1024 megabytes



Fig. 17.12: Audio cassettes

#### 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.

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 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 loudspeakers which reproduce the recorded sound. In video tape/cassettes (Fig.17.14), pictures are recorded alongwith 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.17.15) 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

Floppies are inexpensive, convenient, and reliable, but they lack the storage capacity and drive speed for many large jobs. Data stored on floppy disks is also subject to loss as a result of stray magnetic fields. As far 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 period. As the magnetic fields weaken the data will also be lost.

### HARD DISK

Most users rely on hard disks as their 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 (Fig.17.16). This type of hard disk is never removed by the user. A typical hard disk consists of several

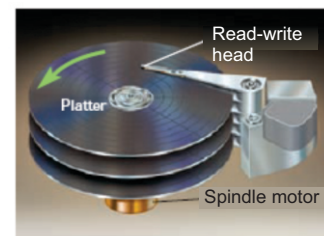


Fig. 17.14: Video cassettes



Fig. 17.15: Floppy disk

#### For your information



In 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.

platters, each accessed via a read/write head on a moveable arm.

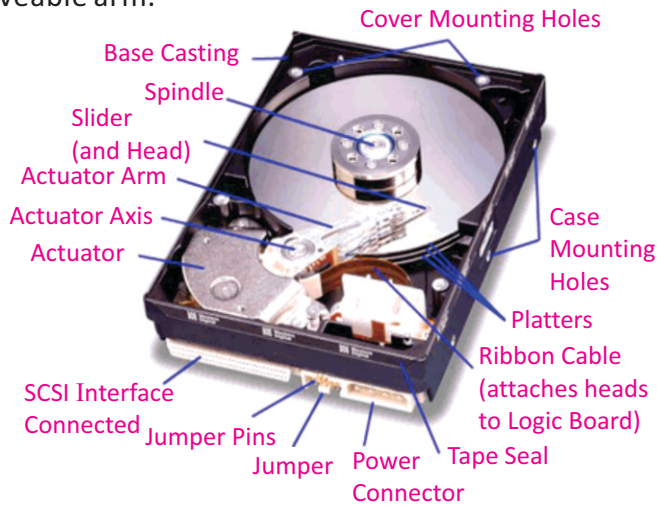


Fig.17.16: Hard disk

### COMPACT DISC (CDs)

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 (Fig.17.17). Pits are the spiral tracks encoded on the top surface of CD and lands are the areas between pits (Fig. 17.18). 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’.

A CD can store over 680 megabyte of computer data. A DVD, the same size as traditional CD, is able to store upto 17gigabytes of data.

### FLASH DRIVE

It is also an electronic based device and consists of data storage ICs. A flash drive is a small storage device that can be used to transport files from one computer to another (Fig. 17.19). They are slightly larger than a stick of gum, yet many of these devices can carry all your homework for an entire year! We can keep one on a key chain, carry it around our neck, or attach it to our book bag.

A flash drive is easy to use. Once we have created a paper or



Fig. 17.17: Compact disk (CD)

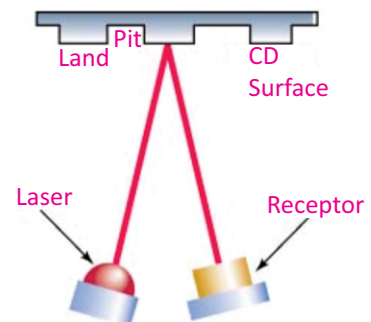


Fig. 17.18



Fig. 17.19: Flashdrive

other work, we can simply plug our flash drive into a USB port. We must make a backup of our created paper or project on our flash drive and save it separate from our computer. A flash drive will also come in handy if you are able to print out homework at school. You can write a paper at home, save it to your flash drive, and then plug the drive into a USB port on a school computer.

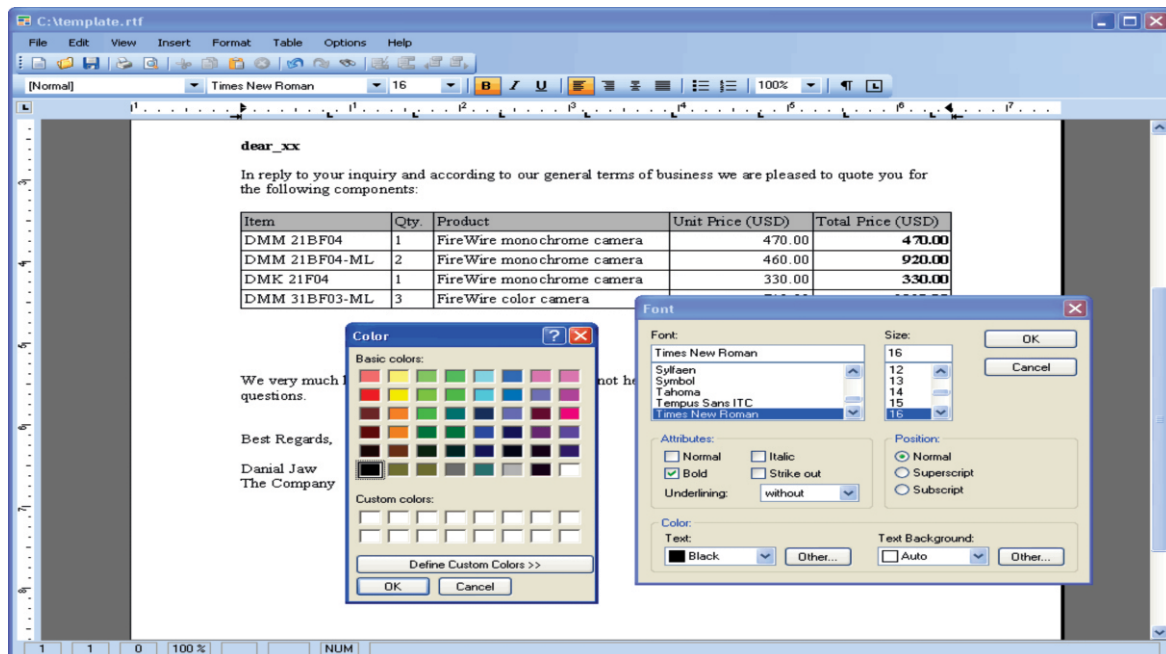
### 17.8 APPLICATIONS OF COMPUTER WORD PROCESSING

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, 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:

#### Do you know?

If the CD is made of metal or glass, it is called hard disk and if it is made of soft elastic material then it is called floppy.



### 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.17.20). 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.

### 17.9 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.17.21. 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.

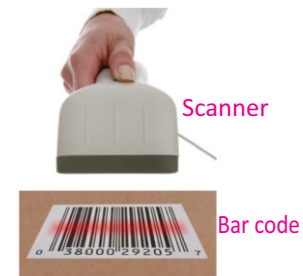


Fig. 17.20: Bar code scanning

### Electronic Banking

Now-a-days, home banking is operating on telephones. We can find our bank balance from the bank on phone, can pay all kinds of bills and transfer our funds by pressing a key of our personal identification number. The bank computer, after our identification, sends us all required information. With the help of ATM machines, we can draw money at any time we want.



Fig. 17.21: Schematic diagram of Internet



## INFORMATION TECHNOLOGY

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 web pages.
- 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 most popular browsers on the market today include Internet Explorer, The World, Opera, Safari, Mozilla Firefox, Chrome, etc. (Fig. 17.22).



Fig.17.22: Icons of different web browsers

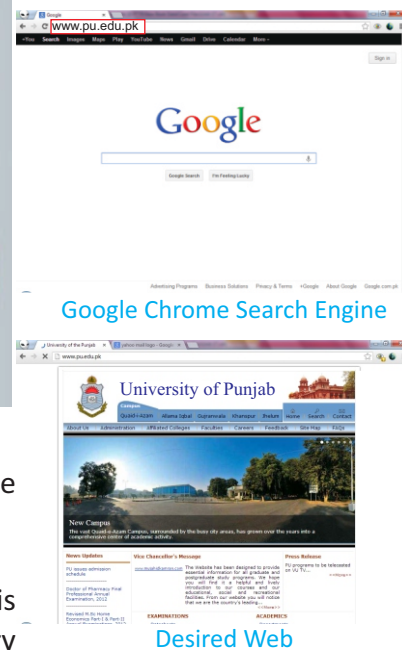
We can search anything through search engine like Google Chrome, Internet Explorer, Mozilla Firefox, etc.

### Electronic Mail

One of the most widely used application of internet is electronic mail (or e-mail), which provides very fast delivery

### Interesting information

Internet is a global web of more than several million nets in which more than 50 million computers are operating and several millions people participate through the world. The number is increasing day by day. Contact can be made at anytime during the day or night on internet.





of messages to any enabled site on the Internet. Communication through e-mail is more quick and 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.

**Versatile**- 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**

### 17.20 Risks of ICT to Society and the Environment

In this modern age, we are expected to rely upon information technology. But blind faith in modern technology may be dangerous in many cases.

Over use of computer is dangerous for our health. Computer crimes are also very common these days. Computer crime is defined as any crime accomplished through knowledge or use of computer technology.

There is also a word theft. Theft is the most common form of crime. Computers are used to steal money, goods, information and computer resources.

Piracy is another issue of importance which is common on computer. It is the illegal duplication of copyright material like books, papers and software etc.

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 organizations by stealing their credit cards and valuable



Yahoo mail icon

#### 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.

#### For your information

E-commerce is the way of doing business on the web. We can order our 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.

## INFORMATION TECHNOLOGY

information.

One way to reduce the risk of security breaches is to make sure that only authorized person have 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.



What is the impact of ICT in education?

### 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.