UNIT 2 INFORMATION AND COMMUNICATION TECHNOLOGY: CONCEPT
AND COMPONENTS

Structure

2.0 LEARNING OUTCOMES

After studying this Unit, you should be able to:

- explain the concept of 'information,' 'communication' and 'information and communications technology'; and

- describe the various types of technologies used in information dissemination, communications and delivery of services.

2.1 INTRODUCTION

Webopaedia defines 'information' as a word, which has many different meanings in everyday usage and in specialised contexts, but as a rule, it is a concept that is closely related to data, instruction, knowledge, meaning, communication, representation and mental stimulus. Information is knowledge derived from data/ data placed within a context. It is a message, something to be communicated from the sender to the receiver. Information in an organisation is the collection of expertise, experience and database that individuals and workgroups use for discharging their responsibilities. It is produced and stored by individual minds, or implicitly encoded and documented in organisational processes, services and systems. It is required for better planning and control. Shannon and Weaver define information as the amount of uncertainty that is reduced when a message is received.

'Communication,' on the other hand, is the process of information, usually via a common system of symbols. Communication can be interactive, transactive, intentional or unintentional; it can also be verbal or nonverbal.

'Information and Communication(s) Technology' (ICT) is then about use of technology in information processing and communication. In particular, it deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and retrieve information. ICT may be discussed in terms of all the uses of digital technology that already exist to help individuals, businesses and organisations use information. ICT covers any product that will store, retrieve, manipulate, transmit or

receive information electronically in a digital form. For example, personal computers, radio, ham, telephone, broadband, digital television, email, robots etc. are all equipment, which can be classified as ICTs. Importantly, it is also concerned with the way these different uses can work with each other.

In this Unit, we will be discussing some of the important technologies that are used in information processing and communication.

2.2 TECHNOLOGIES FOR INFORMATION AND COMMUNICATION

Various technologies have been developed over the years in terms of information and communication. Some of them had many versions as well. However, the feasibility of technology is to the extent it is cost effective to its users and it survives till it is taken over by an alternative far more superior and cost effective technology.

Some of the important and useful technologies used for information and communication are discussed as below:

2.2.1 Telephone

Telephone is a telecommunications device, which is used in transmitting and receiving sound across distance. In this device, electric signals are transmitted over a complex telephone network, which allows the user to communicate with the other user. Usually, there are four ways to connect to a telephone network:

- a traditional fixed phone that is the 'landline,' which uses dedicated physical wire connections connected to a single location;

- wireless and radio telephones, which use either analogue or digital radio signals;

- satellite telephones, where communication is through telecommunications satellites; and

- Voice over Internet Protocol (VoIP) telephones, which use broadband internet connections.

Now-a-days, fibre optic cable, point-to-point microwave or satellite relay, carry transmissions across a network. This has increased the usage of cordless and mobile phones considerably in recent times.

Telephone technology has undergone many changes and innovations since the time it came into being. This has been due to increased demand for this communication device. Today, electrical telephones have been replaced and electret microphones are now used in almost all telephone transmitters. Besides, there are other technologies as well that include manual switchboard, rotary dial, automatic telephone exchange, computerised telephone switch, Touch Tone® dialling (DTMF), and digitisation of sound using different coding techniques including Pulse Code Modulation (PCM). We will discuss some of them briefly.

- **Digital Telephony**
  The Public Switched Telephone Network (PSTN) has improved the capacity and quality of the networks. Digital transmission has made it possible to carry multiple digitised switched circuits on a single transmission medium, known as multiplexing. While today the end instrument remains analogue, the analogue signals reaching the aggregation point (Serving Area Interface (SAI) or Central Office (CO i.e. telephone exchange) are typically converted to digital signals. Digital Loop Carriers (DLC) are often used, placing the digital network even closer to the customer premises.

- **Cordless Telephone**
  Cordless telephone consists of a base unit that connects to the landline system and a remote handset, which uses low power radio. This permits use of the handset from any location within range of the base. Because of the power required to transmit to the handset, the base station is powered with an electronic power supply. The range of cordless phones, today, is normally a few hundred metres because of various factors like quality of voice or interference with other communication devices using the same frequency.

- **Cellular Phone**
  Mobile phone systems are cell-structured. Radio is used to communicate between a handset and nearby cell site. When a handset gets too far from a cell site, a computer system commands the handset and a closer cell site to take up the communications on a different channel without interrupting the call.

- **Voice Over Internet Protocol Telephony**
  Protocols used to carry voice signals over the IP network are commonly referred to as Voice over Internet Protocol or VoIP, or IP Telephony or Internet Telephony or Digital Phone. It is the routing of voice conversations over the internet or any other IP-based network. The voice data flows over a general-purpose packet-switched network, instead of traditional dedicated, circuit-switched voice transmission lines. In general, phone service via VoIP costs less than equivalent service from traditional sources. Some cost savings are due to using a single network to carry voice and data, especially where users are having existing under-utilised network capacity, which they can use for VoIP at no additional cost.

  VoIP makes easy some things that are difficult with traditional phone networks, such that incoming phone calls can be automatically routed to the VoIP phone, irrespective of where one is connected to the network. One can take one's VoIP phone on a trip and anywhere connect it to the internet and receive incoming calls. VoIP phones can integrate with other services available over the Internet, including sending and receiving messages or data files in parallel with the voice conversation, audio conferencing, managing address books and passing information about whether others (e.g. friends or colleagues) are available online to interested parties.

  VoIP technology still has a few shortcomings that have led some to believe that it is not ready for widespread deployment, as it does not provide any mechanism to ensure that data packets are delivered in a sequential order, or for any quality of service guarantees.

2.2.2 Radio
Radio owes its development to two other inventions: the telegraph and the telephone. These three technologies are closely related. Mostly radio broadcasts are sent over telephone wires. However, a few radio broadcasts travel through the air exclusively. Guglielmo Marconi, an Italian inventor, sent and received his first radio signal in Italy in 1895. By 1899, he was able to flash the first wireless signal across the English Channel and two years later in 1902, received the letter 'S', telegraphed from England to Newfoundland. This was the first successful transatlantic radiotelegraph message.

Wireless signals proved effective in communication for rescue works when sea disasters occurred. A number of ocean liners installed wireless equipment. In 1915, speech was first transmitted across the continent from New York City to San Francisco and across the Atlantic Ocean from Naval radio station at Arlington, Virginia to the Eiffel Tower in

Paris. Military radiotelephony was also experimented between ground and aircraft in the First World War.

Today, Radio Frequency IDentification (RFID) is used in transmission, which is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. RFID tag is a small object that can be attached to or incorporated into a product, animal or person. RFID tags contain antennas to enable them to receive and respond to radio-frequency queries from an RFID transceiver. (See Annexe)

2.2.3 Television

Television is a telecommunication system for broadcasting and receiving moving pictures and sound over a distance. Baird transmitted live, moving, and half-tone (grayscale) images in 1925, and gave the world's first public demonstration of a working television system to members of the Royal Institution on 26 January 1926 at his laboratory in London. These were vertically scanned images, using a scanning disc embedded with a double spiral of lenses, having only 30 lines, just enough to reproduce a recognisable human face. By 1934, all electromechanical television systems were outmoded, although electromechanical broadcasts continued on some stations until 1939.

On 25 August 1934, at the Franklin Institute in Philadelphia, Farnsworth gave the world's first public demonstration of a working, all-electronic television system with 220 lines per picture, 30 pictures per second. The first field test broadcast of colour television was by NBC, USA on 20 February 1941. The post-war development of colour television was dominated by three systems namely:

- the field sequential system, which was incompatible with existing black and white sets without an adaptor;

- dot sequential system, which in 1949 became compatible with existing black and white sets; and

- Colour Television Inc.'s system (also incompatible with existing black and white sets), which used three camera lenses, behind which were colour filters that produced red, green, and blue images side by side on a single scanning tube, and a receiver set that used lenses in front of the picture tube (which had sectors treated with different phosphorescent compounds to glow in red, green, or blue) to project these three side by side images into one combined picture on the viewing screen.

Programmes are broadcast on television stations, also called channels. At first, terrestrial broadcasting was the only way television could be distributed because bandwidth was limited. Development of cable and satellite means of distribution in the seventies pushed businessmen to target channels towards a certain audience and enabled the rise of subscription-based television channels. Today, television has grown up all over the world and has become a major source of disseminating information.

Broadcasting
There are many means of distributing television broadcasts, including both analogue and digital versions:

- **Terrestrial Television**
  Terrestrial television is the traditional method of television broadcast where signal delivery is by radio waves transmitted through open space. The signals are usually unencrypted and the system is described as "free-to-air"

- **Stratovision (From aircraft flying in a loop)**
  Stratovision is an airborne television transmission relay system from aircraft flying at high altitudes. This system was used for domestic broadcasting in the USA and by US military in Vietnam and other countries.

- **Satellite Television**
  Satellite television is delivered by way of communication satellites, as compared to the conventional terrestrial television. In many countries, satellite television services supplement older terrestrial signals, providing a wider range of channels and services, including subscription-only services also.

- **Cable Television**
  Cable television is a system of providing television, FM (frequency mode) radio programming and other services to consumers via radio frequency signals transmitted directly to people's televisions through fixed optical fibres or coaxial cables as opposed to the over-the-air method used in traditional television broadcasting (via radio waves) in which a television antenna is required.

  Modern cable TV systems employ digital cable technology, which uses compressed digital signals, allowing them to provide many more channels than they could with analogue alone.

- **Other Cable-Based Services**
  Coaxial cables are capable of bi-directional carriage of signals as well as transmission of large amount of data. Cable television signals use only a portion of bandwidth available over coaxial lines. This leaves plenty of space available for other digital services such as broadband internet and cable telephony.

  Broadband internet is achieved over coaxial cable by using cable modems to convert the network data into a type of digital signal that can be transferred over coaxial cable.

  Another service being added to many cable systems is cable telephone service. This service involves installing a special telephone interface at the customer's premises that converts the analogue signals from the customer's in-home wiring into a digital signal, which is then sent on the local loop to the company's switching centre, where it is connected to the PSTN. Data can be compressed, resulting in much less bandwidth used than a dedicated analogue circuit-switched service for digital cable telephone service. Other advantages include better voice quality and integration to a VoIP network providing cheap and unlimited nationwide and international calling.

- **Multi-Channel Multipoint Distribution Service (Wireless Cable)**
  Multi-channel multipoint distribution service, also known as MMDS or wireless cable, is a wireless telecommunications technology used for general-purpose broadband networking or, more commonly, as an alternative method of cable television programming or programme reception usually in sparsely populated rural areas, where laying cables is not economically viable.

2.2.4 Computer Hardware

Computer hardware means the physical parts of a computer, which enable the computer software or computer programmes and data to operate within the hardware. Computer hardware is also enclosed as embedded systems in automobiles, microwave ovens, electrocardiograph machines, compact disc players and many other household appliances.

A typical personal computer consists of a cover box or chassis and the following parts:

- **Motherboard**: it is also known as a main board, logic board or system board. It is the central or primary circuit board making up a complex electronic system. It has slots for expansion cards and holding parts including:

  i. **Central Processing Unit (CPU)** -or sometimes simply processor**,** is the component in a digital computer that interprets instructions and processes data contained in software. CPUs provide the fundamental digital computer trait of programmability.

  ii. **Random Access Memory (RAM)** – it enables programme execution and short-term data storage, so the computer does not have to take time to access the hard drive to find something. More RAM can contribute to a faster PC.

  iii. **Buses**- in computer architecture, a bus is a subsystem that transfers data or power between computer components inside a computer or between computers. Unlike a point-to-point connection, a bus can logically connect several peripherals over the same set of wires. Each bus defines its set of connectors to physically plug devices, cards or cables together.

     There are two types of buses:

     a. PCI bus: the Peripheral Component Interconnect standard specifies a computer bus for attaching peripheral devices to a computer motherboard. These devices can take the form of:

        - integrated circuits fitted on the motherboard itself (called *planar devices* in the PCI specification); or

        - expansion cards that fit in sockets

     b. US bus: Universal Serial Bus provides a serial bus standard for connecting devices, usually to computers such as PCs. A USB system has an asymmetric design, consisting of a host controller and multiple devices connected in a tree-like fashion using special hub devices, called USB hubs.

- **Storage Controllers**: control hard disk, floppy disk, CD-ROM and other drives. The controllers sit directly on the motherboard (on-board) or on expansion cards.

- **Video Display Controller:** produces the output for the computer display.

- **Computer Bus Controllers** (parallel, serial, USB, FireWire): to connect the computer to external peripheral devices such as printers or scanners.

- **Removable Media Writer**: some of its types are:

  i. **CD (Compact Disk)** – they are the most common type of removable media:

     a. CD-ROM (Compact Disc Read Only Memory) Drive

     b. CD Writer

  ii. **DVD (Digital Video Disk)** – they are comparatively costly but more reliable:

     a. DVD-ROM Drive

     b. DVD Writer

     c. DVD-RAM (Random Access Memory) Drive

 iii. Floppy Disk

 iv. Zip Drive- is a medium-capacity removable disk storage system.

 v. **Tape Drive -** is a peripheral device that reads and writes data stored on a magnetic tape or a punched tape. It is mainly used for backup and long-term storage.

- **Internal Storage** – it keeps data inside the computer for later use:

 i. **Hard Disk** - for medium-term storage of data

 ii. **Disk Array Controller -**disk array is an enterprise storage system, which contains multiple disk drives. In computing, a disk array controller is a computer hardware device, which provides secondary storage services to computer systems, often in large servers.

- **Sound Card** – it translates signals from the system board into analogue voltage levels and
has terminals to plug in speakers.

- **Networking** - to connect the computer to the Internet and/or other computers:

 i. **Modem** - for dial-up connections

 ii. **Network Card** - for DSL/Cable Internet and/or connecting to other computers.

- **Other Peripherals**
In addition, hardware can include external components of a computer system. The following are either standard or very common.

 i. Input or Input Devices

    a. Text Input Devices, such as keyboard

    b. Pointing Devices, such as Mouse and Trackball

    c. Gaming Devices, such as Joystick and Game Pad

    d. Image, Video Input Devices, such as Image Scanner and Web Cam

    e. Audio Input Devices, such as Microphone and Headset

 ii. Output or Output Devices

    a. Image, Video Output Devices

      o Printer
      o Monitor

b. Audio Output Devices

o Speakers

2.2.5 Computer Software
Computer software consists of encoded information (or computer instructions). The term is roughly synonymous with computer programme but is more generic in scope. Software is loaded into RAM and executed in the central processing unit. It is an ordered sequence of instructions for changing the state of the computer hardware in a particular sequence to obtain a particular result. It is generally written in 'high-level languages' (html) that are easier and more efficient for people to use. Software may also be considered an interface between hardware, data, and/or (other) software.

- **Types of Software**
  Practical computer systems divide software into three major classes:

  i. System Software

  ii. Application Software; and

  iii. Programming Software.

System software helps run the computer hardware and computer system. It includes operating systems, device drivers, diagnostic tools, servers, windowing systems, utilities, etc.

Application software allows a user to accomplish one or more specific tasks. Typical applications include business software, educational software, databases and computer games. Most application softwares have a Graphical User Interface (GUI).

Programming software usually provides some useful tools to help programmer in writing computer programmes and software using different programming language in a more convenient way. The tools include text editor, compiler, interpreter, linker, debugger, etc.

2.2.6 Local Area Network
Local Area Network (LAN) is a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings and connect workstations and personal computers. Each node (individual computer) in a LAN has its own CPU with which it executes programmes. It is also able to access data and devices such as laser printers, anywhere on the LAN. This allows many users to share data and devices. Users can also use the LAN to communicate with each other by sending e-mail or engaging in chat sessions.

There are different types of LAN. The following characteristics differentiate one LAN from another:

- **Topology**: the geometric arrangement of devices on the network. For example, devices can be arranged in a ring or in a straight line.

- **Protocols**: the rules and encoding specifications for sending data. The protocols also determine whether the network uses peer-to-peer or client/server architecture.

- **Media**: devices can be connected by twisted-pair wire, coaxial cables or fibre optic cables. Some networks do without connecting media altogether, communicating instead via radio waves.

LANs are capable of transmitting data at very fast rates, but the distances are limited, and there is also a limit on the number of computers that can be attached to a single LAN.

A wireless LAN uses radio waves for transmitting data. The last link with the users being wireless, it acquires the capability to give a network connection to all users in the surrounding area. Areas may range from a single room to an entire campus. The backbone network usually uses cables with one or more wireless access points connecting the wireless users to the wired network. Many laptop PCs now have wireless networking built in, thus eliminating the need for an additional plug-in PCMCIA (Personal Computer Memory Card International Association) card.

2.2.7 Wide Area Network
Wide Area Network (WAN) spans a relatively large geographical area. Typically, a WAN consists of two or more LANs. Computers connected to a WAN are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites.

It enables communication between users and computers in different locations. Many WANs are built for one particular organisation and are private. Others, built by Internet Service Providers, provide connections from an organisation's LAN to the Internet. WANs are most often built using leased lines. At each end of the leased line, a router connects to the LAN on one side and a hub within the WAN on the other. Network protocols including Typical Computer Protocol/Internet Protocol deliver transport and addressing functions. Internet is the largest WAN in existence.

- **Internet**
  The Internet, or simply the Net, is the publicly accessible worldwide system of interconnected computer networks that transmit data by packet switching using a standardised Internet Protocol (IP). It is made up of thousands of smaller commercial, academic, domestic and government networks. It carries various information and services, such as electronic mail, online chat, interlinked web pages and other documents of the World Wide Web.

  Contrary to common perception, Internet and World Wide Web are not synonymous. Internet is a collection of interconnected computer networks, linked by copper wires, fibre-optic cables, etc., whereas web is a collection of interconnected documents, linked by hyperlinks and URLs. Web is a global information space, which people can read and write via computers connected to the Internet.

2.2.8 Satellite
A satellite is an object that orbits another object in the space. The space age began in 1946, as scientists began using captured German V-2 rockets to make measurements in the upper atmosphere. Before this, scientists used balloons (that went up to 30 km) and radio waves to study the ionosphere. From 1946 to 1952, upper-atmosphere research was conducted using V-2s and Aerobe rockets. On October 4, 1957 Sputnik I was launched into orbit. Today, the largest artificial satellite currently orbiting the earth is the International Space Station.

- **Types of Satellites**

  i. **Astronomical Satellites:** are satellites used for observation of distant planets, galaxies and other outer space objects.

ii. **Communication Satellites:** are artificial satellites stationed in space for the purposes of telecommunications using radio at microwave frequencies. Most communication satellites use geo-synchronous orbits or near geo-stationary orbits, although some recent systems use low Earth-orbiting satellites as well.

iii. **Reconnaissance Satellites**: are Earth observation satellites or communications satellite deployed for military or intelligence applications. Little is known about the full power of these satellites, as governments who operate them usually keep information pertaining to their reconnaissance satellites classified.

iv. **Earth Observation Satellites**: are satellites specifically designed to observe Earth from orbit, similar to reconnaissance satellites but intended for non-military uses such as environmental monitoring, meteorology, map making, etc.

v. **Navigation Satellites:** are satellites, which use radio time signals transmitted to enable mobile receivers on the ground to determine their exact location. The relatively clear line of sight between the satellites and receivers on the ground, combined with ever-improving electronics, allows satellite navigation systems to measure location to accuracies often to the order of a few metres in real time.

vi. **Solar Power Satellites:** are built in high Earth orbit that use microwave power transmission to beam solar power to very large antenna on Earth where it can be used in place of conventional power sources.

vii. **Space Stations:** are man-made structures that are designed for human beings to live on in outer space. A space station is distinguished from other manned spacecraft by its lack of major propulsion or landing facilities-instead, other vehicles are used as transport to and from the station. Space stations are designed for medium-term living in orbit for varying periods-weeks, months, or even years.

viii. **Weather Satellites:** are satellites that are primarily used to monitor the weather and/or climate of the Earth.

ix. **Miniaturised Satellites:** are satellites of unusually low weights and small sizes. Classifications are used to categorise these satellites: mini satellite (500–200 kg), micro satellite (below 200 kg), nano satellite (below 10 kg).

- **Orbit Types**
  Many times satellites are characterised by their orbit. Although a satellite may orbit at almost any height, satellites are commonly categorised by their altitude:

  i. Low Earth Orbit (LEO: 200 - 1200kms above the Earth's surface)

  ii. Medium Earth Orbit (MEO: 1200 - 35286 kms)

  iii. Geosynchronous Orbit (GEO: 35786 kms above Earth's surface)

  iv. Geostationary Orbit (GSO: zero inclination geosynchronous orbit)

  v. High Earth Orbit (HEO: above 35786 kms)

2.2.9 Very Small Aperture Terminal

A Very Small Aperture Terminal (VSAT) is a 2-way satellite ground station or may be called an earthbound station. It is used in satellite communications of data, voice and video signals (excluding broadcast television). It consists of two parts:

- a transceiver with a dish antenna (that is smaller than 3 meters, as compared to around 10 meters for other types of satellite dishes) that is placed outdoors in direct line of sight to the satellite; and

- a device that is placed indoors to interface the transceiver with the end user's communications device, such as a PC.

The transceiver receives or sends a signal to a satellite transponder in the sky. The satellite sends and receives signals from a ground station computer that acts as a hub for the system. Each end user is interconnected with the hub station via the satellite, forming a star topology. The hub controls the entire operation of the network. For one end user to communicate with another, each transmission has to first go to the hub station that then retransmits it via the satellite to the other end user's VSAT. VSAT can handle up to 56 Kilo bite per second. It transmits real-time data back for processing.

VSAT is most commonly used for point of sale transactions such as credit cards and RFID applications. VSAT is also used by local dealers affiliated with manufacturers (such as car companies) for transmitting and receiving sales figures and orders, as well as for receiving internal communications, parts ordering, service bulletins and interactive distance learning training courses from the manufacturer. Stockbrokers also make extensive use of VSAT technology.

VSAT technology is also used by 2-way satellite internet providers. These services are used across the world as a means of delivering broadband internet access to sites, which cannot get ADSL or cable Internet access, which are usually the remote or rural locations. Nearly, all VSAT systems are now based on IP with a very broad spectrum of applications.

There are two typologies of VSAT-Star VSAT and Mesh VSAT. The deployment of these topologies depends on their commercial viability. Mesh VSAT systems are preferred for deployment where the number of users is high as they minimise the overall cost of the network. Star topology services can be used to provide broadband WAN or broadband internet access. Star systems are also useful in front and back office applications and manage, store and forward solutions, such as, digital signature and interactive distance learning.

2.2.10 Ham Radio
It is not known where the nickname 'ham' radio operator came from but it is thought to have originated as a Morse Code short hand notation for 'amateur' radio operator. Once licensed, ham operators are able to use a wide variety of communication technologies including:

- World Wide Voice, CW (the technical term for Morse Code communication) and data communications using the short wave bands;

- use of FM voice repeaters at VHF and UHF frequencies - repeaters retransmit a weak signal from a handheld radio (the same size as a cellular phone) so that it can be heard over a wider area;

- access to telephone phone patches for making phone calls over radio system;

- direct access to 9-1-1 emergency communications systems (in many areas);

- packet radio data communication networks, from short wave to high speed microwave networks; and

- satellite communications systems, including numerous U.S., Russian and internationally built amateur spacecraft;

- colour television transmissions both direct and through repeaters.

Amateurs often use a multi-element 'beam' antenna. Such antennas produce 'gain' in both reception and transmission so that a signal ten times weaker can be received. This type of gain is important to enable long distance communications. The typical amateur beam antenna is mounted at about 50 feet above ground level, with significant variations depending on space and costs of installation, resulting in probably most amateur beam antennas being mounted in the 35 foot to 70-foot range above ground level. However, some installations do go higher than this. Height is important for several reasons. If using VHF or UHF radio frequencies, where line-of-sight communications is typical, height overcomes ground level obstructions.

The type of equipment used by ham operators vary from home built or kit built radios to the state-of-the-art communication systems. Probably, the most typical radios are:

- handheld VHF or UHF two-way radio;

- short wave or HF two-way radio transceiver;

- mobile VHF and/or UHF radio for mounting in car; and

- kit-built, particularly low power radios for HF short wave communications.

2.3 CONCLUSION

The various technologies described above are not exhaustive but give a fairly good idea of their applicability in governance structures. It may be stressed here that most of these technologies require massive investments and governmental approvals.

2.4 ACTIVITY

1. Give examples of satellite versions that India has so far placed into the Earth's orbit. Also let us know about their applications.

2. Narrate a VSAT based project (e.g. Edusat or Maharastra------) that has been implemented in our country.

2.5 KEY CONCEPTS

Digital	is one that uses numbers, especially binary numbers, for input, processing, transmission, storage, or display, rather than a continuous spectrum of values (an analogue system) or non-numeric symbols such as letters or icons. The distinction of 'digital' versus 'analogue' or 'symbolic' can refer to method of input, data storage and transfer, the internal working of an instrument, and the kind of display. The word comes from the same source as the word digit and digitus i.e. Latin word for finger (counting on the fingers) as these are used for discrete counting.

Electret Microphone everything — it is the most ubiquitous microphone in use. It can be found in from telephones to children's toys to medical devices. Nearly 90 percent of the approximately one billion microphones manufactured annually are electret designs. They are small, high quality and inexpensive to produce. Electret-- is a thin plastic film that after exposure to a strong electrical field, retains its electrical polarisation without requiring a power source -- something like the electrical equivalent of a magnet, with a positive and a negative side. In an electret microphone, the film is drawn taut like the head of a drum and is suspended just above a metal surface. As you talk into the microphone, pressure fluctuations in the air distort the film. Charges in the metal surface experience fluctuating forces as the polarised electret moves above it. As a result of these forces, a very small current flows from the metal surface through a wire that touches it. It is simple, rugged, versatile and provides high quality sound, especially for telephony. Electret microphones can be made extremely small -- smaller than a shirt button.

Digital Loop Carrier of the — is a system which uses digital transmission to extend the range of the local loop farther than would be possible using only twisted pair copper wires. A DLC digitises and multiplexes the individual signals carried by the local loops onto a single data stream on the DLC segment. Loop carrier systems were ordained to solve two problems: to reduce copper cable pair requirements; and to overcome electrical constraints on long loops. It would also reduce cable pair deployments.

Public Switched telephone Telephone Network concentration of (PSTN) switched networks. Originally, a — is the concentration of the world's public circuit-switched networks, in much the same way that Internet is the the world's public IP-based packet-network of fixed-line analogue telephone systems, the PSTN is now almost entirely digital, and now includes mobile as well as fixed telephones. A circuit switched network is one where a dedicated connection *(circuit or channel)* must be set up between two nodes before they may communicate. For the duration of the communication that connection may only be used by the same two nodes and when the communication has ceased, the connection must be explicitly cancelled.

Grayscale — In computing, a grayscale or greyscale digital image is an image in which the value of each pixel is a single sample. Displayed images of this sort are typically composed of shades of gray, varying from black at the weakest intensity to white at the strongest, though in principle the samples could be displayed as shades of any colour, or even coded with various colours for different intensities. Grayscale images are distinct from black and white images, which in the context of computer imaging are images with only two colours, black and white; grayscale images have many shades of gray in between. In most contexts other than digital imaging, however, the term 'black and white' is used in place of 'grayscale'; for example, photography in shades of

gray is typically called 'black-and-white photography'. The term monochromatic in some digital imaging contexts is synonymous with grayscale, and in some contexts synonymous with black-and-white.

Cryptography
 is the field concerned with linguistic and mathematical techniques for securing information, particularly in communications. In cryptography, encryption is the process of obscuring information to make it unreadable without special knowledge. While encryption has been used to protect communications for centuries, only organisations and individuals with an extraordinary need for secrecy have made use of it. In the mid-1970s, strong encryption emerged from the sole preserve of secretive government agencies into the public domain, and is now employed in protecting widely used systems, such as Internet e-commerce, mobile telephone networks and bank automatic teller machines.

Encryption can be used to ensure secrecy, but other techniques are still needed to make communications secure, particularly to verify the integrity and authenticity of a message; for example, a Message Authentication Code (MAC) or digital signatures.

Pixel
is one of the many tiny dots that make up the representation of a picture in a computer's memory. Each such information element is not really a dot, nor a square, but an abstract sample. With care, pixels in an image can be reproduced at any size without the appearance of visible dots or squares; but in many contexts, they are reproduced as dots or squares and can be visibly distinct when not fine enough. The intensity of each pixel is variable; in colour systems, each pixel has typically three or four dimensions of variability such as Red, Green and Blue, or Cyan, Magenta, Yellow and Black.

Analogue
describes a device or system that represents changing values as continuously variable physical quantities. A typical analogue is a clock in which the hands move continuously around the face. Such a clock is capable of indicating every possible time of day. In contrast, a digital clock is capable of representing only a finite number of times (every tenth of a second, for example). In general, humans experience the world analogically. Vision, for example, is an analogue experience because we perceive infinitely smooth gradations of shapes and colours.

When used in reference to data storage and transmission, analogue format is that in which information is transmitted by modulating a continuous transmission signal, such as amplifying a signal's strength or varying its frequency to add or take away data. For example, telephones take sound vibrations and turn them into electrical vibrations of the same shape before they are transmitted over traditional telephone lines. Radio wave transmissions work in the same way. Computers, which handle data in digital form, require modems to turn signals from digital to analogue before transmitting those signals over communication lines, such as, telephone lines that carry only analogue signals. The signals are turned back into digital form

(demodulated) at the receiving end so that the computer can process the data in its digital format.

Chassis
In computers, the chassis refers to the rigid framework (metal frame) onto which the assembly-worker mounts the motherboard, memory, disk drives and other equipment

Peripheral
is a type of computer hardware that is added to a host computer in order to expand its abilities. More specifically, the term is used to describe those devices that are optional in nature, as opposed to hardware that is either demanded or always required in principle.

The term also tends to be applied to devices that are hooked up externally, typically through some form of computer bus like USB. Typical examples include joysticks, printers and scanners. Devices such as monitors and disk drives are not considered peripherals because they are not truly optional as they are internal devices.

Tape Drive
also known as a streamer, is a peripheral device that reads and writes data stored on a magnetic tape or a punched tape. It is typically used for archival storage of data stored on hard drives. Tape drives are sequential-access and must wind past all preceding data to read any one particular piece of data. They are not the fastest form of data storage, as they are sequential, but are long lasting and cost efficient

Router
is a device that forwards data packets along networks. A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network. Routers are located at gateways, the places where two or more networks connect. Routers use headers and forwarding tables to determine the best path for forwarding the packets, and they use protocols such as ICMP to communicate with each other and configure the best route between any two hosts. Very little filtering of data is done through routers.

Packet Switching
Refers to protocols in which messages are divided into packets before they are sent. Each packet is then transmitted individually and can even follow different routes to its destination. Once all the packets forming a message arrive at the destination, they are recompiled into the original message.

Most modern Wide Area Protocols, including TCP/IP, X.25, and Frame Relay, are based on packet-switching technologies. In contrast, normal telephone service is based on a circuit-switching technology, in which a dedicated line is allocated for transmission between two parties. Circuit switching is ideal when data must be transmitted quickly and must arrive in the same order in which it is sent. This is the case with most real-time data, such as live audio and video. Packet switching is more efficient and robust for data that can withstand some delays in transmission, such as e-mail messages and web pages.

A new technology, ATM, attempts to combine the best of both worlds- the guaranteed delivery of circuit-switched networks and the robustness and efficiency of packet-switching networks.

Uniform Resource Locator	URL or web address, is a standardised address name layout for resources (such as documents or images) on the internet (or elsewhere). First created by Tim Berners-Lee for use on the World Wide Web, the currently used forms are detailed by Internet Standard RFC 1738. It is also known as Universal Resource Locator.
GEO	meaning geo-synchronous or geo-stational earth orbit used to place satellites for purposes of telecommunications. GEOs orbit is at 22,300 miles above the earth's surface. They are tied to the earth's rotation and are, therefore, in a fixed position in space in relation to the earth's surface. The satellite placed in GEO goes around once in its orbit for every rotation of the earth. The advantage of a GEO system is that the transmission station on earth needs to point to only one place in space in order to transmit the signal to the GEO satellite. GEO systems are used for transmissions of high-speed data, television signals and other wideband applications.
ADSL	short for Asymmetric Digital Subscriber Line, a new technology that allows more data to be sent over existing copper telephone lines. ADSL supports data rates from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate). ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.
Operating System	is the most important programme that runs on a computer. Every general-purpose computer must have an operating system to run other programmes. Operating systems perform basic tasks, such as recognising input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. For large systems, the operating system has even greater responsibilities and powers. It is like a traffic cop- it makes sure that different programmes and users running at the same time do not interfere with each other. The operating system is also responsible for security, ensuring that unauthorised users do not access the system. Operating systems can be classified as multi-user that allows two or more users to run programmes at the same time. Some operating systems permit hundreds or even thousands of concurrent users; multiprocessing that supports running a programme on more than one CPU; multitasking that allows more than one programme to run concurrently; multithreading that allows different parts of a single programme to run concurrently; and real time that responds to input instantly.

Operating systems provide a software platform on top of which other programmes, called application programmes, can run. The application programmes must be written to run on top of a particular operating system. Your choice of operating system, therefore, determines to a great extent the applications you can |

run. For PCs, the most popular operating systems are DOS, OS/2 and Windows, but others are available, such as Linux.

As a user, you normally interact with the operating system through a set of commands. For example, the DOS operating system contains commands such as COPY and RENAME for copying files and changing the names of files, respectively. The commands are accepted and executed by a part of the operating system called the command processor or command line interpreter.

Wireless Application Protocol	a secure specification that allows users to access information instantly via handheld wireless devices, such as, mobile phones, pagers, two-way radios, smart phones and communicators. WAP supports most wireless networks. These include CDPD, CDMA, and GSM.

2.6 REFERENCES AND FURTHER READINGS

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