UNIT 1   INTRODUCTION TO COMPUTERS

Structure

1.0   OBJECTIVES

After studying this unit, you should be able to:

- understand the evolution of computers;

- classify computers on the basis of purpose, size and technology;

- describe the various components of computers;

- explain how computers are useful in various areas;

- understand the advantages and disadvantages of computers; and

- differentiate computers from smart phones.

1.1   INTRODUCTION

In the era of machines, computer is the greatest boon to the mankind. The thought came when people wanted a device which could help in calculating problems but now it has become a life savior to human beings and we cannot think of life without computers. Today the word "computer" is not only confined to PC's but also includes laptops, tablets, smart phones, Electrocardiogram (ECG) machines, etc. This unit would help in understanding the origin and evolution of computers, its classification on the various bases, its components and its applications in today's world. The unit also makes the learner to know about certain advantages and disadvantages of computers.

1.2   OVERVIEW OF COMPUTERS

A Computer is basically a programmable electronic device which accepts data, performs operations on the given data and presents the results and can also store the data or results as per the requirements. Computers are general-purpose information machines that can perform a variety of tasks on data. These tasks are all related to the four basic computer operations i.e. to accept data (input), process the data, produce output, and store (storage) the results as needed. These days computers do not only come in the form of personal computers (PC), but have taken various shapes. Computers are designed to do everything with available pool of information and are popularly used for controlling small and large machines which would have otherwise be controlled by human. Computers have made their presence in every field and they have their significance almost in every sphere. Computers have taken various forms in contemporary world. Almost everyone use a personal computer at their work space or in their home for performing tasks such as doing calculations, getting information, watching movies, formulating documents, organizing meetings, writing etc.

Smartphone Replacing Computer

Computers of these days are being replaced by Smart phones they can do many things that our everyday laptops, gadgets and desktops offer us. Infact, smart phones are like microcomputers which are capable to access and process host of data and have camera, interfaces, internet browsing, text and instant messaging, Wi-Fi, and Geographical Positioning System (GPS) capabilities. On a Smartphone input can be provided through touch screen interface and output can be seen on the screen.

Fig. 1.1 : Computer Vs Smart phones

Today's smart phones are incredibly more influential as compared to the desktop and laptops we have been using since years ago. Smartphone is an incredibly essential tool in our daily lives; they are smaller in size and are portable which a computer monitor and keyboard aren't. From replying to

emails, to checking out your daily feed on social media, and uploading the occasional selfie to share to the world, smart phones can do a bunch of imaginable things. In addition to performing the basic functions, smart phones are capable enough to perform various computing activities.

Today's smart phones are more advanced than ever before. The beauty in all of this is the enhanced level of productivity that can now be achieved by our smartphones. A smartphone can be quickly and easily transformed into a versatile desktop Personal Computer (PC). Even though it won't totally replace desktop experience but it can come handy when required. Take a Bluetooth keyboard and mouse, along with one of those portable external displays, and you can basically get your desktop setup situated just about anywhere.

1.3 EVOLUTION OF COMPUTERS

When introduced first early in 1940's, computers were very capacious electronic devices that needed bunches of people to handle and operate them. But with the passing of time and evolution of technology, computers of today are very astounding and have gone through a complete overhauling. Computers of now are so tiny that they can fit on your desk, on your lap, or even in your pocket and they are now thousands of times more expeditious. However, there are six apparent generations of computers which are explained below. Every generation of computer is well-defined by a paramount technological development which changes necessarily how computers operate leading to more compressed, inexpensive, but more dynamic, effective and booming machines.

1) **First Generation (1940-1956):** The first generation computers used vacuum tubes for circuitry and magnetic drums for memory. The size of first generation computers were very huge taking up the space of almost an entire room. They were very costly to operate and in addition used a large amount of electricity and used to produce lots of heat, which was often the cause of malfunction. These first generation computers relied on 'machine language' (which is the most fundamental programming language that can be understood by computers). These computers were used to solve only single problem at a time and it was very difficult to trace and correct the programming error, if any. The examples of first generation computers are Universal Automatic Computer (UNIVAC) and Electronic Numerical Integrator and Computer (ENIAC).

2) **Second Generation (1956-1963):** The second generation of computers was based on the transistors which substituted the vacuum tubes. The transistor was superior to the vacuum tubes in the sense it made computers smaller, faster, cheaper and more energy efficient. It didn't require a complete room anymore. However, even though it was an

improvement over the vacuum tubes to the transistor still generated a great deal of heat which sometimes subjected the computer to damage its internal sensitive parts. This generation of computers used assembly language for programming. In this period, higher level programming language like Common Business-oriented Language (COBOL), Formula Translation (FORTRAN), and Algorithmic Language (ALGOL), Python, were developed.

3) **Third Generation (1964-1971):** Third generation of computers brought a significant change in the way of computing. This generation of computers was based on the use of integrated circuits, which drastically increased speed and efficiency of computers. As a result, computer became smaller in size as more components were squeezed onto the single chip. These were the first computers where users interacted using keyboards and monitors which are interfaced with an Operating System (OS), a consequential leap up from the punch cards and printouts. This facilitates these machines to run various applications at once utilizing a central program which functioned to monitor memory. Examples of this generation of computers are IBM-360 and CDC-6400.

4) **Fourth Generation (1972-2010):** The fourth generation of computers was based on the use of microprocessors, a single silicon chip on which thousands of integrated circuits were built. The use of microprocessors considerably reduced the size of computers now they can even be fit in the palm of hand. The personal computers and laptop all made use of microprocessors. For the first time in 1981, IBM introduced computers for the home users and in 1984, Macintosh was introduced by Apple. Fourth generation computers could be link together to form a network which eventually led to the expansion, birth and rapid evolution of the Internet. Other primary advances during this period have been the Graphical User Interface (GUI), the mouse and advances in laptop capability etc.

5) **Fifth Generation (2010 -2020):** The fifth generation of computers began with major innovations in computer architecture like- parallel processing, intelligent programming, application of artificial intelligence, knowledge-based system etc. The essence of fifth generation is to utilize these technologies to ultimately engender machines which can proceed and acknowledge natural language, and have efficiency to determine and organize them. Movies like Terminator series (1, 2 and 3) and robots are based on the concept of fifth generation computers. Fifth generation based robots have been developed which are enormously being used in medical science and research.

6) **Sixth Generation (2020 onwards):** The sixth generation of computers is based on the nanotechnology. This generation of computers can be defined as the era of intelligent computer, based on artificial neural

networks or "artificial brains". Artificial Intelligence (AI) or artificial brains is a concept in programming which enables the devices to think and take actions on their own. These computers have the ability to learn via a variety of advanced algorithms. The generation also introduced voice recognition, which enables the computers to take dictations and recognize words. The use of nanotechnology is a characteristic of sixth generation computers.

1.4 CLASSIFICATION OF COMPUTERS

Various types of computers are available now a day. The function of each type of computer is to process the data and provide some output to the users. However, the techniques utilized by the computers for data processing and handling may differ. Computers can widely be differentiated on the basis of their abilities to process data. They are classified according to the purpose, size and capacity, and data handling or technology used. We can classify the computer according to the following three basis, as mentioned in figure 1.2.
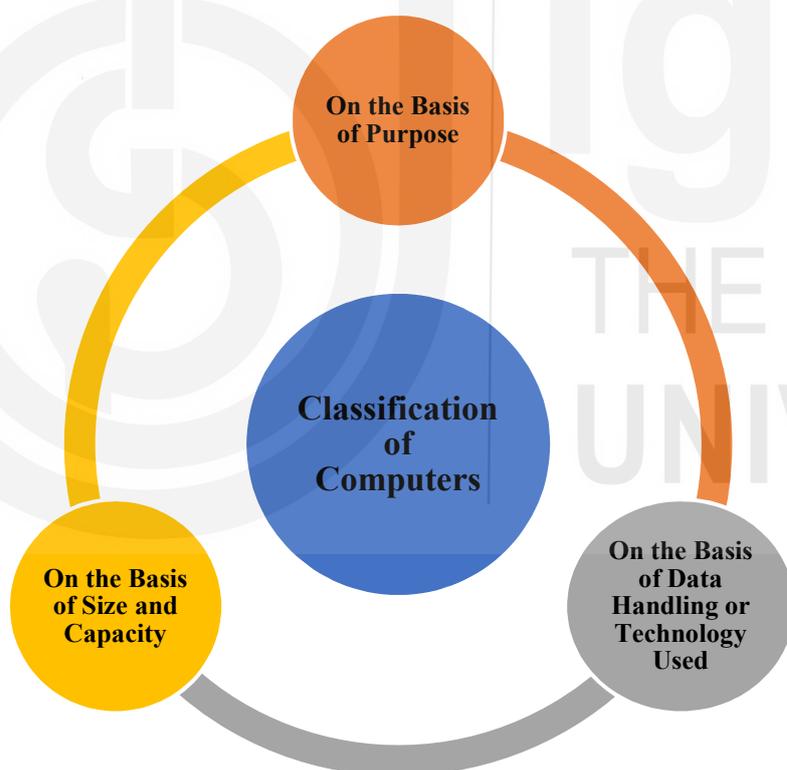

Fig. 1.2: Classification of Computers

1.4.1 On the Basis of Purpose

1) **General Purpose Computers:** General purpose computers fulfill general requirements such as gaming, word processing, invoicing etc. these are usually used at home, school, and in offices.

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2) **Special Purpose Computers:** Special purpose computers are designed to perform specific tasks. These may be used for research activities such as weather forecasting, space research, defense research etc.

1.4.2 On the Basis of Size and Capacity

1) **Micro Computer:** Micro computers are the smallest computer system. They are mostly single user general purpose computers. They are relatively small in size and inexpensive computer with a microprocessor as its CPU. Their speed as in comparison to mainframe or supercomputer is low and their size range from calculator to desktop. These computers are mainly used for computing purpose and mostly used in educational institutions, home and offices. Examples of micro computers are desktop PCs, Laptop, notebook, personal digital assistance, smartphones, tablets, smartwatches etc.

2) **Mini Computers:** Mini computers are larger in size and are suitable for a small business or for a department in a large organization to be used as servers which support hundreds of users at a time in file sharing, printer sharing and storing central information. They were actually designed for control, instrumentation, human interaction, and communication switching and later they became very popular for personal use with evolution. These computers possess greater memory and are capable of handling input output devices. Examples of mini computers are Laptop, PC etc.

3) **Mainframe Computers:** Mainframe computers are popularly known as big iron, they are very big in size and very expensive. These computers are capable of supporting thousands of users at a time and have massive data storage capacity. These computers are basically used by big organizations such as banks, E-commerce portals, insurance companies, railways, airlines etc. for bulk data processing such as statistics, census data processing, transaction processing and are widely used as the servers as these systems has a higher processing capability as compared to the other classes of computers.

4) **Super Computers:** A super computer is a computer with a high level of performance; they are most powerful and very expensive. Super computers are at the apex of computing system as they have ability to perform billions of instructions per second. Super computers play a very vital role in the field of computation, and are utilized for performing intensive computational tasks in numerous fields such as quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modeling, and physical simulations etc. These computers are very costly and are treated as national resources.

Examples of super computers are Parallel Machines (PARAM), Jaguar, Roadrunner, etc.

1.4.3 On the Basis of Data Handling or Technology Used

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

2) **Digital Computer:** Digital computers take input data in form of numbers and perform arithmetic and logical operations onto it to get the results. These computers are of high speed and very accurate. Digital computers count and answer the questions by the answer of how many. It can be used for performing mathematical calculations, organizing and analyzing data, controlling industrial and other processes, and to simulate dynamic systems such as global weather patterns. It gives continuous output but users get the output only when the computations are completed. Examples of digital computers are desktops, notebooks, work stations, smart phones etc.

3) **Hybrid Computer:** A hybrid computer is a digital computer that accepts analog signals, converts them to digital and processes them in digital form. These computers incorporate the technology of both analog and digital computers. These computers store and process analog signals which have been converted into discrete numbers. Analog-to-digital converters are used to convert analog signals into digital signals. These computers are used in radars. For example, in central national defense and passenger flight radar system.

Check Your Progress A

1) What is a computer? What are various features of computer?

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2) What are the basic functions of smartphones?

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3) What advancement can be seen in the sixth generation of computers?

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4) Distinguish between Analog computer and Digital Computer.

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1.5 COMPONENTS OF A COMPUTER SYSTEM: HARDWARE & SOFTWARE

Every computer is composed of two basic components called, hardware and software. Hardware includes the tangible parts of the computer which either can be seen or touched, for example, CPU, keyboard, mouse, monitor, LCD screen and printer, whereas, the software are the components which activates the physical parts. Software consists of features that are responsible for directing the tasks to the hardware. Software can be divided into other programs and data. As compared to software, hardware is a physical entity. Both hardware and software are interconnected, without software, the hardware cannot function. However, without the creation of hardware to perform tasks directed by software via the central processing unit, software would be useless below mentioned figures can gives a clear glimpse about the hardwares.

Desktop	Laptop

Fig. 1.3: Desktop Vs. Laptop

A detailed explanation on Hardware and Software is given below:

Hardware: Hardware is basically the physical element of a computer. It is also called as the machinery or the equipment of the computer. However, most of a computer's hardware cannot be seen; in other words, it is not an external element of the computer. A computer's hardware is consisted of various different parts, but the most vital of all these is the motherboard. The motherboard is made up of even more parts capable to power and control the computer. Hardware is limited to specifically designed tasks that are, taken independently, are very simple. On the other hand, Software implements algorithms (problem solutions) that allow the computer to complete much more complex tasks.

Software: Software is known as programs or apps, comprising of all the instructions that direct the hardware in performing tasks. These instructions come from a software developer in the form and are accepted by the platform (operating system + CPU) that they are based on. Software is capable enough to perform numerous tasks, compared to hardware that can only perform mechanical tasks they are designed for. Software provides the means for accomplishing many different tasks with the same basic hardware. Practical computer systems divide software systems into two parts:

1) **System Software:** System software is designed for controlling and working with computer hardware. It allow users to interact directly with hardware functionality, like the device manager and many of the utilities found in the control panel. It consists of operating systems, device drivers, diagnostic tools, etc. and is almost always pre-installed in computers and smartphones, examples are Windows 10, Linux, Macintosh, Android.

2) **Application Software:** Application software is capable of dealing with user inputs and helping them to complete tasks. It resides above the system software and allows users to accomplish one or more tasks. It is programmed for simple as well as complex tasks. It can either be a single program or a group of programs that are referred to as an application suite. Some examples of application software are Word Processing Software, Web Browsing, Spreadsheet Software, Presentation, Graphics, Multimedia YouTube, Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM), sending email, accounting software, customised shopping apps and cloud based applications such as Google docs.

1.6   APPLICATIONS OF COMPUTERS

Computer is a device which can perform a variety of tasks in our daily life. Computers have their utility and applications in every arena, few of its applications in various fields are explained below:

1) **Business:** Business has variety of applications of computers. From individual to multinational companies all are using computers for business purpose like payroll calculations, sales analysis, budgeting, financial forecasting, managing employee's database and maintenance of stocks etc. Computers have made it possible for the business to grow rapidly and across boundaries. Computers are extensively used for accounting purposes to handle company financial accounts and inventory management using some accounting software like Tally.

2) **Education:** Computers have completely overhauled the education industry by significantly enhancing the performances and delivery of lectures. Various online courses such as Massive Open Online Courseware (MOOC) and distance learning is in trend by utilizing the efficiencies of computers, hundreds of websites are available on internet to deliver free online education in almost every area. The 'E' in E-learning stands for 'Electronic. Henceforth, the unique term 'electronic learning'. The word 'online,' in this contextual, means with an Internet connection or via the Internet. The pedagogy may also refer to a network that can deliver knowledge and skills to one or more individuals. On the other hand, new contemporary of learning appears known as hybrid learning, which is a technique of combining traditional classroom experiences, experiential learning objectives, and digital course delivery that emphasizes using the best option for each learning objective.

3) **Banking:** Computers offers various advantages in banking such as self-enquiry facility, signature retrieval facilities, remote banking, centralized information, digital transactions etc. These have helped in minimizing the human efforts, time and cost involved otherwise in doing the transactions in a traditional manner and it makes banking convenient for customers by providing 24×7 access to banking services.Online banking is an electronic payment system that permits its customers to conduct a variety of financial transactions through their respective websites.

4) **Communication:** Computers can largely reduce the time taken for communication between different stakeholders. Business can use various methods of communication such as email, live chat tools, whatsapp video or phone conferencing, social networking, web conferencing it in a way improves the functioning of the organisation.

5) **Healthcare:** In healthcare, computers offer miraculous therapies to the patients such as ECG, Computed Tomography (CT) scan, X-ray, radiotherapy which was otherwise not possible. With the help of computers most of the medical information from prescription to reports can be digitized. With the help of computers, the record-keeping of medicines as well as patients has become easy. Computer can even keep

track of each and everything going inside the patient's body such as blood pressure and heartbeat etc. which would otherwise have been a cumbersome task. Technology and humans' hand-in-hand for a healthier healthcare. The future of healthcare is shaping up in every aspect with the advancement and development in digital healthcare technologies such as artificial intelligence; VR/AR, 3D-printing, robotics or nanotechnology etc. Artificial Intelligence will control the world within few years. In medicine and healthcare, digital technology could support transmute unsustainable healthcare systems into sustainable ones, equalize the relationship between medical professionals and patients, provide cheaper, faster and more effective solutions for diseases. Technologies in computer age could win the battle for us against cancer, AIDS, Ebola, Corona and could basically lead to healthier individuals living in healthier communities. Atom wise uses supercomputers that cause out therapies from a database of molecular structures. There are certain start-up launched as a virtual search for safe, existing medicines that could be redesigned to treat the pandemics like Corona and Ebola.

6) **Personal Use:** Computer can also be used for various personal uses. One can use computer system to keep all the day-to-day details that are essential to keep anywhere. Computers can be used for keeping a track on personal things such as investments, incomes, expenditures, savings etc.

7) **Military and Defense:** Computers are the major tools which aid in developing missiles and other equipments in the defense system. Construction of weapons and controlling their function is not possible without the aid of computers. Designing and the maintenance are possible only through computers. Computer builds the links between the soldiers and commanders through the satellite. The computers have played a progressively significant role in the military. The computers in the military have been improved or designed to do a broad range of tasks, such as analyzing intelligence, organizing sensible data for military leaders, geospatial analysis, controlling smart weapons, or communications. Computers are used to track incoming missiles target to destroy them. Computers are used in tanks and planes and ships to target enemy forces, benefit diagnose any problems with the platforms. Computers are used to hold documents, upkeep records and records of events.

8) **Insurance:** The emergent technologies those have been enabled by computers only such as Blockchain, Internet of Things (IOT), Artificial Intelligence (AI), Big Data, and Augmented Reality have left a greater impact on the insurance sector. Blockchain, the Distributed Ledger Technology (DLT) ensures that digital data is safe as there are fewer

chances of identity theft or fraud. They also make it easier to authenticate transactions, policies for customers. Insurance companies are keeping all records up-to-date with the help of computers. The insurance companies, finance houses and stock broking firms are widely using computers for their concerns.

Apart from applications of business explained above in various fields, a detailed description on it is given in the second unit named "Application of Computers".

1.7 ADVANTAGES AND DISADVANTAGES OF COMPUTERS

Computers link us to the world of unknown. They support us to gather knowledge and to synchronize gigantic information from the internet and storing it at last in a customize format. Computers are multitasking and adequate enough to be used virtually anywhere and ubiquitously. Computers are versatile machines as they are flexible in performance and have made human life much faster because of its incredible speed, accuracy and storage with which humans can perform a variety of tasks. With numerous advantages, computers have got some disadvantages which are explained as follows:

Advantages of Computers:

Computers have made human life much faster and easier. It has several advantages:

1) **Multitasking:** Computers are multitasking in nature. A lot of tasks can be performed on computers with accuracy which leads to the costs and time saving in a way. Computers can perform trillion of instructions per second. With the help of computers, people can perform multiple tasks, including complex calculations within seconds.

2) **Speed:** One of the major advantages of computer is their incredible speed, which helps us in completing numerous tasks just in few seconds. With the help of computers now operations can be performed in fractions of seconds which otherwise, would have taken a lot of time to perform.

3) **Storage:** With the help of computers a huge amount of data can be stored on the computers at a very low cost. Centralizes database of storing information is the main advantage which helps in reducing cost.

4) **Accuracy:** One of the root advantages of computer is that it can perform not only calculations but also with utmost accuracy.

5) **Data Security:** Data security means protecting the digital data and information from any unauthorised access or breach. Computers with the

help of technologies can provide security from destructive forces and from unwanted action of unauthorized users like cyber attacks or access attacks.

Disadvantages of Computer

As a famous saying states that every coin has two sides, that is equally applicable for computers. With huge advantages computers have got few disadvantages as well. As we know advantage comes with disadvantage, computers are just a machine with no IQ, no feelings, no wisdom and dependency on others is few of the disadvantages of computers rest are explained below:

1) **Reduction in employment opportunities:** We can surely see a gradual decrease in the employment opportunities with the emergent technologies coming to the field of computers and such as IoT, AI, blockchain, human robots, human assistance etc. As computers become smarter and more capable, these technologies have taken over the traditional jobs and reduced new emerging employment opportunities to a great extent.

2) **Potential of loss of privacy:** With computers storing so much of personal information is highly at risk of getting into the hands of others. Privacy violation means that someone access users' data such as private photos, documents and show it to other people without their permission. Once a malicious person has access to someone's personal information, they can also access their associated online accounts or also can use identity theft to open other accounts, such as a new credit card, debit card under their name.

3) **Virus and hacking attacks:** Virus is a type of worm and hacking is simply an unauthorized access over computer for some illicit purpose. Virus can be transferred from email attachment, viewing an infected website advertisement, via portable devices like USB, pen drive. Once virus is transferred in the host computer it can infect and overwrite existing files stored on the computer. Cyber attacks can range from installing spyware on a personal computer to attempting to destroy the infrastructure of entire nations.

4) **Cyber Crimes:** With the emergent technologies cybercrimes are at a rise in every single field. Cybercrime is basically a crime in which a computer and network is involved. This is the major disadvantage of computers. It includes crimes such as cyber stalking, identity theft, loss of privacy and information etc. repercussions of those can be huge to the users.

Check Your Progress B

1) How the computers have changed the healthcare?

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2) What are benefits of computers in business?

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3) Explain the Computer Hardware.

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4) How the evolution of computers has reduced the employment opportunities?

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1.8   LET US SUM UP

A Computer is basically a programmable electronic device which accepts data, performs operations on the given data and presents the results and can store the data or results as needed. Computers are general-purpose information machines that can perform a variety of tasks on data. These tasks are all related to the four basic computer operations i.e. to accept data (input), process the data, produce output, and store (storage) the results as needed.

Now, computers are so tiny that they can fit on your desk, on your lap, or even in your pocket and they are now thousands of times more expeditious. However, there are six apparent generations of computers. Each generation is well defined by a paramount technological development that changes necessarily how computers operate leading to more compressed, inexpensive, but more dynamic, effective and booming machines.

Various types of computers are available now days. The function of each type of computer is processing the data and to provide some output to the users and varies on its data processing abilities. They are classified according to the purpose, size, and technology used.

Computer is an electronic device through which a variety of tasks can be performed in our daily life. Computers have their utility and applications in every arena, few of its applications in various areas be it business, education, banking, insurance, healthcare, personal use, military operations, communication etc.

Computers have made human life much faster and easier. It has several advantages such as multitasking, speed, accuracy, data security, storage. As a famous saying states that *"every coin has two sides"*, that's equally applicable for computers which is a combination of software and hardware. With huge advantages computers have got few disadvantages as well such as reduction in employment, potential loss of privacy, computer virus, cybercrime etc.

1.9 KEY WORDS

Computer: A computer is a programmable device that stores, retrieves, and processes data. The term "computer" was originally given to humans (human computers) who performed numerical calculations using mechanical calculators, such as the abacus and slide rule. The term was later given to a mechanical device as they began replacing the human computers.

Smartphone: A smartphone is a mobile phone that performs many of the functions of a computer, typically having a touch screen interface, Internet access, and an operating system capable of running downloaded apps.

Technology: Technology is the sum of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation.

Data: Data are characteristics or information, usually numerical, that are collected through observation. In a more technical sense, data is a set of values of qualitative or quantitative variables about one or more persons or objects.

Process: A process is the instance of a computer program that is being executed by one or many threads. It contains the program code and its activity, depending on the operating system (OS).

Storage: Storage is a process through which digital data is saved within a data storage device by means of computing technology. Storage is a mechanism that enables a computer to retain data, either temporarily or permanently.

Privacy: Privacy is the ability of an individual or group to seclude them or information about themselves, and thereby express them selectively. When something is private to a person, it usually means that something is inherently special or sensitive to them.

Virus: A computer virus is a malicious program that self-replicates by copying itself to another program. In other words, the computer virus spreads by itself into other executable code or documents.

Cybercrime: Cybercrime is a crime in which a computer and network is involved. It includes crimes such as cyber stalking, identity theft, loss of privacy and information etc.

1.10 TERMINAL QUESTIONS

1)   Explain the evolution of computers over the years.

2)   How are the computers helpful to human beings? State the examples of real world where computers are prominently being used these days.

3)   What are the various advantages and disadvantages of computers?

4)   What are the various classifications of computers?

5)   How the smartphones have replaced computers?

6)   Explain the various components of computer hardware and software.

Note: These questions are helpful to understand this unit. Do efforts for writing the answer of these questions but do not send your answer to university. It is only for yours practice.