Paper: Social Implications of Information Technology

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SOCIAL DIMENSIONS OF SCIENCE AND TECHNOLOGY

Lesson no: 1

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Science and technology are two very important pillars of our modern society. Science creates newer and newer things. It helps us dream new dreams. Technology helps us realize our dreams by giving shape to these dreams. From comfort to convenience, from speed to safety, from connectivity to efficiency, science and technology have helped us achieve almost every thing we wanted. Science and technology have achieved many milestones in fields ranging from health care and medicine, automation, agriculture, industrialization, transportation, to media and entertainment.

In this lesson we shall discuss about the role of science and technology in the society. Specifically, we shall discuss about the social aspects of science and technology. The lesson structure is as follows:

0.0 Objectives

1.1 Introduction

1.2 Presentation of Content

1.2.1 Science and Technology in our Homes

1.2.2 Science and Technology and Automation

1.2.3 Science and Technology in Health and Medicine

1.2.4 Science and Technology in Agriculture

1.2.5 Science and Technology in Industry

1.2.6 Science and Technology in Entertainment and Media

1.2.7 Science and Technology in Transportation

1.2.8 Speed, Safety and Efficiency

1.2.9 Convenience, Connectivity and Convergence

1.2.10 Science and Technology and Demystification

1.3 Summary

1.4 Key Words

1.5 Self-Assessment Questions (SAQs)

0.5 References/Suggested Reading

1.0 OBJECTIVES:

Human civilization has passed through first the agricultural society, then through the industrial society, and now we are entering the *information society*. These developments have been possible because of advancements in science and technologies. Science and technologies have social influences also. Science and technologies have brought about many changes in our life styles, in our perspectives. Science and technologies have changed the way

we think and the way we do things. While we give all the credit to science and technologies for the material changes, we often ignore the social influences of science and technologies.

The objective of this lesson is to give an overview of the social dimensions of science and technologies. We shall discuss how scientific and technological developments have influences our lives and our society in general. The specific objectives of this lesson are as follows:

- *To know about the role of Science and Technology in our Homes*
- *To understand about the role of Science and Technology and Automation*
- *To know about the role of Science and Technology in Health and Medicine*
- *To know about the role of Science and Technology in Agriculture*
- *To understand about the role of Science and Technology in Industry*
- *To know about the role of Science and Technology in Entertainment and Media*
- *To understand about the role of Science and Technology in Transportation*
- *To understand about the role and importance of Speed, Safety and Efficiency*
- *To understand about the role and importance of Convenience, Connectivity and Convergence*
- *To understand about the role and importance of Science and Technology in the Demystification process.*

0.0 INTRODUCTION:

From a humble beginning in the form of the most basic life form *Amoeba proteus* through millions of years of evolution to *Homo sapiens sapiens*, man

has really come a long way. While nature took care of the early development of the *Homo sapiens*, man has been taking care of himself quite well. Through out this long journey, man has had two very important associates. These two are *science* and *technology*. With these two associates, man has journeyed through the *Stone Age,* the *Iron Age,* the *Tools Age*, through to the *agricultural society, industrial society*, and is on the verge of entering the *information society*.

Developments in the field of science and technology have been parallel with the development of mankind. This way science and technology have always been part of the human society. They have played important roles in shaping the growth and development of our society.

Often science and technology are thought of in term of their physical manifestation. Any time we hear the terms science and technology, we think about machines, equipment, appliances, and of course laboratories, factories, and clinics. We are usually lost in the results of scientific and technological developments and advancements. Thus we do not pay much attention to neither the processes related to science and technology, nor do we pay much attention to the underlying principles, etc.

We also forget a very basic fact, that is, science and technologies were developed with the motive of doing well for the mankind. While only a few technical and scientific developments were designed with malicious or harmful intents, most scientific advancements are intended to achieve greater and collective good of the people and the society.

The basic motives behind the developments in science and technology are *to make things faster, easier, convenient, comfortable, safe or secure*, etc. The end-less and untiring pursuit of advancements in science and technology has always been backed by the conviction of achieving greater and collective good for the society.

At a basic level, the pursuit of science and technology results in knowledge. The only difference is that in science and technology, we try to put this knowledge in to practical use. While social sciences often seem to stop at theoretical knowledge, pure sciences are generally more application oriented. In reality, all sciences are theoretical as well as practical in orientation. The only difference is a general perception about social sciences as being theoretical.

In this lesson we shall discuss about some of the scientific and technological developments. Then we shall discuss the social dimensions of science and technology.

1.2 PRESENTATION OF CONTENT:

We now know that science and technology play important roles in our society. In this lesson, we shall discuss in detail what roles science and technology play in a various sphere of our society. The content of this lesson shall be presented as follows:

- *Science and Technology in our Homes*
- *Science and Technology and Automation*
- *Science and Technology in Health and Medicine*
- *Science and Technology in Agriculture*
- *Science and Technology in Industry*
- *Science and Technology in Entertainment and Media*
- *Science and Technology in Transportation*
- *Speed, Safety and Efficiency*
- *Convenience, Connectivity and Convergence*
- *Science and Technology and Demystification*

1.0.0 SCIENCE AND TECHNOLOGY IN *OUR HOMES*:

The modern and ultra modern structures in brick, concrete, steel and wood we live in are results of science and technology. With the help of designing, architecture, building techniques, etc., we have graduated from tree branches and caves we lived in the earliest days. Now we have moved to the safe, secure, and comfortable confines of steel and concrete structures that we call our homes.

Our homes are also filled with modern and convenient apparatus and appliances. Good old brooms are replaced with vacuum cleaners. We wash our clothes in washing machines that heat water, wash the clothes, and dry them also. Various systems are available for cutting vegetables, grinding, making paste, mixing, grating, etc. Refrigerators keep vegetables and other things fresh. Air-coolers keep our homes cool and air-conditioners keep them cool or heated as required.

Modern homes of today are equipped with sophisticated apparatus and gadgets. These range from electronic alarm systems to remote controlled garages, from high voltage music systems to home theatres with large flat screen TV sets, etc. Blue tooth technology keeps all the rooms connected without using wires. Homes today can be converted into veritable forts without a single guard with the help of modern security gadgets. It can convert your room in to a mini theatre with all kinds of music playback and film and video projection systems with a single control.

0.1.0 ROLE OF SCIENCE AND TECHNOLOGY IN *AUTOMATION*:

Human nature generally shuns manual labour. Man, if given an option, will not prefer hard manual work. In the early days we had beasts of burden to do hard and laborious work like lifting, dragging, carrying, drawing, etc. Next

came the machine age. We started developing mechanical devices to do work that involved strength, stamina, coordination, etc.

Next came the industrial revolution. Particularly during the Second World War large and highly sophisticated machines were developed. And since then, we have not looked back. Newer developments have led to large-scale automation. Automated systems are designed to do specific jobs on their own. Such systems help close and open doors, answer telephone with a pre-recorded voice messages. From controlling light conditions to recording you favorite TV shows for you when you are out, such systems can and do many fascinating things for our convenience and comfort.

1.2.3 SCIENCE AND TECHNOLOGY IN *HEALTH AND MEDICINE*:

Health, it is said, is wealth. It is one of our primary concerns. From the beginning of civilization, perhaps even before that, human beings have always looked for ways and means to keep themselves healthy and disease free to the maximum extent possible. Man's quest for good health care and cures for diseases has led to many health care systems. From *Ayurveda*, to Homeopathy, from *Yunani* to Sophisticated *Allopathy*, are results of man's quest.

Today we have highly sophisticated health care machines. The old and still faithful machines, the microscope and the X-ray machines are still there. But they are supplemented by a host of scanning machines like city-scan, MRI-scan, etc. Today we are having less and less of open surgeries. Open-heart surgery is being replaced by *angioplasty*. *Laparoscopes* and many such minute surgical instruments equipped with miniature camera have made surgery less invasive and less painful.

All these developments have made health care practices safer. Hospital stays have become shortened. Health care has become cheaper. Life expectancy has increased while infant mortality has come down.

1.2.4 SCIENCE AND TECHNOLOGY IN *AGRICULTURE*:

Agriculture is the very first occupation that man took up. For a very long time, agriculture was a manual process conducted with the help of beasts of burden. Now every thing related to agriculture can be done mechanically. From tilling to watering, from seed and fertilizer spraying, from harvesting to thrashing, every thing can be done using a wide range of machines.

Power tillers, tractors and accessories like harvesting machines, thrashing machines are some common agricultural machinery. In fact, even small aero planes are used for seed and fertilizer spraying.

In addition to the machineries available, there has been much advancement in the agricultural practices also. Researches conducted in the agricultural universities have resulted in better and disease free varieties of seeds, better fertilizers, efficient agricultural practices, etc.

0.1.4 SCIENCE AND TECHNOLOGY IN *INDUSTRY*:

Invention of the wheel and the discovery of fire marked the beginning of mankind's journey towards industrialization. But it took a long time in coming. The world saw the industrial revolution in the early part of the eighteenth century. And after that we have not looked back. The steam engine, electricity, telephony, inventions and advancements started pouring thick and fast.

Large-scale industrialization started around the First World War. But major advancements took place only during the Second World War. Newer

and better technologies were developed. Large factories were set up. Production of goods started on a large scale.

This was the beginning of mass production. Large-scale production meant there was surplus of goods. This led to mass publicity resulting in mass consumption.

Industrialization resulted in large-scale employment. This caused massive migration from rural places to urban centers. Most importantly the economy boomed. Mass marketing, advertising, etc., emerged as major fields generating further employment opportunities.

0.1.4 SCIENCE AND TECHNOLOGY IN *ENTERTAINMENT AND MEDIA*:

Some of the major scientific and technological advancements have occurred in the fields of entertainment and media. Also a lot of technological advancements have been adopted and adapted for these two fields.

The first major technological advancement in these fields was the invention of the printing press and movable types for printing by Johan Guttenberg in the mid 1450s. This brought many revolutionary changes. It marked the beginning of multiplication of knowledge and its wide spread reach. Following the popularity of books, newspaper made its entry in around 1625.

Then came cinema. The first film was made and shown in 1895 in France. This was followed by radio in the 1920s. Television came in the late 1930s, but took time to spread. Since then there have been hundreds of developments leading to a previously undreamed range of entertainment and media tools.

Today telephony, satellite technology, projection technologies, videography and editing techniques, computers, optical fibers, etc. have combined to present the widest range of entertainment and media products.

0.1.4 SCIENCE AND TECHNOLOGY IN *TRANSPORTATION*:

In the beginning walking and crawling were the only means of going from one place to another. We invented the wheel and we had the humble bullock cart followed by horse drawn carts.

Then came the steam engine paving way for railways, ships, and cars. Aero planes, jet planes, rocket propelled space ships, and the developments in the transportation field continue to amaze one and all. This field has adopted all kinds of technologies to develop wide-ranging and highly efficient vehicles. Every need and want of the consumers is taken into consideration in designing, developing and manufacturing these vehicles.

Today's vehicles offer all kinds of facilities. They offer speed. They offer safety. The comfort and convenience angles are also taken care of. For the action and adventure-minded, there are high-speed racing vehicles. There are a wide variety of entertainment options in today's vehicles.

There are passenger vehicles, there are commercial vehicles, and there are sports vehicles. Then there are the SUVs (sports utility vehicles), MUVs (multi utility vehicles), and RVs (recreation vans).

So far we have discussed about the advancements in the fields of science and technologies. Now let us discuss some major benefits and issues related to these developments.

0.1.4 *SPEED, SAFETY AND EFFICIENCY*:

Speed and particularly, fast pace has always been a common human want and weakness. Many a scientific and technological advancements are geared towards this end. In most of the equipment, appliances, etc., speed is one of the major attributes.

But more important than speed is safety. Almost all machinery and appliances, safety measures are in-built. Most manufacturing companies take safety very seriously. And such machines undergo a series of stringent safety tests over a long period of time before being put in the market.

An equally important element of any such machine is efficiency. In fact, the very basic principle behind mechanization is efficiency. Machines and appliances today are also multi utilitarian. These not only perform one function efficiently, these also perform multifarious functions.

0.1.4 *CONVENIENCE, CONNECTIVITY AND CONVERGENCE*:

Who wants to do hard work? Who wants to do things manually? It is a basic human nature that we do not like such things. So we have developed instruments, machines, and tools, appliances that perform such jobs for us. Thus such machines provide us convenience of washing clothes without wetting our hands, cleaning without dirtying our hands, etc. In addition to convenience, such appliances also provide comfort.

Vehicles and communication devices help us stay connected. Transport vehicles provide physical connectivity and help us reach anywhere we want. On the other hand, communication devices help us in staying connected cutting across barrier of space and distance.

Convergence, in simple terms, is the combination of different technologies. Related and complimentary technologies, particularly information and communication technologies are combined to provide better, more diverse, and efficient devices.

0.1.4 SCIENCE AND TECHNOLOGY AND *DEMYSTIFICATION*:

Since the very beginning, human beings have always faced mysteries. In the early days, we were afraid of such natural things as the Sun and the moon,

etc. Science helps us uncover such mysteries related to natural and unnatural phenomena and enhance our understanding.

Science, particularly technology, in itself has some mystery attached. A common example of this is *techno-phobia* or fear of technical things. Many people are afraid of even checking an electrical fuse. But gradual exposure and more first hand experience helps us over come such phobia. This way technology helps in the process of demystification.

0.2 SUMMARY

The main points discussed in this lesson can be summarized as follows:

- With the help of science and technologies, man has journeyed through the Stone Age, Iron Age, the age of tools, through to the agricultural society, industrial society, and is on the verge of entering the information society.
- Developments in the field of science and technology have been parallel with the development of mankind. This way science and technology have always been part of the human society.
- While only a few technical and scientific developments were designed with malicious or harmful intents, most scientific advancements are intended to achieve greater and collective good of the people and the society.
- The basic motives behind the developments in science and technology include making things faster, easier, convenient, comfortable, safe or secure, etc. The end-less and untiring pursuit of advancements in science and technology has always been backed by the conviction of achieving greater and collective good for the society.

- Automated systems are designed to do specific jobs on their own. Such systems help close and open doors, answer telephone with a pre-recorded voice messages.
- Today we are having less and less of open surgeries. Open-heart surgery is being replaced by angioplasty. Laparoscopes and many such minute surgical instruments equipped with miniature camera have made surgery less invasive and less painful.
- Power tillers, tractors and its accessories, harvesting machines, thrashing machines are some common agricultural machinery. In fact, even small aeroplanes are used for seed broadcasting and fertilizer spraying.
- Industrialization resulted in large-scale employment. This caused massive migration from rural places to urban centers. Most importantly the economy boomed. Mass marketing, advertising, etc., emerged as major fields generating further employment opportunities.
- Today telephony, satellite technology, projection technologies, videography and editing techniques, computers, optical fibers, etc. have combined to present the widest range of entertainment and media products.
- Today's vehicles offer all kinds of facilities. They offer speed. They offer safety. The comfort and convenience angles are also taken care of. For the action and adventure-minded, there are high-speed racing vehicles.
- Vehicles and communication devices help us stay connected. Transport vehicles provide physical connectivity and help us reach anywhere we want. On the other hand, communication devices help us in staying connected cutting across barrier of space and distance.

Convergence, in simple terms, is the combination of different technologies.

1.4 KEY WORDS:

Information Society: When maximum people in our society were involved in agriculture, it was called an agricultural society. When maximum numbers of people were involved in the industrial process, it was called an industrial society. Now maximum numbers of people are involved in collection, processing, storage, retrieval, transmission, and receiving of information. Thus our society now is called an information society.

Automation: We often do not want to do things manually. We want things to be done automatically, or mechanically. Automated systems are designed to do specific jobs on their own. Such machines, devices, or systems combine strength, stamina, and coordination to do specific jobs.

Such systems help close and open doors, answer telephone with a pre-recorded voice messages. From controlling light conditions to recording you favorite TV shows for you when you are out, such systems can and do many fascinating things for our convenience and comfort.

Convergence: Convergence is the combination of different technologies; particularly information and communication technologies. Such technologies are combined to provide better, more diverse and efficient devices.

Demystification: Science and technology are often considered mysterious. A common example of this is *techno-phobia* or fear of technical things. Many people are afraid of even checking an electrical fuse. But gradual exposure and more first hand experience helps us over come such phobia. This is the process of demystification.

1.5 SELF-ASSESSMENT QUESTIONS:

- Discuss the changes brought about by science and technology in our homes.
- Automation has become a necessity today. Elaborate.
- Discuss the important changes in the fields of health care, agriculture, and industry.
- There have been significant changes in entertainment and media. Discuss these changes in detail.
- Discuss how science and technology have helped in the demystifying things.

0.5 REFERENCES/SUGGESTED READING:

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Lesson no: 2

INFORMATION TECHNOLOGY AND SOCIETY

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Sukumar Chopra

Director,

Computer Center,

Kurukshetra University,

Kurukshetra, (Haryana).

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Information technology is often considered a mere tool in devising machines and systems that can help us in many fields. IT does help in creating machines and systems in the fields of computing, automation, health care, connectivity, media and entertainment, etc. But in addition, IT plays an

important role in the society. In this lesson, we shall discuss the social implications of IT in detail. The structure of this lesson shall be as follows:

2.0 Objectives
2.1 Introduction
2.2 Presentation of Content
2.2.1 Various Developments in the Field of IT
2.2.2 Impact of IT on Organizations
2.2.2.1 Impact of IT on Government Organizations
2.2.2.2 Impact of IT on Business Organizations
2.2.2.3 Impact of IT on Media Organizations
2.2.2.4 Impact of IT on Educational Organizations
2.2.3 Impact on Individuals
2.2.4 Other Impacts of IT
2.2.4 Problem Areas Related to IT
2.2.4 IT and Society – An Overview
2.3 Summary
2.4 Key Words
2.5 Self-Assessment Questions (SAQs)
2.6 References/Suggested Reading

2.0 OBJECTIVES:

Today we are living in the information age. In many parts of the globe, we have entered the information society. Information technologies have become very important today. We all know about the functional uses of IT. But we are also concerned about the social aspects of IT. The objective of this lesson is to give an overview of the social aspects of information technologies. We shall discuss some of the main technological developments that have taken place

in information technology and how these developments have had an influence on the way we work and on society in general.

In this lesson, we shall discuss the following in detail: *Information Technology Defined, Various Developments in the Field of IT, Impact of IT on Government Organizations, Impact of IT on Business Organizations, Impact of IT on Media Organizations, Impact of IT on Educational Organizations, Impact on Individual, Other Impacts of IT, Problem Areas Related to IT and IT and Society – An Overview.*

2.1 INTRODUCTION:

We shall start with what is information technology? It would be useful to outline some "working definitions" for information technology. A very common definition of information technology is as follows:

> *“Information technology is the technology or combination of technologies that are used to store, manipulate, distribute or create information. The type of information or data is not important to this definition. The technology is any mechanism capable of processing this information or data.”*

Another definition of information technology is:

> *"Information technology means the tools we use to perform calculations, to store and manipulate text, and to communicate. Some of these twentieth century tools include: the adding machine, slide rule, and calculator for performing calculations, the typewriter and word processor for processing text, and the telephone, radio, and television for communicating."*

Now that we understand what is information technology, let us find a definition for "society". Society can be defined as "a community, nation, or broad grouping of people having common traditions, institutions, and

collective activities and interests." Presently we shall see what role IT plays in society.

2.2 PRESENTATION OF CONTENT:

In this lesson, we shall examine how the developments, which have occurred in information technology, have influenced society in general. We shall also try to understand how these information technologies have influenced "broad groups of people" in their "common traditions, institutions and/or collective activities".

What changes then have taken place in information technology i.e., the "technological developments"? A development in information technology is any improvement in the mechanism used to "store, manipulate, distribute or create information". This lesson first aims to provide a brief summary of these developments. We shall be highlighting only those developments that have influenced society in general. Then we shall examine what influence these advances have had on society.

The content of this lesson shall be presented as follows:

- *Impact of IT on Organizations*
- *Impact on Individuals*
- *Other Impacts of IT*
- *Problem Areas Related to IT*
- *IT and Society – An Overview*

2.2.1 MAJOR DEVELOPMENTS IN INFORMATION TECHNOLOGIES:

Here is a year-wise, but brief list of the major developments that have taken place in the field of information technology:

1969: The Arpanet is introduced, funded by the Department of Defense in the US.

1970: The first automatic teller machine is introduced.

1971: The first single chip central processing unit was introduced, the Intel 4004.

Ray Tomlinson of Bolt Boranek and Newman send the first network e-mail message.

1972: Lexitron, Wang and VYTEC introduce Word Processing systems.

1973: The Xerox Paulo Alto Research Center developed the Alto, an experimental computer that uses a graphical user interface and a mouse.

1978: Ron Rivest, Adi Shamir and Leonard Adelman introduce the RSA cipher as a public key cryptosystem.

1979: The first electronic spreadsheet program is introduced.

1981: IBM introduces its first personal computer with an operating system developed by Microsoft.

1983: The switchover to the TCP\IP protocol marks the beginning of the global Internet.

1985: Microsoft releases the Windows operating system.

1989: The World Wide Web project is proposed to the European Council for Nuclear Research (CERN).

1990: Windows version 3.0 is released bringing a stable graphical user interface to the IBM Personal Computer.

1993: The National Center develops the Mosaic NCSA for Super-computing Applications.

1995: Toy Story, the first full-length feature movie created by a computer is released.

2000: Emergence of electronic commerce.

2.2.2 IMPACT OF *IT* ON ORGANIZATIONS:

How has the development of information technology influenced the society? This is a big question. We shall try to answer this question here.

Social attitudes have changed following these developments in such a way that citizens of our society now expect to be better informed. They also expect to be having more access to more information about a specific product, service or organization so that they can make informed decisions. These developments in the field of information technologies have influenced all most all spheres of the society. The maximum impacts have been on a wide array of institutions or organizations. These include:

- Governments,
- Commercial businesses,
- News & Media organizations,
- Educational organizations.

12.1.1.0 IMPACT ON GOVERNMENT ORGANIZATIONS:

Developments in information technology have helped governments to improve their "service" to their citizens. Advances in Database technology, for example, have enabled the governments of various countries to collate and monitor statistical information they can use to combat fraud, manage the economy in a more informed way.

Information Technology has also had a major impact on the defense capabilities of governments. This covers both a government's capabilities to go to war and their intelligence gathering capability. Advances in weapons technology and weapons design have increased the effectiveness of various governments' armed forces. For example it would have been impossible to design aeroplanes such as the B2 Bomber if it were not for the advances made in information technology. The B2 bomber relies on a "continuous curvature" design to minimize radar signature. It would have been impossible

to design or build this machine without the development of computer modeling techniques.

Information Technology has also had a major impact on a government's intelligence agencies. Encryption of sensitive information has enabled government's to obtain added security. However attempting to decrypt information is also a major area of work for those employed by the government.

The advance of information technology has also led to a need for new legislation to be introduced, for example in the United Kingdom the Data Protection Act of 1998. The governments data protection act Web Site gives the following eight rules regarding personal information:

0. It must be fairly and lawfully processed;
0. Processed for limited purposes;
0. Adequate, relevant and not excessive;
0. Accurate;
0. Not kept longer than necessary;
0. Processed in accordance with the data subject's rights;
0. Secure;
0. Not transferred to countries without adequate protection.

In India also the Information Technology Act, 2000 has been enacted. This has further been modified for accommodating the changing scenario in which electronic interactions and transactions take place in today’s time.

2.2.2.2 *IMPACT ON BUSINESS ORGANIZATIONS*:

The advances in information technology have heavily influenced commercial businesses in several ways. The most important role of information technology in a commercial business however is to provide a commercial advantage. Advances such as computer aided design, relational database technologies, spreadsheets, and word processing software all provide a commercial benefit to the business, as does automation of manufacturing processes.

The use of information technology to monitor a business performance can also enable the business to highlight areas where they are not making the most use of their resources. The use of information technologies can also increase the business income through advertising in the various available forums.

2.2.2.3 *IMPACT ON MEDIA ORGANIZATIONS*:

Due to the peculiar nature of news and media organizations, the information technologies have particular relevance to them. As noted earlier "Information technology is the technology used to store, manipulate, distribute or create information". News and media organizations are desperately requiring each of these elements of information technology and use them extensively.

Developments such as the Internet and satellite television have created new media and audiences through which and to which these organizations can disseminate their information.

Given the situation thirty years ago the developments that we have seen have enabled the news and media organizations access to more people, they have a wider audience. The audience however now has a wider, global choice. News reports can be received which highlight many different sides of an international conflict than was possible before.

The relative cheapness of being able to publish information on the Internet means that virtually anyone can publish information accessible anywhere in the world.

2.2.2.4 *IMPACT ON EDUCATIONAL ORGANIZATIONS*:

Educational establishments have also been influenced in various ways. The most obvious example has been the introduction of information technology related courses. These courses are introduced to try to satisfy the demand that society has for qualified people to develop these information technologies.

The developments that have occurred in information technology have also had other influences on educational establishments. As in case of media organizations, educational organizations also have a goal to distribute information from a source (lecturer, books, on-line resources etc.) to the student. The processes by which educational establishments distribute information have become increasingly diverse, and the effectiveness of the process has also improved.

The distribution of information is not the only concern of educational establishments. For example one of the aims of Universities is to *create information* in the form of course material, research findings, etc. This "creation" is done by research. Information technologies have enabled researchers to access a wider source of information than previously available through such technologies as the Internet (the original Arpanet being set up primarily to assist research). The Internet and other related technologies such as electronic mail, also enable collaborative projects to be undertaken between geographically distant groups.

2.2.3 IMPACT OF *IT* ON INDIVIDUALS:

Interactions between individuals have been enhanced by the development of information technologies. New channels of communication have been opened between people in the last thirty years. These developments have been assisted by such projects as the Arpanet, which was the forerunner to the Internet. The Internet facilitates interconnectivity among individuals along with its other uses.

As other developments occurred, such as the widespread availability of modems and personal computers became more widespread, the general population was integrated into what is known as the Internet.

Individuals now have the ability to interact with other individuals through such developments as e-mail, chat-rooms and the Usenet.

This proliferation of Internet technologies has enabled people with disabilities such as those who are blind or visually impaired, physical disabilities or others to be able to enjoy access to sources of information and ways of communicating they may not have had the opportunity to have used before.

Satellite technologies, mobile and wireless technologies, and digital technologies have added many more means and tools of interpersonal communication among individuals.

2.2.4 OTHER IMPACTS OF *IT:*

It has been shown that the developments in information technology have had an impact on various types of institutions an also on individuals. It has changed the general perception of information in our society. Without going into specific detail about specific situations, it has been found that that impact has been in the following four areas:

- Storage,

- Manipulation,
- Distribution,
- Creation

These four areas dealing with information are where the society's perception of information has changed. As communication and information technologies have been developed, the various elements that constitute society, whether they are individuals or organizations, expect to be able to use information in ways that were not possible earlier. These include:

- Society expects to be able to store more information than was previously possible.
- Society expects to be able to manipulate the information they have for their benefit, to increase understanding and facilitate change.
- Society expects to be able to distribute information quickly, efficiently and cheaply.
- Society now expects the creation of new information to be facilitated by these new technologies.

2.2.5 PROBLEM AREAS RELATED TO *IT:*

The growth and wide spread use of information technologies have answered many previously unanswered questions. But with the large-scale use of information technologies, there are many questions that are still unanswered. Questions worth considering include:

- Are we going to be overloaded with information?
- Will we gain greater access to required information, along with a greater individualization of products and services, or will we drown in info-junk?
- What should software and hardware sellers of the twenty-first century offer to propel the Information Market-place beyond its current stage?

- Will computers increase the industrial performance of the world's nations?
- What will happen to employment, outside the IT fields?
- Will our quality of life improve through cheaper, faster and higher quality health care and greater access to knowledge?
- Will the rich who can sooner afford these technologies get richer?
- Will the poor be given new leverage or will they be left further behind?
- What new gadgetry and interface might appear, and how will we use them?
- Will the governments better serve ordinary citizens?
- Will our privacy be assured on this electronic network?
- Should we amend our laws to protect against this new technology?
- How might war and peace be affected?
- How will human relationships be affected by the relentless progress of technology?

2.2.6 *IT* AND SOCIETY- AN OVERVIEW:

There is a very basic question that is more important than the above questions. ***Are information technologies improving the quality of peoples' lives?*** The answer, to a great extent, is ***YES***.

Today's technologies offer a better deal for everyone. Individuals are acquiring greater control over their lives, their minds, their bodies, and even their genes, thanks to breakthroughs in medicine, communication, transportation and industry.

These technologies are simultaneously providing social benefits and undoing some of the environmental damage caused in the past. Improved technology helps to conserve natural resources and reduce pollution.

The Information Revolution is also leading to peaceful cooperation between people and countries by decentralizing power. Today, tyrants and autocrats are thrown out because their subjects can communicate directly with one another via the World Wide Web, satellite communications, etc.

Information Technology has given people the tools to do their jobs at home. People are also forging new communities in cyberspace and developing new relationships with their neighbors in real space.

Also there is no reason to assume that the omnipresent personal computers will remain complicated. Computers and other such equipment will become more users friendly as technologies mature and marketers appeal to the masses.

12.1 SUMMARY

- *Information technology is the technology used to store, manipulate, distribute or create information.*
- *From 1969 till today, there has been much advancement in the field of information technologies.*
- *IT has influenced all most all spheres of the society including a wide variety of institutions.*
- *Advances in Database technology, for example, have enabled the governments of various countries to collate and monitor statistical information they can use to combat fraud, manage the economy in a more informed way.*
- *In many countries, laws related to IT have been enacted for positive use of IT.*
- Advances such as computer aided design, relational database technologies, spreadsheets, and word processing software all provide a

commercial benefit to the business, as does automation of manufacturing processes.

- News and media organizations using information technology extensively.
- The Internet, satellite technologies, mobile and wireless technologies, and digital technologies have added many more means and tools of interpersonal communication among individuals.
- Information technologies offer a better deal for everyone. Individuals are acquiring greater control over their lives, their minds, their bodies, and even their genes, thanks to breakthroughs in medicine, communication, transportation and industry.
- Information technologies are simultaneously providing social benefits and undoing some of the environmental damage caused in the past.

2.4 KEY WORDS:

Information Technology: Information technology is the technology or combination of technologies that are used to *store, manipulate, distribute or create information*. Another definition of information technology is: Information technology means the tools we use to perform calculations, to store and manipulate text, and to communicate.

Society: Society is usually *a community, nation, or broad grouping of people having common traditions, institutions, and collective activities and interests.*

Impact of IT: The recent developments in the field of information technologies have influenced all most all spheres of the society. The maximum impacts have been on Governments, Commercial businesses, News AND Media organizations, and Educational organizations. Of course, IT influences individuals in a wide array of ways.

2.5 SELF-ASSESSMENT QUESTIONS (SAQs)

4. List out the major developments in the field of IT and discuss their impact on society.
2. Discuss in detail the impact of IT on the various types of institutes.
2. Define IT in your own words. Discuss the impact of IT on individuals.
2. IT has solved many questions. But it also has raised many questions itself. Discuss these questions in detail.

2.6 REFERENCES/ SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams, Stacy C. Sawyer and Sarah E. Hutchinson; Irwin Publishing; Chicago; 2003
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Lesson no: 3

RESHAPING OF CHOICES IN THE DIGITAL AGE

Writer: Sh. M.R. Patra

Lecturer, Dept. of Communication Management & Technology,

Guru Jambheshwar University of Science and Technology, Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology, Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Today we are living in the digital age. The days of analogue data generation, storage, and processing are almost over. Now we generate data digitally in the form of bits and bytes. Data generation, storage, and processing have become much easier.

Digital processing and the related digital tools have given us more choices. In almost every field we now have more choices. In this lesson, we shall discuss these choices thrown up by digitalization. The structure of this lesson shall be as follows:

3.0 Objectives

3.1 Introduction
3.2 Presentation of Content
12.1.0 Trends in IT
3.2.2 IT and Global Forces
3.2.3 IT and Economy
3.2.4 Information Technologies and Defense
6.1.4 Information Technologies and Quality of Life
6.1.4 Information Technology in Higher Education
3.3 Summary
3.4 Key Words
3.5 Self-Assessment Questions (SAQs)
3.6 References/Suggested Reading

10.0 OBJECTIVES :

Our society is an information society. More specifically, today we are living in the digital age. We are driven by information and the technologies related it. These information technologies have brought about many transformations. Changes are occurring in every sphere of life. One major change is the availability of many alternatives.

Now more and more options are there in every field. Also many choices are reshaped. We shall discuss these choices brought about by IT in this lesson. Specifically, we shall focus on the following: *Trends in IT, IT and Global forces, IT and Economy, Information Technology in Defense, Information Technologies and Quality of Life, and Information Technology in Higher Education.*

3.1 INTRODUCTION

Today computers and IT offer many choices. The traditional options of yesteryears are changing fast. For example, knowledge of computers coupled with training in another field offers interesting career paths. Examples include *bioinformaticist* (biology and computer background) who studies gene maps, and *virtual set designer* (training in architecture and 3-D computer modeling) who designs sets for TV shows by designing sets on computers. Clearly, information technology is changing old jobs and inventing new ones. IT is providing more options in all spheres.

16.1 PRESENTATION OF CONTENT:

The digital age has provided us more alternatives. We have more options in most of the fields. There are more options in the field of education, in the job sectors, in media and entertainment sector. There are more jobs related to information generation, information warehousing, and information processing.

In this lesson we shall discuss about the various options thrown open bt digitalization. The content of this lesson shall be presented as follows:

- *Trends in IT*
- *IT AND GLOBAL FORCES*
- *IT and Economy*
- *INFORMATION TECHNOLOGIES AND DEFENSE*
- *INFORMATION TECHNOLOGIES AND QUALITY OF LIFE*
- *Information Technology in Higher Education*

3.2.1 TRENDS IN THE FIELD OF *IT*:

Many new and exciting changes are taking place in various fields because of IT. But before discussing these changes and the related newer choices in various fields, let us discuss the principal trends of the Information Age. Let's consider these trends in the development of computes and communications.

***Miniaturization, Speed and Affordability*:**

One of the first computers, the outcome of military-related research, was delivered to the U.S. Army in 1946. This computer called the ENIAC (Electronic Numerical Integrator and Calculator) weighed 30 tons and was 80 feet long and two stories high. But it could multiply a pair of numbers in (the then remarkable time of) three thousands of a second. This was the first general-purpose, programmable electronic computer, the grandparent of today's lightweight handheld machines.

Since the days of ENIAC, computers have developed in three directions.

***Miniaturization*:** Computers today have become smaller. First there were vacuum tubes. Then we had transistors. The nest step was development of tiny integrated circuits or chips. The miniaturized processor, or microprocessor, in a personal desktop computer today can perform calculations that one required a computer filling an entire room.

***Speed*:** Thanks to miniaturization, computer makers can pack more hardware components into their machines, providing faster processing speeds and more data storage capacity.

***Affordability*:** Computers and the related hardware are cheaper today. Processor costs today are only a fraction of what they were 15 years ago. A state-off the art processor costing less than 25,000 rupees provides the same processing power as a huge 1980s computer costing more than a few lakh.

These are the three major trends in computers. Similarly there have been changes in the field of communications.

***Connectivity, Interactivity, and Multimedia*:**

There have been three recent developments in communications:

***Connectivity*:** This is the ability to connect computes to one another by communications line, so as to provide online information access. The connectivity resulting from the expansion of computer networks has made possible e-mail and online shopping, for example.

***Interactivity*:** Interactivity is about two-way communication. Using an interactive system, a user can respond to information he or she receives and modify the process. That is, there is an exchange or dialogue between the user and the computer or communications device. The ability to interact means users can be active rather than passive participants in the technological process.

***Multimedia*:** Multimedia refers to technology that presents information in more than one medium, such as text, pictures, video, sound, and animation, in a single integrated communication. The development of the World Wide Web expanded the Internet to include pictures, sound, music and so on as well as text.

These developments are exciting. But truly mind-boggling possibilities emerge as computers and communications combine.

***Convergence, Portability & Personalization*:**

Sometimes in the 1990s, computers and communications stared to fuse together. This marked the beginning a new era called the Digital Age. The result was three further developments.

***Convergence*:** Convergence is the combining of several industries through various devices that exchange data in the format used by computers. The industries are computers, communications, consumer electronics, entertainment and mass media. Convergence has led to electronic products that perform multiple functions, such as TVs with Internet access or phones with screens displaying text and pictures.

***Portability*:** In the 1980s, portability, or mobility, meant less computing power and convenience for smaller size and weight. Today, however, things have changed. As a result, we now have small, powerful, wireless personal electronic devices that will transform our lives far more than the personal computer has done so far.

***Personalization*:** Personalization is the creation of information tailored to your preferences. For example, programmes that automatically gets recent news and information from the Internet on just those topics you have decided and fed into your computer. Companies building products (cars, computers, and clothing) customized to your heart's desire are another example of personalization.

3.2.2 FORCES OF GLOBAL CHANGE:

We live in an era of profound change. Political, economic, and technological changes are taking place everywhere. Global competition has reached unprecedented levels. Free market principles are expanding existing markets, and bringing consumers more choices and higher quality at lower costs.

Great amounts of information can be stored, retrieved, and transmitted at a speed and on a scale not possible before. Above all, technology is reshaping our world at a speed unimaginable just a few decades ago. Technology is reshaping our economy, our lives, and a whole lot of other things.

3.2.3 INFORMATION TECHNOLOGY AND ECONOMY:

Today information technology is the engine that drives economic growth. It is behind the fastest growing industries and growth in every major industrialized nation. Today, technological leadership often means the difference between success and failure in the global market place for companies and countries alike.

Technical progress is the single most important determining factor in sustained economic growth. Increases in productivity have long been recognized as one of the primary mechanisms by which technology contributes to growth. It is estimated that technology and advances in knowledge account for approximately 80 percent of total productivity growth. And in the last few decades, the fastest growing technological field has been the field of IT.

Information Technology is transforming competition enabling small businesses to perform high-quality design and manufacturing work that previously required the resources of big business. IT is also allowing big businesses to achieve the speed, flexibility, and closeness to customers that were once the sole domain of smaller firms.

Technology provides the tools for creating a spectacular array of new products and new services. It is creating new industries, advanced materials, mobile cellular communications, electronic commerce, etc.

Information technologies are transforming every sector of our economy, from manufacturing to services, from transportation to health care, from education to even the government.

Information is now the most important commodity in the world's economic system. The speed with which we process information to create knowledge and our ability to put it to work are astounding.

6.1.3 INFORMATION TECHNOLOGY AND DEFENSE:

On the battlefield, technology can be the decisive edge. Technological superiority helps defense forces to protect the freedom, democracy, and security of a country. Advancements in the field of IT, when applied by he defense forces, help to stand

in defending our borders, preserve the peace, deter hostilities, repel aggression, etc.

High-technology weapons and the transportation and logistics systems support military operations. Continued technological leadership is essential for any country's national security, military readiness, and global influence.

3.2.5 INFORMATION TECHNOLOGY AND QUALITY OF LIFE:

New technologies are also improving the quality of life. IT is being applied in so many different fields. Medical research in pharmaceuticals, biotechnology, and medical devices has resulted in better health care for the sick and a healthier life for all.

Environmental research offers cleaner air, water, and soil through better monitoring, and prevention technologies. Advanced monitoring and forecasting technologies using satellites and simulation are helping save lives and minimize property damage caused by hurricanes, blizzards, microbursts, and severe weather conditions.

Sophisticated traffic management systems for land, sea, and air transportation enable the movement of more people and goods in less time. There is increased safety in all kinds of traffic management also.

Agricultural research is producing a wide variety of safer, healthier, and tastier food products. Automobile research is providing safer, cleaner, more energy efficient fuels and more intelligent vehicles. These have led to saving of lives, preserving natural resources, and keeping our environment cleaner.

Aeronautical technology is making air travel safer, less expensive, and environmentally compatible. Energy research is helping to deliver cleaner and less expensive fuels by tapping alternative sources of energy like solar energy, nuclear energy, geothermal energy, biomass energy, and hydroelectric energy.

Information and telecommunications technologies have enabled instantaneous communications across the globe. The world is truly moving towards becoming a *global village*.

3.2.6 INFORMATION TECHNOLOGY AND HIGHER EDUCATION:

Information technology's power and omnipresence have grown at a very fast rate. It has brought many sweeping changes in a wide range of fields. It is true for the field of higher education, particularly, higher education.

Research in higher education has rapidly adopted advanced information technologies. New fields such as computational chemistry and nano-technology are blossoming. New technologies such as grid computing, extremely large databases, and very high-speed networks continue to transform how a great deal of today's research is conducted.

Today's students are using the Internet, PCs, and fast-paced interactive games. They expect and get a good IT environment at their educational institutions.

One thing seems certain. The teaching and learning dimensions of education will be transformed. We are moving from lecture-based teaching to experimenting with new modes of teaching. Information technologies help implement innovative interactive learning environments. IT is playing a positive role in both content development for teaching and also in providing hardware support.

An interesting facet of the relationship between higher education and IT community is the high degree of collaboration and among educational institutions. Colleges and universities collaborate to accomplish IT related projects that are strategically important for the entire education community. Such strategic partnerships occur when the participants know that the potential success of collaboration is big in magnitude. So they do not act independently and competitively.

Several universities continue to experiment with distance-learning models. In such systems the students are free from the constraints of space and time. Some of these models have been successful, and some have failed, but the experimentation continues. More about the use of IT in education is covered in another lesson.

3.3 SUMMARY:

- Major developments in the computer field include miniaturization, speed, and affordability.
- With miniaturization, computer makers can now pack more hardware components into their machines, providing faster processing speeds and more data storage capacity.
- Major developments in the communication field are connectivity, interactivity, and multimedia.
- Using an interactive IT system, a user can respond to information he or she receives and modify the process. The ability to interact means users can be active rather than passive participants in the technological process.
- The development of the World Wide Web expanded the Internet to include pictures, sound, music and so on as well as text.
- The major advancements resulting from the combining of computers and communication are convergence, portability, and personalization.
- Convergence is the combining of several industries or fields like computers, communications, consumer electronics, entertainment and mass media. Convergence has led to electronic products that perform multiple functions, such as TVs with Internet access or phones with screens displaying text and pictures.

- Today information technology is the engine that drives economic growth. It is behind the fastest growing industries and growth in every major industrialized nation.

3.4 KEY WORDS:

Miniaturization: Computers today have become smaller. From vacuum tubes to transistors and now to tiny integrated circuits or chips, the miniaturization process continues. The miniaturized processor, or microprocessor, in a personal desktop computer today can perform calculations that one required a computer filling an entire room.

Speed: Miniaturization and other related developments provide faster processing speeds and more data storage capacities to computers. Computers today have become smaller and much faster.

Affordability: A state-off the art computer costing less than 25,000 rupees provides much more processing power as huge 1980s computers costing more than a few lakh.

Connectivity: This is the ability to connect computes to one another by communications line. This provides online information access. The connectivity resulting from the expansion of computer networks has made possible e-mail and online shopping, for example.

Interactivity: Using an interactive system, a user can respond to information he or she receives and modify the process. This

leads to in an exchange or dialogue between the user and the computer or communications device. The ability to interact means users can be active rather than passive participants in the technological process.

Multimedia: Multimedia refers to technology that presents information in more than one medium, such as text, pictures, video, sound, and animation, in a single integrated communication. The development of the World Wide Web expanded the Internet to include pictures, sound, music and so on as well as text.

Convergence: Convergence is the combining of several industries through various devices that exchange data in the format used by computers. The industries are computers, communications, consumer electronics, entertainment and mass media. Convergence has led to electronic products that perform multiple functions, such as TVs with Internet access or phones with screens displaying text and pictures.

Portability: In the 1980s, portability, or mobility, meant less computing power and convenience for smaller size and weight. Today, however, things have changed. As a result, we now have small, powerful, wireless personal electronic devices that will transform our lives far more than the personal computer has done so far.

Personalization: Personalization is the creation of information tailored to your preferences. For example,

programmes that automatically gets recent news and information from the Internet on just those topics you have decided and fed into your computer. Companies building products (cars, computers, clothing) customized to your heart's desire is another example of personalization.

3.5 SELF-ASSESSMENT QUESTIONS (SAQs)

4. Discuss the major developments in the fields of computers and communication in detail.
4. Elaborate the newer choices that are available today because of IT.
4. How IT is changing the quality of life? Discuss.
4. Discuss the benefits of convergence, interactivity, and connectivity.

3.6 REFERENCES/SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
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FUTURE TRENDS
OF
INFORATION TECHNOLOGY

Writer: Sh. M.R. Patra
Lecturer,
Dept. of C. M. & T.
Guru Jambheshwar University of Science and Technology,
Hisar, (Haryana).

Vetter: Prof. Sukumar Chopra
Director,
Computer Center,
Kurukshetra University,
Kurukshetra, (Haryana).

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Today we are living in the information society. The days of manual or analogue data generation, storage, and processing are almost over. Now we do almost every thing using IT. Generation, storage, and processing of information have become much easier. Digital processing and the related digital tools have made our lives more comfortable, convenient, and more connected. In almost every field we now have more changes.

Here a question arises? After all these achievements, what can we expect next? In this lesson, we shall try to answer this question. The structure of this lesson shall be as follows:

4.0 Objectives

4.1 Introduction

4.2 Presentation of Content
4.2.1 The Future Scenario of IT: An Overview
4.2.2 Artificial Intelligence
4.2.3 Robots, Neural Networks, and Fuzzy Logic
4.2.4 Artificial Life
4.2.5 Virtual Reality
4.2.6 Future developments in Hard Ware
7.1.6 Future developments in Soft Ware
4.3 Summary
4.4 Key Words
4.5 Self-Assessment Questions (SAQs)
4.6 References/Suggested Reading

4.0 OBJECTIVES:

Information technologies have changed the present. These have brought speed and efficiency to our working. These have come out of the confines of offices and work places and have invaded the privacy of our homes and resulted in many positive changes. Computers and many IT-based equipment and gadgets have brought higher levels of comfort and convenience.

What then is the future of IT? We shall try to find about the future trends of IT in this lesson. Specifically, we shall focus on the following:

- To know the Future Scenario of IT
- To understand Artificial Intelligence and its Future Implications
- To understand Robots, Neural Networks, and Fuzzy Logic
- To understand Artificial Life and its Future Implications

- To understand Virtual Reality and its Future Implications
- To know about Future Developments in Hard Ware
- To know about Future developments in Soft Ware

4.1 INTRODUCTION

The future of information technology is exciting. Experts in the filed predict that there will be more "natural communication" between human beings and computers. In order for people and computers to collaborate we must "interface" or communicate as efficiently and naturally as possible. Interfaces are important because that is where people come into contact with the machinery of the Information Technologies. IT will not reach its full potential until the interaction between humans and machines become closer to human-to-human communication.

Besides keyboards and mouse, today's interface devices include **trackballs, joysticks,** and **hand held styluses for handwriting and drawing, microphones** that pick up speech, and both **still cameras** and **video cameras** for images. There are many other devices being developed around the world.

Scientists and engineers are currently working on **gloves** that let the computer know the precise movement of your fingers. Experts are also working on **glasses** and **head tracking helmets with mechanical, electromagnetic and optical gadgets** that track eye and head movements so that the computer knows where you are looking.

Complete body suits that convey the motions of the torso and limbs are not readily available but they have been built (in clumsy forms) and will undoubtedly appear in the future.

These newer devices will feed information back to you, flooding your senses. These will provide spoken information, three dimensional video and audio information. These will also provide tactile impressions.

These state of the art interfaces will forever alter the way we work and "re-create" in the near future. These new interfaces may allow individuals to work simultaneously with colleagues around the globe, order food from a French waiter in French, even though you don't know the language and even take dance lessons at home from an instructor across town. The application possibilities for these interface technologies are mind-boggling.

4.3 PRESENTATION OF CONTENT:

It is an accepted fact that IT has brought about many changes in most spheres of our lives. The rate of growth and developments in this field has been phenomenal. Thus every body is interested in the future implications of IT. In this lesson, we shall discuss about the future of IT. The content presentation shall be as follows:

- *The Future Scenario of IT*
- *Artificial Intelligence*
- *Robots, Neural Networks, and Fuzzy Logic*
- *Artificial Life*
- *Virtual Reality*
- *Future Developments in Hard Ware*
- *Future developments in Soft Ware*

4.2.1 THE FUTURE SCENARIO OF *IT* – AN OVERVIEW:

This is the twenty-first century. This is the age of highly sophisticated technologies and machines. This is the age of information technologies. We enjoy the benefits of some of the most advanced and highly efficient technological gadgets. We depend on these wonderful machines for every thing. From doing household chores to getting informed, educated, and entertained, to staying connected to even working from where ever we are, we depend on these wonderful information technologies based machines.

Now let us think about the future. What changes will be there in the future? Today we have TV sets and computers. Already both these devices are combined together to form the **teleputer**. It works both as a computer and a TV set. Today we have telephone sets, cordless phones, mobile phones, videophones and satellite phones.

A few years from now, there would be no such thing as a telephone. In its place, there will be an artificially intelligent device called the **neural net computer.** It will be ready to assist you with many tasks, including communications. It will be a combination of a telephone, computer, and shall be connected through Blue-Tooth technology and have artificial intelligence.

Such a scenario sounds strange and very new. But technological changes have always made many impossible things possible. Radio, for instance, was originally thought to have not much use other than to broadcast some important information. It took imagination and vision and of course,

technological advancements to see a world in which radio sets brought news, sports, weather, and music into every home and car.

So what will happen in the future with regard to advancements in the field of information technologies? Generally, short-range predictions of technological progress are much easier than long-range ones. In this lesson, we shall discuss some probable short-range advances likely to take place in the next decade or two. This might give you some insight and guesses about long-range possibilities of future advancements in the fields of communication and information technologies.

Some of these technologies will be in the fields of *artificial intelligence, artificial life,* and *virtual reality.*

4.2.2 ARTIFICIAL INTELLIGENCE:

Artificial intelligence is the capability that helps a machine or computer program to mimic or do some or all of the characteristics (or activities) of human intelligence. We are not talking about a robot that can converse in many languages and have emotions, and act and behave like human beings. This type of artificial intelligence is very far away (even if it is possible). Still, efforts continue in giving computers at least some of the attributes of human intelligence. And some efforts have been partially successful.

Mimicking intelligence is fine, but being intelligent is another. Most critics believe that we are intelligent because we think. Our intelligence is characterized by self-awareness. We are conscious. We know we exist, and we can reflect on that fact. A computer program might be capable of mimicking a person's words, but it is far from being self-aware.

But some artificial intelligence researchers disagree. They believe that our self-awareness is just the result of our very complex programming.

There is no doubt that of all the future technologies, the most far-reaching in its potential impact is artificial intelligence. Computer scientists

working in the field of artificial intelligence believe that the one area of human intelligence, which is at the core of human intelligence, is what is often called “common sense.”

In the United States, two groups of artificial intelligence teams are currently working on diverse attempts at creating artificial intelligence in a computer. One approach is to imitate human thought, and the other approach is to create the same effect as human thought, regardless of how that is done.

Rodney Brooks of MIT is developing a machine, named **Cog**, that has cameras for eyes; a “skin” that has sensory input; and a brain of eight 32-bit, Macintosh-type processors. **Cog** is learning the way humans learn, by trial and error. The object is an artificial intelligence machine that can do diverse tasks and think the way humans can.

Douglas Lenat of Austin, Texas, is developing a machine, called **CYC**, that is being fed all the rules of “human consensus reality”, or common sense. Instead of having **CYC** learn by experience, the knowledge of the experience is being input. Lenat believes that once **CYC** has about two million common sense rules, it will be able to do much of its own learning. For example, **CYC** can read the encyclopedia and then ask questions about anything it did not understand – and its common sense will be strong enough to tell it what it did or did not understand.

CYC represents the top-down approach to artificial intelligence, that the basis of human thought is symbolic knowledge. Coding the logical structures we use to understand the world can create artificial intelligence.

Cog represents the bottom-up approach to artificial intelligence. This approach encourages programmes to work more like biological structures than logical structures. The programs build a lot of small, simple programs and let them interact and learn which interactions are successful.

One computer, called **Deep Blue**, has been programmed to play chess at the world-class level. In 1996, World Chess Champion Garry Kasparov was able to win his match with Deep Blue, with a lot of difficulties.

But Deep Blue could not drive itself to the match, talk to the press about the significance of the match, and then play world-class chess. Only Kasparov could do that. Computers are being developed to exhibit human intelligence, but not to replace humans.

Research that scientists are performing in several related areas is advancing our knowledge of artificial intelligence. These areas include *natural language recognition, expert systems, robotics, neural networks, and fuzzy logic*.

Natural Language Recognition: Even if we cannot define intelligence adequately, we can recognize some aspects of human intelligence, such as the abilities to reason; to solve problems; to learn; and to use a natural language, such as English or Hindi, to communicate.

Attempts are being made to incorporate speech recognition capabilities in to computers. But the process is very slow.

Considering the slow progress in computer voice recognition, creating a computer that we can talk to is not about to happen in the near future. Today's computer voice recognition systems can "understand" a few hundred verbal commands, such as "Open window" or "Start program." But that capability is very different from a person's being able to say. "Computer, show me all my appointments for next Tuesday, OK?

What's holding back the computer's capability to recognize a natural language? Human languages are so complex that linguists have not agreed on a single model of a natural language grammar system. Although some

computer programs do accept natural language input, the sentences must be phrased to conform to fairly strict syntax rules.

4.2.3 ROBOTS, NEURAL NETWORKS, AND FUZZY LOGIC:

Today computers have been developed that exhibit human intelligence. But computers cannot replace humans. However, scientists are conducting research in several related areas is advancing our knowledge of artificial intelligence. These areas are *robotics, neural networks, and fuzzy logic*.

4.2.3.1 ROBOTICS:

A robot is a computer that outputs motion instead of information. Robots do not need to look, move, or act like humans.

Today's robots include input sensors that detect light, sound, touch, and heat. These sensors enable the robot to change its motion based on outside instructions.

In the absence of artificial intelligence, today's robots are not very smart. They can perform a few manual tasks repeatedly and rapidly, but they can do only the tasks they are programmed to do. Cog, mentioned earlier in this lesson, may be a prototype of future robots because it combines sensory input and AI- like thinking.

In general, robotic systems can do precise tasks accurately and consistently. Robots can perform tasks that are dangerous for humans. Robots can also do repetitive tasks without getting bored and careless. Robots have many applications in industry. For example, spot-welding machines are non-mobile robots that move an "arm" (a manipulating mechanism) while the base is fixed to a track or a holding base.

Although robots are expensive, they work 24 hours per day, do not go on strike, and do not require pensions. As robots grow more capable, the opportunities for unskilled and semi-skilled employment are sure to decline.

4.2.3.2 NEURAL NETWORKS:

A neural network (or just neural net) is a computer that does not use the linear IPOS (input-processing-output-storage) design used by almost all computers of today. Instead, a neural network mimics the structure of the human brain.

In a neural network system, thousands of computer processing units are connected in multiple ways, just as the neurons in a brain are connected. Neural nets are not programmed; they are trained. The net “learns” by trial and error, just the way humans do.

After the training is finished, the neural net “knows” how to do something, such as operate a robot. Neural nets behave much the way brains behave. In fact, neural nets exhibit electromagnetic waves that are surprisingly similar to the brain waves in humans. None of today’s neural nets, however, approaches the complexity of even an animal’s brain, but more complex neural nets are planned.

Ordinary computers are very good at solving problems that require linear thinking, logical rules, and step-by-step instructions. Neural nets are very good at recognizing patterns, dealing with complexity; and learning from experience.

Japan has been developing uses of neural networks since 1988. The Japanese have integrated neural networks into devices ranging from air conditioners to rice cookers to word processors. Neural networks have also been used to help decide when to buy and sell securities, to ensure the best quality of a photocopy; and to classify welding defects.

4.2.3.3 FUZZY LOGIC:

Traditional computers make binary decisions: yes or no, right or wrong, on or off. But humans make decisions according to a scale. You are not 100 percent happy or sad; you are more happy than sad. Evaluating by degree is called fuzzy logic. Along with neural networks, computer scientists have been trying to get computers to make decisions by using fuzzy logic.

An example of an application of fuzzy logic is the circuitry that enables a handheld video camera to adjust disturbances and show a steady picture. The circuitry figures out what probably should and should not move and adjusts the image accordingly.

4.2.4 ARTIFICIAL LIFE:

Computer viruses have at least one of the key characteristics of living organisms, the capability to reproduce.

Computer viruses have inspired a new area of research known as artificial life. In artificial life research, researchers try to create “life” within the computer.

One outgrowth of artificial life research is experimentation with genetic algorithms. In genetic algorithm research, scientists are trying to create computers that mimic nature.

Genetic algorithm research mimics nature in the following way. A number of algorithms are placed into a computer “environment” and are given the potential to mutate or change in random ways. All the algorithms compete to try to solve the problem. Over time, one of the algorithms emerges as the best at tacking the problem.

4.2.5 VIRTUAL REALITY:

Virtual reality is a computer technology that uses multiple sensors for input and output and interactively adjusts the output based on the input. In a typical

VR system, the user wears glasses with twin television screens (one for each eye), stereo headphones, and a glove. The glasses and headphones put the user in an imaginary environment. The user alters the environment by moving the glove.

Computer and Video Game makers have adopted VR. However, VR has serious uses as well. While an architect is designing a building, the buyer may not be able to visualize the structure. With VR, the buyer can “walk through” a building while it is still being designed.

The most important application of VR made to date is in training doctors, the doctors are practice a procedure as many times as needed to master it satisfactorily.

Tomorrow’s virtual reality systems may transform the nature of entertainment. Instead of watching a movie on a flat screen, you will feel as if you are in the movie yourself, with the action going on all around you! This was shown in the film **Matrix**.

The possibilities are limitless-and so are the concerns. Virtual reality could very well become the “addictive drug” of the twenty-first century, producing sensory addictions that could be hard to leave.

Virtual Reality Beyond Entertainment: Research in the last twenty-five years has demonstrated that self-locomotion experience plays an important role in a child’s development. Skills such as spatial and depth perception, shape recognition, visually guided reaching, awareness of self-motion, and problem solving in multi-dimensional space are all developed through mobility. These skills form an important part of how we interact with and use our environment. Children with limited mobility cannot have these learning experiences.

Computer generated virtual reality (VR), however, provides a way to substitute simulated experiences for actual mobility. Thus, VR enables physically handicapped children to develop spatial perceptual abilities.

In the Virtual Reality Labs, a program that provides these missing mobility experiences for orthopeadically-impaired children is under way.

4.2.6 TOMORROW'S TECHNOLOGY: HARD WARE

Additional advances in computing technologies include hardware developments, software developments and major improvements in communications. These are in different fields like hardware and software.

Much of the progress has been achieved in the semiconductor industry. These advances have enabled the computer hardware industry to mass-produce highly complex, but miniature electronic devices.

Hardware advances include larger capacity for RAM, faster processing speeds using optical computing and parallel processors, optical storage media with huge capacity, and much smaller processors using nanotechnology.

Memory: In a few years, the size of RAM is desktop computers will from 256M to 1024M. The processing speeds will also increase by about 100 times.

Speed: Using light instead of electrons is the idea behind optical processors. Because light can travel much faster than electrons, optical processors should be several hundred times faster than the electronic circuits used today.

Parallel Processing: One limitation of processor design is that processing occurs in series. Parallel processors now being designed and built can greatly increase the MIPS-millions of instructions per second-the computer can accomplish. Today, supercomputers are being designed around microprocessor chips arranged in a parallel pattern, not a serial pattern.

4.2.6.1 Digital Video Discs:

Digital discs, which hold 7 to 12 times the amount of data on a CD-ROM, can transfer data faster than the fastest CD-ROM. This technology is being built

today. A DVD can contain an entire movie in high-quality video on a single side of a disc (up to 2 hours and 13 minutes), with the capacity to include digital sound in three languages, plus subtitles in four additional languages.

When used for data storage for computers, DVD-ROM has 4.7 gigabytes of storage on a single layer and 8.5 gigabytes on a dual-layer-disc. This is 12 times the capacity of a CD.

4.2.6.2 Nanotechnology:

The technology advance in the more distant future is nanotechnology, or molecular manufacturing. Nanotechnology involves building a processing chip up from the atomic level. A prediction for the future of nanotechnology is that a unit the size of a sugar cube will include hundreds of processors working in parallel at incredible speeds. In the United States, scientists at IBM, Xerox PARC, and other places are working on nanotechnology, how to build it, control it, and apply it to problems.

4.2.7 FUTURE SOFTWARE SCENARIO:

The sheer complexity of today's huge programmes creates problems for software developers and users alike. Some major growth areas in software are the increasing use of graphical user interfaces and the use of software development tools such as object-oriented programming and natural language processors.

4.2.7.1 Graphical User Interfaces:

Although the use of graphical user interfaces, such as the Macintosh interface and Microsoft Windows, has been growing, the full power of this type of platform has not been explored. The next few years will bring a lot of software products that simplify the interface between the user and the computer.

4.2.7.2 New programming Languages:

The next anticipated level of software development is fifth-generation languages. In fifth-generation languages, the user gives the instructions to the computer in a natural language-English, Japanese, etc.

4.2.7.3 Communications:

Communications is the fastest-growing, fastest-changing area of computer use. Changes occurring now are the emergence of wireless transmission; the development of videoconferencing; and the creation; transmission, and reproduction of digitized documents.

4.2.7.4 Wireless Transmission:

Like cellular phone technology, wireless transmission uses radio waves. Most wireless communication is over relatively short distances. The current use of wireless transmission is to create local area networks (LANs) with nodes (individual PCs connected to the LAN) that can be moved around without rewiring. Cellular phones can also create wireless transmission; a portable fax machine in your car can use the cellular phone in the car to send a fax.

Wireless transmission may be the answer for countries that can not afford to upgrade their traditional telephone systems.

4.2.7.5 Desktop Videoconferencing and Networked Video:

Videoconferencing enables people who are physically separated to hold a conference. When one person is talking, everyone sees that person. When someone else speaks, that person appears on everyone's video. Because the

technology has been so expensive, videoconferencing centres have been created.

The next breakthrough will be to have an on-screen window for each person participating in the videoconference. This capability will increase the level of satisfaction for communications such as distance learning.

4.3 SUMMARY:

- In addition to keyboards and mouse, today we have many interface devices. These include *trackballs, joysticks,* and *hand held styluses* for handwriting and drawing, microphones that pick up speech and both still cameras and video cameras for images.
- The future IT devices could feed information back to us, flooding our senses. These will provide spoken information, three dimensional video and audio information. These will also provide tactile impressions.
- A few years from now, there shall be an artificially intelligent device called the neural net computer. It will be ready to assist you with many tasks, including communications.
- Many of the future technologies will be in the fields of artificial intelligence, artificial life, and virtual reality.
- Artificial intelligence is the capability that helps a machine or computer programme to mimic or do some or all of the characteristics (or activities) of human intelligence.
- Robotic systems can do precise tasks accurately and consistently. Robots can perform tasks that are dangerous for humans. Robots can

also do repetitive tasks without getting bored and careless. Robots have many applications in industry.

- In a neural network system, thousands of computer processing units are connected in multiple ways, just as the neurons in a brain are connected. Neural nets are not programmed; they are trained.
- Evaluating by degree is called fuzzy logic. Along with neural networks, computer scientists have been trying to get computers to make decisions by using fuzzy logic. This element has been introduced in many devices like refrigerators, TV sets, etc.
- One major area of artificial life research is experimentation with genetic algorithms. In genetic algorithm research, scientists are trying to create computers that can mimic nature.
- Virtual reality is a computer technology that uses multiple sensors for input and output and interactively adjusts the output based on the input. In a typical VR system, the user wears glasses with twin television screens (one for each eye), stereo headphones, and an IT-sensitive glove. The glasses and headphones put the user in an imaginary environment. Computer and Video Game makers use VR extensively.
- Hardware advances in the future shall include larger capacity for RAM, faster processing speeds using optical computing and parallel processors, optical storage media with huge capacity, and much smaller processors using nanotechnology.
- Some major growth areas in software are the increasing use of graphical user interfaces and the use of software development tools such as object-oriented programming and natural language processors.

4.4 KEY TERMS:

Artificial intelligence: It is the capability that helps a machine or computer program to mimic or do some or all of the characteristics (or activities) of human intelligence.

Cog: A machine that has cameras for eyes; a “skin” that has sensory input; and a brain of eight 32-bit, Macintosh-type processors. It learns the way humans learn, that is, by trial and error. The objective is an artificial intelligence machine that can do diverse tasks and think the way humans can.

Deep Blue: A computer programmed to play chess at the world-class level.

Robots: A robot is a computer that outputs motion instead of information. Robots do not necessarily look, move, or act like humans.

Neural Networks: A neural network (or just neural net) is a computer that does not use the linear IPOS (input-processing-output-storage) design used by almost all computers of today. Instead, a neural network mimics the structure of the human brain.

Fuzzy Logic: Evaluating by degree you are more happy than sad as humans make decisions according to a scale.

Artificial Life: Computer viruses have inspired a new area of research known as artificial life as computer viruses have at least one of the key characteristics of living organisms, the capability to reproduce.

Virtual reality: It is a computer technology that uses multiple sensors for input and output and interactively adjusts the output based on the input.

Digital Video Discs: A disc, which can hold 7 to 12 times the amount of data on a CD-ROM and can transfer data faster than the fastest CD-ROM.

Nanotechnology: involves building a processing chip up from the atomic level.

Video-Conferencing: A technology that enables people who are physically separated to hold a conference.

4.5 SELF-ASSESSMENT QUESTIONS (SAQs)

1. Write a detailed note on the likely developments in the field of IT.

2. The pace at which IT is growing, the future seems very different. Elaborate.

3. What is artificial intelligence? Explain with suitable examples.

4. Write in detail about the likely developments in the fields of robotics, neural networks, and fuzzy logic.

5. What is virtual reality? Discuss its potential in the entertainment field.

4.6 REFERENCES/SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
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Lesson no: 5

ECONOMIC ROLES OF INFORMATION TECHNOLOGY

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

In today's highly materialistic times, most activities are directed towards monetary gains. So it is important to understand the monetary or economic aspects of IT. In this lesson, we shall focus on this. The structure of this lesson shall be as follows:

5.0 Objectives
5.1 Introduction
5.2 Presentation of Content

5.2.1 Computers and Economic Growth
5.2.2 IT and Economy
8.1.2 IT and Transformation of Organizations
5.2.4 Changing Interactions with Suppliers
5.2.5 Changing Customer Relationships
5.2.6 IT Application and Changes in Organizations
5.2.7 IT and Manufacturing
5.3 Summary
5.4 Key Words
5.5 Self-Assessment Questions (SAQs)
5.6 References/Suggested Reading

5.0 OBJECTIVES:

Some people say that we are fast moving towards an Information Society. Others say that we are already living in an Information Society. Today more and more people are getting involved in the collection, collation, compilation, processing, storage, ware housing, and retrieval of information. The field of information technology has seen unprecedented growth in the last few decades. IT plays important functional roles. It plays social roles. In addition, IT also plays a wide range of economic roles. We shall discuss about the economic roles of IT in this lesson as under the following headings:

- *TO KNOW THE ROLE OF COMPUTERS IN ECONOMIC GROWTH*
- *To Understand the Relationship between IT and Economy*
- *To Understand the Role of IT in Transformation of Organizations*
- *To Know how IT is Changing Interactions With Suppliers*
- *To Understand Changing Customer Relationships*
- *To know the role of IT Applications and resultant Changes in Organizations*
- *To Understand the Relationship between IT and Manufacturing.*

5.1 INTRODUCTION:

Today more and more people are getting in to the field of information technology. There large numbers of IT organizations. More and more investments are being made in the field of IT. Information technology enabled packages and equipment is making our jobs simpler and more efficient. They are making our homes more comfortable and convenient to live in. IT is also making our lives easier, fun-filled and exciting.

All this has important economic implications. We are now getting better gadgets. Most of the tools are smaller and highly efficient. We are better connected because of these machines and tools. And these tools and technologies are quite affordable.

5.2 PRESENTATION OF CONTENT:

The fundamental economic role of computers becomes clearer if one thinks about organizations and markets as information processors. Most of our economic institutions and intuitions emerged in an era of relatively high communications costs, limited computational capability, and related constraints. Information technology, defined as computers as well as related digital communication technology, has the broad power to reduce the costs of coordination, communications, and information processing. Thus, it is not surprising that the massive reduction in computing and communications costs has engendered a substantial restructuring of the economy. Virtually every modern industry is being significantly affected by computerization.

We shall discuss about these in detail in this lesson. The lesson content is presented as follows:

- *Computers and Economic Growth*
- *IT and Economy*
- *IT and Transformation of Organizations*

- *Changing Interactions with Suppliers*
- *Changing Customer Relationships*
- *IT Application and Changes in Organizations*
- *IT and Manufacturing*

5.2.1 COMPUTERS AND ECONOMIC GROWTH:

How do computers contribute to business performance and economic growth? Even today, most people tend to think of computational tasks as the only strengths of computers. Computers have excelled at computation since the *Mark I* (1939), the first modern computer, and the ENIAC (1943), the first electronic computer without moving parts.

Computers are much more than calculators. They are information and data processors. The same basic technologies can be used to store, retrieve, organize, transmit, and algorithmically transform any type of information. Computers deal with any information that can be digitized. They deal with numbers, text, video, music, speech, programs, and engineering drawings, etc.

As computers become cheaper and more powerful, the business value of computers is limited less by computational capability, and more by the ability of developers to invent new processes, procedures and organizational structures that make the best use of this capability. As this area of innovation continues to develop, the applications of computers and information technology are expected to expand well beyond computation in the future.

Information technology is economically beneficial mostly because they facilitate complementary innovations.

Advancements in IT are linked to higher productivity and organizational transformation and other measures of economic performance. A significant component of the value of IT is its ability to enable complementary

organizational investments such as business processes and work practices. Such advancements also lead to productivity increases by reducing costs and, more importantly, by enabling firms to increase output quality. Additional benefits include convenience, timeliness, quality, and variety.

5.2.2 INFORMATION TECHNOLOGY AND ECONOMY:

Information Technology is the main engine of economic growth today. It is one of the fastest growing industries. It creates high-wage jobs, provides the tools needed to compete in every business today, and drives growth in every major industrialized nation. Today, technological leadership often means the difference between success and failure in the global market place for companies and countries alike.

Technical progress is the single most important determining factor in sustained economic growth, estimated to account for as much as half a Nation's long-term economic growth over the past 50 years. Increases in productivity have long been recognized as one of the primary mechanisms by which technology contributes to growth. It is estimated that technology and advances in knowledge account for approximately 80 percent of total factor productivity growth. Ultimately, long-term, non-inflationary growth is the only true path to real wage increases and an improved standard of living.

Firms that use advanced technologies are more productive and profitable, pay higher wages, and increase employment more rapidly than firms that do not. Information technology is transforming the very basis of competition, enabling small businesses to perform high-quality design and manufacturing work that previously required the resources of big business. It allows big businesses to achieve the speed, flexibility, and closeness to customers that were once the sole domain of smaller firms.

Information technology provides the tools for creating a spectacular array of new products and new services. It is creating new industries, advanced materials, mobile and cellular communications, electronic commerce and revitalizing old ones like steel, automobiles, and textiles.

The information industry as we know it now barely existed few decades ago. Today, however, the communications and information industries are among America's largest, constituting about 10 percent of U.S. gross domestic product and employing more than 4.5 million people in the United States. The economic importance of these technologies extends beyond the borders of the communications and information industries. By making it possible to manage vast quantities of information, these technologies are transforming every sector of our economy, from manufacturing and services, transportation, health care, to education, and even the government. In the process, IT is changing the way people live, work, and interact with one another.

By the end of the 20^{th} century, information will be the most important commodity in the world's economic system. The speed with which we create knowledge and our ability to put it to work will surely lead to an exciting world in the next century. Advances in information technology software, semiconductors, microprocessors, and telecommunications are essential for managing this information explosion, putting a world of knowledge, global commerce, and communications at our fingertips.

There is no doubt that America is leading the world into the Information Age. The United States is planning a National Information Infrastructure (NII) that will link schools and homes, offices and factories, hospitals and clinics, and other businesses, academic, and social institutions. This network will enable a colossal leap in knowledge sharing, propelling scientific inquiry and

discovery, business productivity, transportation system performance, and the education of our citizenry.

The NII and its international corollary the Global Information Infrastructure will spur the growth and creation of jobs, facilitate the conduct of business worldwide, and accelerate the development of new products, services, and capabilities. Organizations, large and small alike, will be able to respond quickly and flexibly to ever-changing global market demands with high quality, customized goods and services at competitive prices.

Also organizations have transformed themselves by combining IT with changes in work practices, strategy, and products and services; they have transformed the firm, supplier relations, and the customer relationship.

5.2.3 *IT* AND TRANSFORMATION OF THE ORGANIZATION:

Computerization and IT-enabling of organizations is not enough. It also requires matching of organizational structure to technology capabilities. For example, computer integrated manufacturing require major changes including giving workers authority for scheduling machines, process and workflow innovation, more frequent interactions with customers and suppliers, increased lateral communication and teamwork, etc.

5.2.4 ROLE OF *IT* IN CHANGING INTERACTIONS WITH SUPPLIERS:

Advancements in information technologies such as electronic data interchange (EDI), internet-based procurement systems, and other inter-organizational information systems have significantly reduced the cost, time and other difficulties of interacting with suppliers. For example, firms can place orders with suppliers and receive confirmations electronically, eliminating paperwork and the delays and errors associated with manual processing of purchase orders. Manufacturers and consumers both benefit

from lower prices, and increased product variety, convenience, and innovation.

5.2.5 ROLE OF *IT* IN CHANGING CUSTOMER RELATIONSHIPS:

The Internet has opened up a new range of possibilities for enriching interactions with customers. Many companies have succeeded in attracting customer orders and improving service by placing configuration, ordering, and technical support capabilities on the web. This helps in just-in-time inventory management, build-to-order production systems, and tight integration between sales and production planning.

5.2.6 *IT* APPLICATIONS AND CHANGES IN ORGANIZATION:

All kinds of organizations are changing with the advent of IT. For example, till recently all banking was conducted the teller windows. Today, there are ATMs. Customers can access a wide network of thousands of ATMs 24-hours a day, 7 days a week. Also there are vastly expanded arrays of banking services including tele banking, Internet banking, etc.

Computer-controlled medical equipment has facilitated more successful and less painful medical treatment. Many medical procedures that previously required extensive hospital stays can now be performed easily and require less time. Instead of surgical procedures, many medical tests now use non-invasive imaging devices such as x-rays, MRI, or CT scanners. Information technology has supported the research and analysis that has led to these advances plus a wide array of improvements in medication and outpatient therapies.

A lawyer today can access much wider range of information through online databases and manage many more legal documents. In addition, some

basic legal services, such as drafting a simple will, can now be performed easily by a lawyer using standard software packages.

Computers enable more new goods to be developed, produced, and managed in all industries. For instance, the number of new products introduced in the markets has grown tremendously. The data management requirements to handle so many products would be difficult with out computers.

All this suggests that application of IT helps increase output along with variety, customer convenience, and service.

5.2.7 *IT* AND MANUFACTURING:

Manufacturers are fast moving from the traditional systems to the computer-based planning and control systems. The explosive growth of e-business has necessiated this change.

For traditional manufacturing, less is best. This means *Less inventory, Less material movement, Less floor space, Less variability,* and *Fewer steps, options* and *choices in work*. But in computerized manufacturing, more is best. This means More information, More flexibility, More functions and features, More comprehensive business processes, and Faster, more frequent decision making made by more people. IT enabled manufacturing helps maximize productivity and quality at the lowest possible cost. For example, in the auto industry, customer responsiveness today is taking the form of fast order-to-delivery and mass customization.

The four major benefits of computerized manufacturing are: Elimination of waste, Standardization of work, Zero defects, and controlled flow.

In the auto industry, only by using computer systems can manufacturers solve the many constraints and issues related to operations and planning.

Only by extensively relying on computer systems can a large manufacturer possibly hope to create optimized plans and schedules with relation to suppliers, plants, and logistics companies.

Advanced planning and scheduling (APS) play an important role in manufacturing. APS is continuously re-planning, re-scheduling and re-sequencing. It constantly updates manufacturing operations to reflect changing market conditions, capacity constraints, etc.

Computers have an overwhelming impact on economic growth that is disproportionately large compared to their share of capital stock or investment. This impact is likely to grow further in coming years. New business processes, new skills, and new organizational and industry structures are major contributions of IT. These resulting assets are much more than the investments in the computer technology itself.

Thus computers have made a much larger real contribution to the economy. The outcome has been a better understanding of the key inputs, including complementary organizational assets, as well as the key outputs including the growing roles of new products, new services, quality, variety, timeliness and convenience.

5.3 SUMMARY:

- Today more and more people are getting involved in the collection, collation, compilation, processing, storage, ware housing, and retrieval of information.
- The field of information technology has seen unprecedented growth in the last few decades.
- IT plays important functional roles. It plays social roles. In addition, IT also plays a wide range of economic roles.

- Computers are much more than calculators. They are information and data processors.
- The computing technologies can be used to store, retrieve, organize, transmit, and algorithmically transform any type of information.
- Computers deal with any information that can be digitized. They deal with numbers, text, video, music, speech, programs, and engineering drawings, etc.
- The economic importance of these technologies extends beyond the borders of the communications and information industries. By making it possible to manage vast quantities of information, these technologies are transforming every sector of our economy, from manufacturing and services, transportation, health care, to education, and even the government.
- IT is changing the way people live, work, and interact with one another.
- By the end of the 20th century, information will be the most important commodity in the world's economic system.
- Advances in information technology soft ware, semiconductors, microprocessors, telecommunications are essential for managing this information explosion, putting a world of knowledge, global commerce, and communications at our fingertips.
- Eliminating paperwork and the delays and errors associated with manual processing of purchase orders. Manufacturers and consumers both benefit from lower prices, and increased product variety, convenience, and innovation.
- Computerized manufacturing means More information, More flexibility, More functions and features, More comprehensive business processes, and Faster, more frequent decision making made by more

people. IT enabled manufacturing helps maximize productivity and quality at the lowest possible cost.

- Computer-controlled medical equipment has facilitated more successful and less painful medical treatment. Instead of surgical procedures, many medical tests now use non-invasive imaging devices such as x-rays, MRI, or CT scanners.
- Computers enable more new goods to be developed, produced, and managed in all industries.
- Advanced planning and scheduling (APS) helps continuous re-planning, re-scheduling and re-sequencing. It constantly updates manufacturing operations to reflect changing market conditions, capacity constraints, etc.

5.4 KEY WORDS:

Information Society: Today more and more people are getting involved in the collection, collation, compilation, processing, storage, ware housing, and retrieval of information. Thus our society is called an information society.

Roles of IT: IT plays important functional roles. It plays social roles. In addition, IT also plays a wide range of economic roles.

5.5 SELF-ASSESSMENT QUESTIONS (SAQs)

2. Discuss the economic role of IT with suitable examples.
2. What role does IT play in the field of manufacturing? Elaborate.
2. Organizations have under gone sea changes with the advent of IT. Discuss in detail.

5.6 REFERENCES/ SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
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INFORMATION TECHNOLOGY IN BUSINESS AND MANAGEMENT

Writer: Sh. M.R. Patra
Lecturer,
Dept. of C. M. & T.
Guru Jambheshwar University of Science and Technology,
Hisar, (Haryana).

Vetter: Prof. Sukumar Chopra
Director,
Computer Center,
Kurukshetra University,
Kurukshetra, (Haryana).

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

In today's time, most activities are directed towards managing things properly. The most important field here is the management of businesses. In this lesson, we shall focus on the role of IT in business management. The structure of this lesson shall be as follows:

6.0 Objectives
6.1 Introduction
6.2 Presentation of Content
6.2.1 Information Technology in Office Automation
6.2.2 Information Technology in Retail Business

6.2.3 Information Technology in Banking and Finance
6.2.4 Information Technology in Stock Market
6.2.5 Information Technology in Manufacturing
6.3 Summary
6.4 Key Words
6.5 Self-Assessment Questions (SAQs)
6.6 References/Suggested Reading

6.0 OBJECTIVES:

Information technologies are playing very important roles in various fields. We all know about the great positive changes brought about by the use of IT. Major developments have resulted in the fields of business and management because of IT. We shall discuss these developments in this lesson.

- *Role of Information Technology in Office Automation*
- *Role of Information Technology in Retail Business*
- *Role of Information Technology in Banking and Finance*
- *Role of Information Technology in Stock Market*
- *Role of Information Technology in Manufacturing*

6.1 INTRODUCTION:

Since the very beginning, business has been the main backbone of any country's economy. To run business and organizations successfully, we need efficient management practices. Efforts are always on to improve management practices. The most important of these efforts are the adoption of computers and information technologies for improving management practices. Business and industry have changed dramatically since the first computer was introduced in 1951.

Today, it is difficult to imagine how business could operate without computer. The current growth in business and management of organizations would not be possible without computers, and information and communications technologies.

In India, since the beginning of the 1990's, genuine efficiencies in the office have occurred because there are better procedures to accompany the machines. Where the computer once simply replicated the previous manual tasks, it now automates more fully. The processes and the procedures have improved. Accordingly, management of business and organizations has also improved many folds. The most important advancements have occurred in the development of two business-computing systems, namely Office Automation and Management Information Systems (MIS).

6.2 PRESENTATION OF CONTENT:

Business today has become very complex and highly competitive. Managing businesses thus has become tricky. In addition to managerial skill, today high quality IT skills are also being used to manage businesses. In this lesson, we shall discuss the role of IT in business management. The content of this lesson is presented as follows:

- *IT in Office Automation*
- *IT in Retail Business*
- *IT in Banking and Finance*
- *IT* in Stock Market
- *IT* in Manufacturing

6.2.1 INFORMATION TECHNOLOGY IN OFFICE AUTOMATION:

For a long time, most of the office work was being done manually using papers, files, etc. Now most of the office work is done on the computers. The advent of information technologies has further improved this.

Simply put, office automation is using computers, and information and communications technologies for better use and management of information. Office automation technology includes all types of computers, telephones, electronic mail, and office machines that use microprocessors or other high-technology components.

In many offices, information (often in paper form) is the end product and is essential for conducting the company's business. Office automation systems keep track of the information originating in various operations throughout the company, such as order processing, accounting, inventory, and manufacturing. Office automation provides managers, planners, and decision-makers with information-processing systems to collect, analyze, plan, and control information about the many aspects of the business. An additional benefit of office automation is that it allows information processing in many modes. These include text, voice, graphics and video display technology.

Office automation does not replace manpower. It, however, requires less number of people. In addition to reduced manpower, office automation also leads to higher levels of efficiency. That means fewer people and more and efficient work.

Recent Improvement in Office Automation:

Business automation, i.e., office automation differs from factory automation. In a factory, machines may sometimes replace workers completely. But we have learned that offices cannot be automated in the same way factories are automated. Office tasks involve a great deal of thinking and decision-making.

As a result, office systems must be flexible and versatile. Moreover, they must be designed so any user of the system, regardless of background

can easily use them. This is called ergonomics. It is the study of how to create safety, comfort and ease of use for people who use machines.

In the recent times, ergonomics engineers have improved the office automation systems, furniture and environments for the computer users. Intensive development and advancements have resulted in the best designs for keyboards, reduced eye fatigue levels for monitors, and specified desk and seating designs that reduce physical stress. Ergonomics has played a significant role in helping people use computers and related technology more effectively.

Technologies For Office Automation:

Five primary technologies are used in managing information in office automation:

- Text or written words.
- Data as in numbers or other non-text forms.
- Graphics, including drawings, charts and photographs.
- Audio, as in telephone, voice mails, or voice recognition systems.
- Video, such as captured-images, videotapes, or teleconferencing.

Before the advent of office automation, different technologies were used for creating these forms of information. Text was created using conventional typewriters or more recently, word processing. Data, such as sales reports, was stored in files, which in turn were stored in almirahs. Charts and graphs were either hand-drawn or created using 35mm slide photography and videotapes were used for training. Audio was limited to the phone or tape recording. It was not possible to combine these various forms of information.

Computers and information technologies help generate data in any of the above forms. Data created using other traditional technologies can also be

transferred in to the computers. This is possible through the various input devices like scanners, TV tuner card, video-blaster card, sound-blaster card, etc.

Now computers are used for data generation, data storage, data processing, data retrieval, etc. All these processes combined are called data ware housing.

Computers produce documents called electronic documents. An electronic document can be simple memo that is printed on paper, stored in the computer for future use, or transmitted via electronic mail, etc. It can be a complex document, with graphics or even video. Most computer systems can incorporate sound, so that an on-screen document can be supplemented by spoken.

Present day computers integrate the various media like text, still visuals and graphics, audio, video, and animation. All types of data, whether text, sound, and images can be entered into a computer, stored and changed into the kind of output we need. These days many offices or organizations use specially designed software for specific purposes. Such application software, called group-ware, allows networked PCs and workstations share information and electronic documents from both corporate and on-line sources. This kind of integrated work situation is possible because of networking and other related information technologies.

Office Automation Systems:

As we have already discussed, office automation means the use of computer-based systems for providing information to help planners and decision-makers

take management related decisions. Office automation systems include few subsystems. These are:

- Text Management Systems,
- Business Analysis Systems,
- Document Management System, and
- Network and Communications Systems

Any computer system designed to work with the written or typewritten work is called a text management system. Earlier there was only one such device, and that is the typewriters. Present day text management systems include all kinds of word processing systems, PCs with word processing facilities, PCs with desktop publishing systems and text editing systems. In addition, computerized typesetting equipment is also available.

Text management systems are used for tasks like writing memos, notes, letters and other short documents. They also used for printing envelopes and labels, preparing pre-printed forms such as invoices. Composing complex documents like proposals and reports, retrieving and editing documents such as contracts, creating display documents like newsletters, etc. is also done on text management systems.

For efficient management, managers require good quality data. Such data help them in making good decisions for the business. Before the advent of computers, managers relied on their experience, etc., for taking decisions. A business analysis system with the proper software helps managers in processing the data properly. Such a system puts data in proper prospective and helps managers take more effective decisions. For example, spreadsheets are used for analyzing cost and benefits and for creating budgets. There are hundreds of such applications of business analysis systems.

In addition to business analysis systems, other software tools are also available for performing data analysis. These are Decision Support Systems (DSS), Expert Systems (ES) and Executive Support Systems (ESS).

A decision support system helps users in extracting information from the various management information system (MIS) database, etc. It also helps in analyzing such information. The result is used to formulate decisions or a strategy for business planning.

An expert system can store and retrieve data with special problem solving expertise. Executive support systems helps in consolidating and summarizing raw data collected from various sources.

A document management system helps in filing, tracking and managing documents. A manual document management system helps in managing paper-based files. But a computer-based electronic document management system helps in managing electronic files. Managers often demand that data be immediately accessible and instantaneously retrievable. This is not possible with manual document management systems. For this reason, we are slowly moving away from paper-based files towards electronic document forms that can be stored on the computer.

Today, managers have many ways to communicate with others. In addition to telephones and fax, there are other modern means. These include e-mail, chatting, voice-mail, internet-telephony, teleconferencing, etc. They can also communicate using computer controlled PBX telephone systems to record digital messages and leave them in the recipients' electronic mailboxes. These systems are called network and communication management systems.

6.2.2 *IT* AND COMPUTERS IN RETAIL MARKETING:

In the last thirty years, information technology has emerged as a major force. IT has revolutionized the working patterns in many fields. We have already discussed the role and importance of IT in the fields of office management and MIS. Now let us discuss the role of IT in other fields. We shall start with the role of IT in the field of retail marketing.

In the last two decades, computers and IT have transformed retail marketing. A large number of new IT-based interactive tools have revolutionized the field of retail marketing. These include:

- Interactive Kiosks,
- Point of Sale Terminals,
- Universal Price Codes (UPC),
- Use of Debit and Credit Cards,
- Electronic Shopping,
- Electronic Data Interchange (EDI)

Interactive Kiosks: These are the newest tools in retail. An interactive kiosk presents the customer with a number of interactive video screens and offers all the choices to the customers. Many shopping malls and departmental stores the world over have installed interactive information kiosks. Shoppers can use a touch-screen to indicate their choice and the goods will be brought to them. The kiosk also plays music in addition to running promotional videos on other screens. In many cases interactive kiosks are doing the job of both the sales persons, the catalogues, and display board.

Point-of-Sale (POS) Terminals: Many shops are now point-of-sale (POS) terminals instead of using cash registers. These computerized terminals are connected to a central computer. The central computer performs a multitude

of jobs. It locates the product in a database stored on disk, determines the current selling price, and automatically updates the store inventory.

Universal Product Code: Many retail stores today use universal product codes (UPC) or bar codes for marking the price of products on the packages. Computerized terminals can find the price of a product based on the universal product code (UPC) or bar code encoded on a label or tag. This code can either be keyed by the checker or read with a scanner. The UPC identifies the item with a series of bars. The code is based on the width of the bars and the space between the bars. Use of the UPC code has resulted in faster processing of items, fewer price errors, and decreased inventory costs.

Use of Debit and Credit Cards: Some stores allow customers to use Credit cards or debit cards for purchasing purpose. The credit or debit card is entered in the store's computer, which then directs the customer's bank to transfer funds electronically from his or her bank account to the store's account.

Electronic Shopping: Another electronic practice that can bring more changes in the retail industry is electronic shopping. This is the capability to order goods electronically. A consumer in New Delhi can find about the products available in a departmental store in London by using a microcomputer to access an information service. The order is placed electronically, and the items are automatically billed to the customer's charge card and delivered to the customer's door.

Electronic Data Interchange: Another IT-based system used in retail marketing is electronic data interchange (EDI). Companies use this system for exchanging information with suppliers and manufactures. EDI enables a

purchasing department to electronically place an order with a supplier. The supplier's computer informs the production department that the order needs to be filled, and informs the transportation department where the ordered goods should be sent.

6.2.3 INFORMATION TECHNOLOGY IN BANKING AND FINANCE:

The "cash-less society"-long predicted by computer experts-is quickly becoming a reality. Large sums of money are transferred electronically the world over every day.

The banking industry has been a pioneer in using computers for data processing. Banks use computers and IT-based devices to provide the customers with a large number of value-added services. These include Electronic Funds Transfer (EFT) Systems, Automated Teller Machines (ATMs), Internet Banking, Phone Banking, Paying Bills through Banks, Any-Branch Any-City Banking, etc.

ATMs are available 24 hours a day, 7 days a week. ATM networks link the ATMs of many different banks. Thus customers have a wide range of banking locations. An ATM is a specialized computer terminal that enables customers to make deposits and withdraw funds without having to wait in the bank. Customers can also use the ATM to transfer funds between accounts.

6.2.4 INFORMATION TECHNOLOGIES AND THE STOCK MARKET:

Companies and business organizations need to raise money to run their business. People invest in these companies by buying their shares. When millions of people purchase shares, companies can raise the money necessary to make massive investments. Earlier, most of the transactions or trading in stock markets were done manually. Now computers are changing the way investors trade shares. All transactions are maintained

and tracked with mainframe computers. Brokers place their order electronically, and computers determine appropriate changes in stock prices based on trading activity. Speculators can track the performance of stocks, access current prices, and place buy-and-sell orders by using their computers.

Very soon the trading floor of stock markets will be transformed. Both the American Stock Exchange (AMEX) and the New York Stock Exchange (NYSE) are experimenting with wireless cellular technology. Traditionally, brokers have shouted their transactions across the floor. Now brokers can use personal digital assistants (PDAs) to process orders and transmit information. The result will be less paper, less noise, and increased accuracy.

Stock markets exist in a number of countries. Japan, England, and the United States have the largest stock markets. India also has large stock markets that are doing booming business. Computers have opened these markets to international trading. Computers provide investors and financial advisors with instant access to financial data and analysis.

6.2.5 INFORMATION TECHNOLOGIES AND MANUFACTURING:

Like in other fields, computers are also transforming the field of manufacturing. The use of computers for manufacturing means that fewer workers are needed for production works. A modern manufacturing unit may contain many robotic arms performing repetitive tasks, supervised by one or two peoples.

Manufactures use multimedia to improve their operations. Engineers and managers develop multimedia presentations that show manufacturing processes to workers. This is a much easier way of understanding.

Computer-Aided-Design (CAD) applications enable engineers, architects, and artists to create or modify objects quickly. In CAD, the

computer monitor replaces a manual drafting table and enables the designer to create three-dimensional images that can be manipulated easily.

The Computer-Aided-Design (CAD) output becomes input to Computer-Aided-Manufacturing (CAM) devices. These devices then automatically make modifications to production equipment according to the electronically provided instructions. Many CAD/CAM software are available for mainframes computers and minicomputers. CAD and CAM software packages are now available for microcomputers and workstations also.

Using CAD/CAM applications facilitates the automation of certain portions of a manufacturing unit. Integration of computer technology into the entire manufacturing process is known as Computer-Integrated-Manufacturing (CIM). Computer-Integrated-Manufacturing (CIM) uses computers to link the entire manufacturing procedure, from order entry to production and even to warehousing and distribution. CIM reduces production times by many folds. Production cycles that once required weeks or months can be accomplished in days or hours.

Another innovative use of IT and computers in manufacturing is Just-in-time (JIT) manufacturing. Such systems monitor inventory and activate the manufacturing process only when inventory levels are sufficiently lessened or diminished. JIT enables manufacturers to order supplies as they are needed for production and to maintain minimal inventory levels. This saves a lot of time, unnecessary paper work, and reduces the number of people involved.

Manufacturers are also using virtual reality to test various designs. Virtual Reality (VR) is an information technology-based system that puts the user in an imaginary computer-generated world. The user, wearing a special head-mounted-display (HMD) and a sensor glove, navigates through this illusory world. The computer interactively adjusts the output according to the user's input. Using virtual reality, manufacturers can perform many different

tests on various designs without destroying expensive models. Just-In-Time manufacturing and the testing of designs using virtual reality systems reduce production cost and save a lot of time.

6.3 SUMMARY:

- Office automation uses computers and IT-based systems efficient information processing and better decision making.
- Office automation allows users to collect, analyze, plan, and control information for better management using text, voice, graphics, audio, and video display technology.
- Retail stores use point-to-sale terminals to find out product prices of different products and update inventory.
- Customers use credit cards and debit cards to transfer funds directly from their accounts to the stores' account while purchasing something.
- Electronic shopping enables customers and suppliers to exchange order information electronically.
- Many bank transactions are performed electronically using Electronic Funds Transfer or Automated Teller Machines.
- The speed of stock trading has been increased by the use of computers and IT-based systems.
- Manufacturing firms use computers in every aspect of the manufacturing process.

6.4 KEY TERMS:

Interactive Kiosk: An interactive kiosk presents the customer with a number of interactive video screens and offers all the choices to the customers.

Point-of-Sale (POS) Terminals: A computerized terminal where central computer performs a multitude of jobs. It locates the product in a database stored on disk, determines the current selling price, and automatically updates the store inventory.

Universal Product Code: Many retail stores today use universal product codes (UPC) or bar codes for marking the price of products on the packages. Computerized terminals can find the price of a product based on the Universal Product Code (UPC) or bar code encoded on a label or tag.

Electronic Shopping: This is the capability to order goods electronically.

Electronic Data Interchange: Companies use this system for exchanging information with suppliers and manufactures. EDI enables a purchasing department to electronically place an order with a supplier.

6.5 SELF ASSESSMENT QUESTIONS

3. Write a detailed note on the role of IT in business.
3. What changes have come in the field of management because of IT?
3. Write a detailed note on the role of IT in office automation.
3. Write a detailed note on the role of IT in retail marketing.
3. Write a detailed note on the role of IT in banking and stock markets.
6. Write a detailed note on the role of IT manufacturing.

6.6 REFERENCES/SUGGESTED READING:

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THE INTELLIGENT HOUSEHOLD:

IT IN OUR HOMES

Writer: Sh. M.R. Patra
Lecturer,
Dept. of C. M. & T.
Guru Jambheshwar University of Science and Technology,
Hisar, (Haryana).

Vetter: Prof. Sukumar Chopra
Director,
Computer Center,
Kurukshetra University,
Kurukshetra, (Haryana).

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

In today's time, most activities are directed towards managing things properly. The most important field here is the management of businesses. In this lesson, we shall focus on the role of IT in business management. The structure of this lesson shall be as follows:

7.0 Objectives

7.1 Introduction

7.2 Presentation of Content

7.2.1 Business applications of IT at Homes

7.2.2 Role of IT in Money Management at Home

7.2.3 Role of IT in Communication, Education, and Information at Home

7.2.4 IT and Home Entertainment
7.2.5 IT and Leisure and Creativity
7.2.6 IT and Home Automation
7.3 Summary
7.4 Key Words
7.5 Self-Assessment Questions (SAQs)
7.6 References/Suggested Reading

7.0 OBJECTIVES:

Information technologies have become the lifeblood of our existence today. Computers and many IT-based equipment and gadgets have come out of the confines of offices and work places and have invaded the privacy of our homes. And this has resulted in many positive changes.

This raises a few questions: What are people using home computers for? What kinds of role will computers play in tomorrow's homes? We shall try to find out answers to these questions in this lesson. We shall focus on the following:

- *To Know About the Different Business applications of IT at Homes*
- *To Know About the Role of IT in Money Management at Home*
- *To Understand the Role of IT in Communication and Education at Home*
- *To Know About the Role of IT in Home Entertainment*
- *To Understand the Role of IT and Leisure in Creativity*
- *To Understand the Role of IT in Home Automation*

7.1 INTRODUCTION:

Long back, Car manufacturer Henry Ford had said that he would only make cars in black. Now we get cars in all possible colors. In 1977, Ken Olson of Digital Equipment Corporation said that, there is no reason for any individual to have a computer in their home. In 1978, Apple Computers introduced the Apple II computer for home use. Soon dozens of other companies sold millions of computers to individuals. Today, the home computer market is very large and it is still growing. Along with computers, all information and communication technologies have come to our homes.

13.1 PRESENTATION OF CONTENT:

IT has achieved a lot for various industries, different organizations, various businesses, etc. From media and entertainment to defense, from business management to education; almost every field has benefited form IT. But has IT been able to contribute to our homes? In this lesson, we shall try to answer this very question. The lesson content shall be presented as follows:

- Business applications of IT at Homes
- Role of IT in Money Management at Home
- Role of IT in Communication and Education at Home
- IT and Home Entertainment
- IT and Leisure and Creativity
- IT and Home Automation

13.1.0 BUSINESS APPLICATIONS OF *IT* AT HOME:

Generally home computers can be used for the same applications at home as they do in their offices.

- *Word Processors:* For writing letters, memos. The word processor has replaced the typewriter.
- *Spreadsheets:* A spreadsheet program can find answers to questions involving numbers, i.e., numerical problems.
- *Database Programs:* Many people use database programs for address books, family records keeping, and other data storage jobs.
- Personal Information Management Programmes: To manage appointment calendars, to-do lists, addresses, phone numbers, etc. Some people use home computers to keep their personal lives organized.
- *Accounting and Income Tax Programmes:* These programmes can balance chequebooks, keep financial records for tax time, and provide data for income tax calculation programmes, etc.

7.2.2 IT AND HOME MONEY MANAGEMENT:

For most people, the advantages of computerized home money management are not worth the time and effort required entering every financial transaction into the computer. Some people strike a balance by only storing important transactions. Some others subscribe to home banking programs so they can download their balance statements

directly from bank computers. But for most people computerized money management will not happen until there's an effortless way to record transactions, perhaps a device that, when inserted into the computer, can tell the software about each purchase and the paid bill. That device we are talking about is a smart card.

A smart card looks like a standard credit card, but instead of a magnetic strip it contains embedded microprocessors and memory. Some smart cards even contain touch-sensitive keypads for entering numbers. Whether it has a keypad or not, a smart card receives most of its input when it's slipped into a special slot on a computer. Data stored in smart cards can be password protected. There are hundreds of millions of smart cards in use.

Smart cards are set to replace magnetic strip credit cards. In addition to storing critical ID information, a smart card can automatically record each transaction for later retrieval. But smart cards have other applications, too. Office workers use smart cards as keys to access sensitive data on computers.

Many people in America and Europe use smart cards to pay highway tolls and unscramble cable TV broadcasts. In the future, it might be possible to use one card to buy groceries, check out library books, and store personal medical information in case of an emergency. Future smart cards will use pattern recognition techniques to verify signatures on checks or credit receipts and helps prevent millions of dollars in fraud and forgery.

7.2.3 *IT* IN COMMUNICATION AND EDUCATION AT HOME:

Millions of people use home computers for education and information. Children and adults in homes use many of the educational software programs. *Edutainment* (Education and Entertainment) programmes specifically geared towards home markets combine education with entertainment so they can compete with television and electronic games. Encyclopedias, dictionaries, atlases, telephone directories, medical and other specialized references now come in low-cost CD-ROM versions. Most of these CDs have multimedia capability. More up-to-the-minute information is available from the Internet and other on-line sources like mobile phones. Of course, Internet connections also provide electronic mail, discussion groups, and other communication options for home users.

As computer technology and communication technology converge on the home, they will produce services that will threaten television and newspapers as our main sources of information.

Television is a broadcast medium; it transmits news and information to broad audiences. In the future we'll see narrow casting services. These will provide custom newscasts aimed at narrow groups or individuals.

Personalized multimedia news programmes will combine many of the best features of television news and newspapers. You'll be able to request an index of available features and use it like a menu to build your own news program. Your personal newscast will include what eve you want. It could include the results of yesterday's election, highlights

of the previous day's cricket game, this weekend's weather forecast, a feature on your favorite local musician, etc.

You'll be able to train your news service to identify particular subjects so that even the menu is customized to suit your tastes. All of this is technologically possible now. Prototype systems have been running for years at MIT's Media Lab, and private companies now offer a few pilot services through the Internet.

7.2.4 *IT* IN HOME ENTERTAINMENT:

Regardless of how people say they use home computers, surveys suggest that they use them mostly to play games. Computer games and video game machines (which are just special-purpose computers) represent a huge industry-one that is likely to evolve rapidly in the coming years.

Most computer games are simulations. Computer games can simulate board games, card games, sporting events, intergalactic battles, street fights, corporate takeovers, or something else, real or imaginary. Many require strategy and puzzle solving; others depend only on eye-hand coordination.

Many of the most popular games require some aspects of each. With dazzling graphics, digitized sound, and sophisticated effects, many of today's computer games represent state-of-the-art software. But in a few years these computer games are likely to look as primitive in a decade as these early pong games look today.

The biggest changes in electronic games are likely to come as computers and communication technology converges on the home entertainment industry. As this happens, the line that separates television programmes and computer games will grow fuzzy.

A few years ago, software shops stocked a variety of interactive fiction games stories with primitive natural languages interfaces that gave payers some control over plot. Those non-graphic, not-very-intelligent programs have been squeezed off the software shelves by interactive movie-animated features in which one or more of the characters are controlled by the viewers.

Today's interactive movies are not Academy Award material; at best, they are like cartoons with controls. But as technology improves and the multimedia market grows, you can expect to see all kinds of hybrid forms of entertainment.

14.1.4 IT IN LEISURE AND CREATIVITY AT HOME:

Interactive movies demand more involvement than television, but they are still a relatively passive pastime. Many people worry that television, computer games, and other media are replacing too many real-world activities. Instead of making up stories to share, we watch comedies on TV.

Instead of playing music on guitars, we play music on boom boxes. Instead of playing one-on-one basketball, we play one-on-one video games. Is electronic technology turning us into a couch-potato culture?

Perhaps yes! But there's another possibility. The same technology that mesmerizes us can also unlock our creativity. There are many examples. Word processors help many of us to become writers.

Graphics software brings out the artists among us. Desktop publishing systems put the power of the press in more hands. Electronic music systems allow us to compose music even if we never mastered instrument and multimedia systems open doors to cable-access TV channels.

7.2.6 IT AND HOME AUTOMATION:

With the advent of computers and IT, the concept of "Home Sweet Home" is changing fast. Modern IT-based appliances and gadgets are changing our homes. Our houses are getting automated. From garages to front doors, from drawing rooms to bedrooms, from study rooms to kitchens, IT-enabled appliances are making their presence felt.

These appliances are making our lives much easier. These gadgets help us from doing hard work. These help us save time. These appliances have brought previously unheard of comfort and convenience.

Automated garages can be opened and closed with remote controls. Instructions can be given for washing your car and an automated system will spray jets of water to wash the car in your garage only.

Your car can become your office with a laptop computer and a mobile phone. You can stay connected with the entire world with such equipment. Also, your car can provide you all kinds of entertainment. Advanced GPS (Global Positioning System) system allows you to find

out the exact location of your car in case the car is lost or stolen. Such systems allow navigating through unknown territory without any outside help.

An advanced automated system in your car will tell you in its computerized voice about the various requirements like the petrol or diesel level, air-pressure in the tyres, wheel alignment positions, etc.

Now there is no need to use cables and wires to connect your computer monitor, keyboard and mouse, etc. Sophisticated BLUETOOTH technology allows such equipment to get connected without any physical connection through wires and cables. Similarly, all the rooms in your house can be connected using this technology. Also IT-enabled equipment your car can stay connected with the equipment at home through this technology.

The cooking apparatus, music system, lighting equipment, heating equipment, etc. at your home can be controlled through remote controls. Such controls can be programmed to work both when you are at home or away.

Stock taking of your refrigerator, cupboards, etc., can be done with the help of IT-enabled equipment. All most all gadgets, equipment, appliances can be automated. These appliances can be programmed to work in the way you want.

IT-based systems not only help automate your home, these also bring a higher level of convenience and comfort in to your life. These systems can also provide protection in the form of sophisticated alarm systems, automated door closing and opening, etc.

A few years from now, there will be an artificially intelligent device called the **neural net computer.** It will be ready to assist you with many tasks, including communications.

When you open the door of your house, flat translucent panels will illuminate the drawing room, and you hear a gentle voice welcoming you. Then you hear a pleasant voice saying, “There is a call from your client. Shall I display the call on-screen?” You say, “Sure, computer, but wait a second until I have put the groceries in the refrigerator.”

When you close the refrigerator door, it will thank you. Then the telephone takes over. Your client appears on screen, in beautiful color, and you hear his voice in clear, stereo sound. You have your conversation with your client. Your telephone records the instructions given by your client and prepares a schedule for you. Then it will remind you about the deadlines well in advance. Is this scenario possible? Yes. And it is already happening.

7.3 SUMMARY:

- The home computer market today has become very large and it is still growing. With computers, all information and communication technologies have come to our homes.
- Home computers can be used for the same applications at home as they do in their offices.
- Home computers are used at home as *word processors* and *spreadsheets*. These are also used for data base management,

personal information management, and accounting and tax management purposes also.

- IT-enabled smart cards are now used to pay highway tolls and unscramble cable TV broadcasts. In the future, smart cards will be used to buy groceries, check out library books, and store personal medical information.
- Future smart cards will use pattern recognition techniques to verify signatures on checks or credit receipts and helps prevent fraud and forgery.
- *Edutainment* (Education and Entertainment) programmes combine education with entertainment so they can compete with television and electronic games.
- Encyclopedias, dictionaries, atlases, telephone directories, medical and other specialized references now come in low-cost CD-ROM versions. Most of these CDs have multimedia capability.
- The convergence of computer technology and communication technology will shortly produce mass media services that will threaten television and newspapers as our main sources of information.
- Computer games that simulate board games, card games, sporting events, intergalactic battles, street fights, corporate takeovers, or something else, real or imaginary are becoming highly popular. Many require strategy and puzzle solving; others depend only on eye-hand coordination.

- Some times information technology can also unlock our creativity. For example word processors help many of us to become writers.
- Graphics software brings out the artists among us. Desktop publishing systems put the power of the press in more hands. Electronic music systems allow us to compose music.
- IT-enabled electronic appliances are making our lives much easier. These gadgets help us from doing hard work. These help us save time. These appliances have brought previously unheard of comfort and convenience.
- The cooking apparatus, music system, lighting equipment, heating equipment, etc. at your home, if these are IT-enabled, can be controlled through remote controls. Such controls can be programmed to work both when you are at home or away.

7.4 KEY WORDS:

Smart Cards: Smart cards are like credit cards in appearance. But instead of a magnetic strip it contains embedded microprocessors and memory. Some smart cards even contain touch-sensitive keypads for entering numbers. Whether it has a keypad or not, a smart card receives most of its input when it's slipped into a special slot on a computer. Data stored in smart cards can be password protected. There are hundreds of millions of smart cards in use.

Edutainment: *Edutainment* combines education with entertainment. Many IT packages are designed with both education and entertainment content so they can compete with television and electronic games.

Encyclopedias, dictionaries, atlases, telephone directories, medical and other specialized references now come in low-cost CD-ROM versions.

Computer Games: Most computer games are simulations. Computer games can simulate board games, card-games, sporting events, intergalactic battles, street fights, corporate takeovers, or so many different things- either real or imaginary. With dazzling graphics, digitized sound, and sophisticated effects, many of today's computer games represent state-of-the-art software.

7.5 SELF-ASSESSMENT QUESTIONS (SAQs):

15. Discuss the role of IT and computers at home. Give suitable examples.
15. How can computers help us in home money and business management? Elaborate.
15. Home entertainment has under gone revolutionary changes in the last few decades. Discuss these changes in detail.

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Paper: Social Implications of Information Technology

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Lesson no: 8

INFORMATION TECHNOLOGY

IN

EDUCATION AND LEARNING

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Education has always been perhaps the most sought after thing in the world. For this a wide variety of systems have been developed in different times. But today, IT is rewriting the education and learning processes. In this lesson, we shall focus on the role of IT in education and learning. The structure of this lesson shall be as follows:

8.0 Objectives
8.1 Introduction
10.1 Presentation of Content
8.2.1 Limitations of Traditional Learning Systems
8.2.2 Traditional Distance Learning
8.2.3 Traditional Education in IT Age
8.2.4 Virtual Universities
8.2.5 IT in Schools
8.1.5 Computers for Young Children
8.1.5 IT in Institutes of Higher Education
8.1.5 Computers and IT for Research
8.1.5 IT for Distance Learning
8.1.5 Computers for Administrative Uses
8.1.5 IT for Education Outside Schools
8.3 Summary
8.4 Key Words
8.5 Self-Assessment Questions (SAQs)
8.6 References/Suggested Reading

8.0 OBJECTIVES:

In our ever-continuing endeavor to improve the quality of education and learning, we have started large-scale use of computers and information technologies. In this lesson we shall focus on the use of computers and IT in various fields of education. These include the following:

- *Role of IT in schools,*
- *Role of IT in colleges and universities,*

- *Role of IT in distance learning,*
- *Role of IT in research.*

12.0 INTRODUCTION

Education and learning have always been of prime importance for all of us. We have always tried to improve the quality of education and learning. One of the major tools of improving education has been technology. In the recent times, computers and information technologies have provided newer ways and methods of learning and education. These have brought about many revolutionary changes. One major change shall be in the status of educational institutions.

There are significant changes already in the field of education. The studying population has grown larger; it is also becoming older, and has additional obligations - mainly work and family. As a result, there is an increasing demand for a *flexible learning framework*, one that does not bind the learner down to a specific time or place. Differences between individuals also require an adaptable pace and mode of study, suited to personal abilities and different learning styles.

Throughout the industrial era, the educational system focused upon serving the educational needs of youth to prepare them for a lifetime of work.

Today it is clear that the future will involve a lifetime of learning in order to work.

8.2 PRESENTATION OF CONTENT:

A few decades from now, the educational institutions, particularly big university campuses will perhaps no longer exist. They will perhaps become extinct. You may find this hard to believe. But indications are already there. The cost of higher education has increased many folds in the recent times and is still increasing. Already we are beginning to deliver more lectures and classes teaching *off-campus via satellite* or *two-way video*. All this is possible at a fraction of the cost of classroom teaching.

Newer modes of learning are here to stay. **Technology-Mediated Learning (TML)** and **Technology-Mediated Distance Learning (TMDL),** and particularly learning through the Internet, are becoming major vehicles for fulfilling the needs of present day learners. Yes, today we have more and more of learners and less number of regular students who join courses run regularly by institutions of higher education.

Welcome to the world of **life-long learning (LLL)**. This is a highly interesting concept. Life-long learning refers to the new opportunities for learning all through one's life. Such opportunities are available through the integration of learning technologies and information technologies.

In this lesson the content will be presented as follows:

- *Limitations of Traditional Learning Systems*
- *Traditional Distance Learning*
- *Traditional Education in IT Age*
- *Virtual Universities*
- *IT in Schools*
- *Computers for Young Children*
- *IT in Institutes of Higher Education*
- *Computers and IT for Research*
- *IT for Distance Learning*
- *Computers for Administrative Uses*
- *IT for Education Outside Schools*

8.2.1 LIMITATIONS OF EXISTING TEACHING SYSTEM:

Universities and other educational institutions offer an impressive array of advantages, both in theory and in practice. Educational institutions try to provide an ideal and optimal learning situation for an interchange between an instructor and students.

However, traditional learning can no longer satisfy all learning needs for many reasons like:

- High quality learning depends, to a large extent, on finding a sufficient number of suitable lecturers;
- Traditional learning is limited to a particular place (the classroom on campus, which is also expensive to set up), a specific time, and a uniform pace.

8.2.2 LIMITATIONS OF TRADITIONAL DISTANCE LEARNING:

Distance learning provides answers to the problems of availability (accessibility and cost) and the demand for flexibility (time, place and pace) in learning. Traditional distance learning methods (utilized by open universities around the world) mainly use textbooks and other written materials (which replace lecturers), and supply students with varying degrees of individual support (academic and administrative).

Under this model, distance learning is essentially self-learning, and requires great will power and self-discipline on the part of the student as well as suitable learning skills. Such studies often suffer from an inferior public image and/or low popularity compared to regular students of traditional universities. This is because of low-quality academic materials and poor academic control. The problem is compounded because of the difficulty faced by students in dealing alone with complex learning materials with out the help of teachers.

The information and communication era has brought in many opportunities. We have seen large-scale adoption of computers in the 1980s and developments in communications technology in the 1990s. With this, the potential for improving the quality and effectiveness of distance learning has increased.

This has resulted in the development of a variety of learning technologies. This includes the incorporation of a number of new elements into distance learning like video films, multimedia course material, and live lessons delivered to remote classrooms through television or the Internet.

8.2.3 TRADITIONAL HIGHER EDUCATION IN THE *IT* AGE:

The growing demand among learners for improved accessibility and convenience, lower costs, and more direct applicability of contents to work settings is beginning to change the higher education environment. Technological developments like the Internet, digital technology, satellite technology, and innovative applications of virtual reality are having dramatic effects on learning environments at all levels. New teaching and learning styles are being developed. These include:

- *Learning based on prepared electronic materials,*
- *Learning by doing, and*
- *Collaborative learning*

And it seems that we are moving from ***lecturing and telling*** to ***facilitating and guiding*****.**

Major developments are taking place worldwide in higher education. Most universities are in the process of integrating advanced technologies into their regular on-campus teaching practices. These are usually **IT-based asynchronous modes**. Such modes allow **for any-time, any-place, any-**

pace learning and are generally delivered via the Internet. These modes are intended to supplement traditional (synchronous) teaching.

It is now predicted that the distinction and difference between distance and on-campus learning will disappear, and students will act as intelligent consumers who will determine the appropriate combination of courses delivered electronically and physically.

The integration of information technologies and learning technologies provide universities with the opportunity for improved and more effective teaching of on-campus students. This is achieved through the integration of electronic multimedia learning materials, special simulations and demonstrations; accessibility to a variety of knowledge data bases and experts; continuous on-line contact with instructors and peers; better utilization of lessons for discussion and amplification.

Another big change is *inter-university collaborations*. Inter-university networks have been formed for this purpose. As the educational marketplace becomes a global one, new initiatives in the form of international cooperation and global universities are emerging. These global initiatives lead to the formation of **virtual universities**.

8.2.4 VIRTUAL UNIVERSITIES:

Traditional universities can cater to only a limited number of students. But by adopting information technologies, they will be able to reach out to new student populations. They will be able to provide services, such as continuing education (e.g., to engineers, teachers and doctors), and cater to students who meet admissions requirements but who cannot physically attend university campuses for various reasons.

The way to effectively answer the needs of these students is through **technology-mediated distance teaching** (**TMDL**). The traditional mode provides the added value of presenting a complete picture of the subject matter, enabling clarification of complex or difficult topics, providing for real-time interaction and allowing for student socializing. The adoption of newer IT-based technologies takes this to where ever the learners are. Virtual universities are leading to **border-less education**.

8.2.5 INFORMATION TECHNOLOGIES IN SCHOOLS:

Just imagine what will the “perfect” classroom look like in ten or twenty years? The front of the classroom will be a clean white wall; it can be used to show a video clip, project a computer screen image, or even write on with special pens. The wall is touch-sensitive, and a printer is attached to it that can be used to print whatever is currently displayed.

This wall is part of a network with direct access to the **personal digital assistants** (**PDAs**) of each child. At enrollment, each child receives a PDA, which is returned when the child moves to a different school. The PDAs can directly capture text sent from the instructor's computer.

Such an innovation may sound unrealistic. But it is already happening. Now let us discuss the advantages of having computers in the classroom?

8.2.6 COMPUTERS FOR YOUNG CHILDREN:

The first few years of a child's education are crucial. Research has shown that lecturing (talking at students) is not the most effective way to transfer knowledge, and that many people do not learn by sitting still and listening. Every student, regardless of learning style, needs to be visually stimulated and regardless of learning style, needs to be visually involved. Fortunately, visual stimulation and active involvement are two of the things that computers do best.

Now the question arises, when is the best time to expose a child to computers? Computers can be beneficial from the time children begin to learn colors, numbers and letters. A number of different multimedia products, incorporating sound and animation, help pre-school and kindergarten children learn to read.

Besides teaching reading, word pronunciation, and narrative structure, many of the IT based programmes are highly interactive. These programs are not merely adaptations of textbook lessons; they are exercise in participatory learning.

In most elementary schools, overworked teachers teach more than thirty children at a time. Not everyone learns at the same pace or from the same type of material. The teacher simply cannot keep repeating in different ways until he or she is sure that all the children understand the concept. But a computer can do this easily. Computers let every child learn at his or her own pace. Computer programmes can turn difficult concepts and ideas into the interesting and interactive presentations.

Slightly older children can benefit from *edutainment*. It is a combination of education and entertainment. *Edutainment* based programmes present children with facts within the framework of a game. They present a fascinating means of learning by merging fact and fiction.

Some people ask if edutainment is good for children. Others ask should education be fun. The answer to both of these questions is an “Yes”! Learning can and should be fun; students learn more and challenge themselves to go beyond what is required if they are having fun. And computers and IT-based programming help in making learning much more interesting than traditional means of teaching.

8.2.7 COMPUTERS IN INSTITUTES OF HIGHER EDUCATION:

High school and college students also benefit from computer-based learning experiences. The way older students use the computer is very different from the way younger children use it, however. Such programmes are less entertainment oriented but still exciting and challenging.

Using the computer to provide intelligent teaching is increasing in popularity in both high school and colleges. Computer based tutorials (CBT) are helpful to students no matter what their level of subject mastery. Advanced students are not bored by questions that seem repetitive and simplistic, and students having more difficulty with the subject will be asked more questions in order to reinforce concepts. Students receive immediate feedback from the computer, enabling them to see the correct answers while the question is still fresh in the student's mind.

Many colleges are offering introductory computer classes. More and more colleges are making it compulsory that all students learn word processing. Additionally, colleges are changing their curriculum requirements to ensure that all graduates are computer literate.

8.2.7.1 *IT* in the Classroom: Dissecting a frog in the biology class was messy to say the least. Today, students can "dissect" the frog by using a

computer simulation. Students can design a frog, build an animal with the behavior patterns of a frog, teach the animal, stimulate its muscles, and learn about the frog without having to dissect a dead animal.

Educators can also get CD-ROM programs that show a frog being dissected; the illustrations are interspersed with theoretical explanation and line diagrams further illustrating the dissection. Many areas of science such as botany, chemistry, and anatomy can be taught effectively using multimedia presentations.

CD-ROM-based interactive problem-solving programmes also help students develop critical thinking skills.

Computer labs allow students to learn computer skills and to use computers to assist in classes that are not directly computer-related. Computer labs that feature networked computers provide a social learning experience and opportunity for discussion that is both different and superior to the solitary experience of a single user.

8.2.7.2 Simulation Games: To simulate means to create an illusory world that looks very real. Simulations games reflect an aspect of the real world. One of the first, and most popular, simulation games enables the user to “fly” an airplane. A number of realistic and educational flight simulation games are available.

Simulation games have been developed also to teach aspects of business such as production and marketing. Most simulations involve the students in small decision-making groups that compete against each other to produce the most profit.

8.2.8 IT AND COMPUTERS FOR RESEARCH:

The most tedious part of a research study or a science project has always been to find source material. Using computer communications capabilities, students can access primary sources from their school library, classroom or home. Wireless technologies are making access from remote locations effortless.

Using a computer to access the Internet, it is possible for a student to contact an expert on a topic and engage in a dialogue, using e-mail. Libraries can offer on CD-ROM a wealth of resources that the school could not otherwise afford to purchase. Online information services have encyclopedias and a wealth of current articles. The Internet offers users access to libraries around the world. Research skills developed in this way prepare students for the world of work.

Students are also using computers to create projects. Computer-based projects can incorporate text and graphics to explore any topic of interest to a student. Students can narrate the presentation as it

appears on the computer monitor. Instructors can use the projects to determine subject mastery and student skills. Computer-based projects are excellent for individual or group activities.

8.2.9 IT AND COMPUTERS FOR DISTANCE LEARNING

Distance learning takes the classroom to the student. It has been tried without much success over the last few decades. The idea has merit; students who live far away from college campuses find it difficult to get education. Distance learning can and does help such students. Adult students who are working and supporting family members find it difficult to attend classes at fixed times.

More importantly, the primary problem with the early distance learning experiments was the absence of interaction between the instructor and the students. The students read the study material, watched some educational videos and sometimes went to the college campus to take a final exam. This system lacked interaction.

The new computer assisted form of distance learning is considerably different. Using videoconferencing students gather at a center where a satellite transmission is received. The students see the instructor and the entire room where the instructor is located. On the opposite end of the transmission, the instructor can see the students and the room where they are

located. Students and instructor can also talk to each other. The opportunity for interaction leads to an increased amount of learning.

Today, college students can take video courses using their home computers. Students work independently but communicate with faculty and other students by e-mail. Homework assignments are frequently posted, and turned in, using e-mail.

8.2.10 ADMINISTRATIVE USES OF COMPUTERS:

With the increase in population, educational institutes could not function without computers. Some of the ways in which educational institutions use computers are fairly obvious. Computers make it easier for teachers to maintain student grades, develop lesson plans, and create homework assignment. Schools use computers to maintain all students' records, assign students to classes, assign classes to rooms, and pay employees. These functions alone make the computer a necessity. Colleges are also required to use the computer for financial aid reporting procedures.

IT is now increasingly being used for promoting educational institutes. A new marketing strategy is to distribute CD-ROMs that enable students to see the campus, hear students and professors talking about the school, and

learn about financial aid opportunities. Some colleges are paying for virtual-reality technology that gives a prospective student the opportunity to walk through the campus. Many colleges have home pages on the World Wide Web to inform prospective students about their campuses.

College campuses are beginning to feature information kiosks that provide campus maps and listings of college activities. The programs displayed by the kiosks can be updated regularly to provide students with current information.

8.2.11 EDUCATION OUTSIDE THE SCHOOL:

Education does not stop in the classroom. Many computer programmes, disguised as games, are excellent educational tools. When young people are exposed to learn in an enjoyable setting, they want to learn more.

Reference materials can also prove fascinating and educational when presented in the video format or in CD-ROMs. Encyclopedias become fascinating when you can see and hear a video of a famous person or an animal. Encyclopedias on CD-ROM are also much less expensive and contain more current information than encyclopedias in book form. All these products prove that learning is fun and should not be confined to the classroom.

8.3 SUMMARY:

- People learn better when they are actively involved and visually stimulated rather than when they are passive listeners.
- Computer programs are available to assist pre-school children in learning the alphabet and reading.
- *Edutainment* provides educational material in a setting similar to a game so that education becomes entertainment.
- Computer simulations enable students to learn in an interactive, group environment that mirrors a part of the world, such as a particular business enterprise.
- Computers facilitate research by making sources easily available.
- Educational administrators use computers to help run the institution.
- Education should not stop in the classroom. A variety of games, reference materials, and special-interest programs enhance learning at home.

8.4 KEY TERMS:

Personal digital assistants (**PDAs**): This wall is part of a network with direct access to the personal digital assistants (PDAs) of each child. At enrollment, each child receives a PDA, which is returned when the child moves to a different school. The PDAs can directly capture text sent from the instructor's computer

Virtual Universities: Traditional universities can cater to only a limited number of students. But by adopting information technologies, they will be able to reach out to new student populations. They will be able to provide services, such as continuing education (e.g., to engineers, teachers and

doctors), and cater to students who meet admissions requirements but who cannot physically attend university campuses for various reasons.

Flexible Learning Framework: A *flexible learning framework* does not bind the learner down to a specific time or place. Differences between individuals in terms of learning abilities are also taken care off. This flexible framework allows for an adaptable pace and mode of study, suited to personal abilities and different learning styles.

Technology-Mediated Learning (TML): This moves teaching and learning away from the classroom. In traditional teaching, teachers are the major factor. But in TML, there are many sources. Studying and learning through the Internet are becoming major vehicles for fulfilling the needs of present day learners. Thus today we have more and more of learners and less number of regular students who join courses run regularly by institutions of higher education.

Technology-Mediated Distance Learning (TMDL): Distance learning started with studying through correspondence. In traditional distance learning, students depended on the study material provided and the very inadequate contact teaching. Now newer and IT-enabled tools and systems including CDs are replacing the traditional practices. The newer options in TMDL include audio and video cassettes, live or recorded teaching modules on the Internet, etc.

Life Long Learning (LLL): This is a highly interesting concept. Life-long learning refers to the new opportunities for learning all through one's life. Such opportunities are available through the integration of learning technologies and information technologies.

8.5 SELF-ASSESSMENT QUESTIONS (SAQs):

- Discuss the difference between the traditional learning system and the IT-based learning system. Give suitable examples.
- Technology-Mediated-Learning and Technology-Mediated-Distance-Learning are here to stay. In this light discuss the role of IT in education and learning.
- Distinguish and differentiate between traditional universities and virtual universities. Give suitable examples.
- What role do computers and IT play in the education of young children? Elaborate.
- Discuss how educational institutes are using computers and IT.

Discuss what role IT plays in distance learning.

8.6 REFERENCES/SUGGESTED READING:

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Lesson no: 9

INFORMATION TECHNOLOGY AND DIGITAL DIVIDE IN INDIA

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Education has always been perhaps the most sought after thing in the world. For this a wide variety of systems have been developed in different times. But today, IT is rewriting the education and learning processes. In this lesson, we shall focus on the role of IT in education and learning. The structure of this lesson shall be as follows:

9.0 Objectives

9.1 Introduction
9.2 Presentation of Content
9.2.1 Digital Division – an Overview
9.2.2 Measuring Digital Division
9.2.3 Digital Division: The Indian Scenario
9.2.4 Nature of Digital Division
9.2.5 Factors Affecting Digital Division
9.2.6 Initiative to Bridge Digital Division
9.3 Summary
9.4 Key Words
9.5 Self-Assessment Questions (SAQs)
9.6 References/Suggested Reading

9.0 OBJECTIVES:

Information technologies have become very important today. We all know about the great positive changes brought about by the use of IT. But we are also concerned about the still limited reach of IT across many segments of the world. The major concern here is about the divisions caused by IT. The objective of this lesson is to give an overview of the digital division. We shall discuss how digital division is created and its influence on society in general.

- **To Have an Overview About Digital Division**
- To Understand How to Measure Digital Division
- To Know About the Digital Division Scenario in India
- To Understand the Nature of Digital Division
- To Know About the Factors Affecting Digital Division
- To Know About the Initiatives to Bridge Digital Division

9.1 INTRODUCTION

Through out the history of civilization, there have been many divisions in the world. These divisions have been on the basis of geography, race, religion, culture, etc. But perhaps the most important, clear and longest standing division is the economic division between the rich people and the poor people. Large-scale industrialization has further made the rich-poor division more distinct.

The technology divide came after the rich-poor division. This is the division between technology-haves and technology-have-nots. Then the emergence of communication technologies resulted in the information divide between people with access to information and people with no access to information.

Now the information divide has become more complicated. The recent rapid advancements in the field of digital technologies have added another division called the digital divide. This is the division between people with access to digital technologies and people with no access to digital technologies.

Like in case of other divisions, digital division presents a complicated picture. Because, on one hand there are some people with access to and control over digital technologies. Then on the other hand there are large masses of people with no or little access to digital technologies.

There are quite a few problems with digital divide. Today we are living in the most technologically advanced time since the beginning of civilization. But futurologists and planners are predicting a very dark picture of the future. According to certain reports, most of the developing world will be left behind in the race for better living. Vicious circles of poverty and instability are predicted. The gap between rich and poor will widen again. The growth of new Information and Communication Technologies (ICTs) and digital technologies

has given a new dimension to several spheres of human life. It has created a distinct digital divide.

10.1 PRESENTATION OF CONTENT:

The growth of new Information and Communication Technologies (ICTs) has marked the beginning of a knowledge-based society. It has started a very rapid process of globalization. Geographical and political boundaries are vanishing. Easy commercial transactions, improved health care and efficient adoption of innovations and advancements are here to stay.

The same technology has created more gaps among the exiting “haves” and “have-nots. It may even create newer social and economic divisions, leading to social tensions and conflicts. The digital divide has several social implications. The exact nature type and extent of this divide is to be studied and understood.

The term digital divide is of recent origin. However, the division phenomenon is not new. For developing countries like India where the concerns for knowledge gap, inequality of access, highly imbalanced distribution of ICTs and related equipment in different regions, the unequal access to different age groups, and the wide gap in the use by women and men have long been debated.

An effort is made in this lesson to understand the digital divide and the various efforts made for bridging this gap in India. The content of this lesson will be presented as follows:

- Digital Division – an Overview
- Measuring Digital Division
- Digital Division: The Indian Scenario
- Nature of Digital Division
- Factors Affecting Digital Division

o Initiative to Bridge Digital Division

9.2.1 DIGITAL DIVIDE – AN OVERVIEW:

The term digital divide is widely used today. There is not one single definition of digital divide. But most of the definitions are more or less talking about the same thing. At first, some narrower definitions of the digital divide were focused only on access to computers and Internet. But access alone does not bridge the technology gap.

Here are two definitions that state clearly what is digital divide:

> "The term 'digital divide' describes the fact that the world can be divided into people who do have access to and people who don't have access to - and the capability to use - modern information technology, such as the telephone, television, or the Internet. The digital divide exists between those in cities and those in rural areas. It also exists between the educated and the uneducated, between economic classes, and, globally, between the more and less industrially developed nations".

> The digital divide is the "Differences based on race, gender, geography, economic status, and physical ability: *in access to information, the Internet and other information technologies and services*; and *in skills, knowledge, and abilities to use information, the Internet and other technologies*".

First, these two definitions noticeably show the multidimensional nature of the digital divide. They stress the necessity of access and knowledge. A third dimension can be added, which is content. These three key points access, knowledge, and contents are what will determine the participation to Internet and IT related activities.

Looking at access, we can see that the Internet is expanding its territory very rapidly. Soon we might be able to get the Internet anywhere and in multiple forms (you can already find it in mobile phones or digital

Televisions). However, today it is still mainly through computers that one can access the web. Either you can buy your own computer to access Internet but this is not affordable for all.

Governments aware of this financial problem are pushing for installation of computers in public spaces, such as libraries or post offices in villages and many remote areas. The market also tries to answer this new demand by the creation of cyber cafés. The success of cyber cafes depends on fast connections at low price and a 24 hours access.

Another important aspect of the digital divide is the training level of the users. Most of people are scared of the newer technologies and thus shy away from using them.

> Moreover the fast pace of evolution of information technology requires any participant in the Information Society to continually improve one's knowledge. In addition, mastering the Internet, one needs formal training, but knowledge also develops through learning by doing, one can improve it by trying things out, sharing one's problems and seeing what others are doing. All this will contribute to a lifelong learning society where people will have to continuously learn to master these constantly changing technologies, and therefore to be able to participate in their society.

Finally to participate, people must have access to information that is relevant for them; the contents can be found on the Web will determine the success of this participation. Currently on the web, more than 78% Websites are in English. Also 96 % of e-commerce sites are in English.

The dominance of English, and especially US content, makes it less useful to other countries. English speakers were the first users of Internet, so the predominance of their language was natural. But, now a days just over 50% of all Internet users are native English speakers with an increasing

diversity of users but this, so there is a necessity to have more variety in languages on the Web.

Additionally, non-English countries produce less local content making the Internet less relevant to their lives. It is also necessary that users become content creators as well by the creation of their own websites. By doing that, they participate in the construction of the Web and produce sites that might interest others.

9.2.2 MEASURING THE DIGITAL DIVIDE:

"Digital divide" is one of the most talked about topics today. The International Network of UNESCO Chairs in Communications, Montreal (Canada) undertook a project to decide a methodology to measure the digital divide. The methodology and model for measuring the disparities among social groups within a nation or between the nations in access and utilization of new communication technologies is called the Digital Divide Index (DDI).

This index is used to measure the degree of 'ICT-ization' or presence of ICT. The DDI takes into consideration a combination of 'info-density' and 'info–use'. Info-density refers to the ICT capital and ICT personnel, and their role in the productive capacity of the economy. It includes ICT networks, machinery and equipment, as well as ICT skills, indispensable for the functioning of information, knowledge-oriented societies. Info-use refers to the utilization of various ICTs by households, businesses and governments and the intensity of their actual use.

9.2.3 DIGITAL DIVIDE - THE INDIAN SCENARIO:

India is a very large country with a population of over a billion and diversity of languages, geographical climates, religions, etc. It is also a country of

contrasts. India houses the highest number of illiterate people in the world. At the same time India has a very large pool of highly skilled IT professionals and has the third highest scientific manpower in the world. India also presents a clear-cut case of digital divide.

The major problem with the digital divide in India is the spread of information and communication technologies. The spread of technology is far from equal and it flows from the top to the bottom very slowly and unevenly. A large number of urban, educated middle class persons have access to the most modern means of Information and Communication Technologies (ICTs). These are satellite or cable television; Internet; personal computers; mobile telephones; facilities of audio-video teleconferencing, etc.

In comparison, in most of the villages in India there are only a few TV sets because of irregular electricity supply and poor affordability. In such a situation, it is obvious that most of the villages in India do not have the most elementary ICTs, There are lakhs of villages where there is no access to new ICTs like the Internet or even the PC.

9.2.4 THE NATURE OF THE DIGITAL DIVIDE:

It is understood that the digital divide exists not only between different countries but also between various segments within a country. For example, there is a distinct digital divide between rural and urban areas; men and women; literate and illiterate populations; young and old; etc. Of course, exact data on the quantum of the divide are not available.

A recent study of various Asian countries reveals that countries like Pakistan, Sri Lanka and China, along with India provided their people with greater access to media like television. In Singapore, Malaysia, Indonesia,

Thailand and the Philippines, computer networks are more common. Japan is another leading info-state with maximum reach and use of ICTs.

Bangladesh lacks most of the ICT facilities. Yet in Bangladesh, the new communications technologies are already seen to be making an impact on the lives of rural people. A 'Grameen Phone' (Village phone) programme in Bangladesh enables rural people not only to interact but also to do business.

In India, the new technologies like computers, the Internet and cell phones are available largely in cities. Such technology is available more to men and less to women. Also younger people have more access to such technologies than older people. Knowledge and power are concentrated in the hands of the privileged few that own and control the communications system.

9.2.5 FACTORS AFFECTING DIGITAL DIVIDE:

Digital divide has basically four main aspects. These are:

(i) Level of technology (Technology),
(ii) Penetration and availability (Reach),
(iii) Use and Consumption (Access), and
(iv) Socio-economic effect (Impact).

All these aspects are important as each factor or any combination of the above factors can really widen digital divide. In addition, there are some equally important factors that affect digital divide. These are:

- Economic, geographic and educational inequalities between developed and developing countries. Such inequalities among areas within a country (like rural-urban areas) can also lead to digital divide.
- 85% Internet content is in English whereas 10% world's population speaks English. A large number of Indians are fluent

in English but the overall percentage of Indians knowing English remains a miniscule.

- Hesitation in accepting new technology (resistance). This is not a major constraint in India as there is little resistance to accepting new technologies and the people also have the skills to use and are very adept at it. This is more evident in case of people who use technology for the first time.
- Lack of awareness regarding new technologies or lack of motivation from the society/family/educational institutes. This also is not a major constraint in India.
- Cost of the new equipment like computers and related software. It is very often the recurring expenditure that discourages people rather than the initial investment
- Technological barrier such as unavailability of infrastructure or lack of training. Such support systems are not easily available or are very expensive. For example, irregular electricity supply prevents viewing of television or inefficient telephone lines hamper the use of Internet. On the other hand, systems with better speed and better connectivity are quite costly.

9.2.6 INITIATIVES TO BRIDGE DIGITAL DIVIDE:

The digital divide is not just a technical gap. It involves serious socioeconomic and developmental consequences. There can be serious, social, political and economic problems as a consequence of continued digital divide. It is also important that necessary actions are taken to minimize and if possible, bridge the digital gap.

The big question is what can be done about it? One option is to leave it to the market forces. The spread of satellite and cable television networks is

largely due to market forces. The phenomenal growth in the number of mobile phones is largely due to the market forces. There are two main reasons here. One the prices involved in getting a cable TV connection or a mobile phone is quite affordable. But a simple personal computer costs at least twenty thousand rupees. The second reason is that cable TV and mobile phones offer instant gratification, i.e., their benefits are immediate.

The growing market forces may over a long period of time help in spreading the communication technologies – the trickle down effect – but by and large the benefits of the market economy go to the privileged few. Market forces will go only where there is money and cannot always help in bridging the divide. By and large the market forces tend to increase rather than bridge the digital divide.

`It is also true that such market forces can play an important part only if the government policies are favorable and if there is a strong industrial base to support. India today certainly has a favorable situation on both these counts. In spite of all these advantages of efficiency of the market forces, there is an inevitable necessity for planned intervention from other sources as well.

Some Indian states are endowed with excellent infrastructure, have forward looking policy initiatives, facilitate access to ICTs and encourage the use of ICTs. States like Andhra Pradesh, Kerala, Tamil Nadu and Karnataka fall in the high ICT category states and some regions of the Northeast and states like Uttar Pradesh and Bihar would probably fall in the low ICT category. Unfortunately there is hardly any empirically measured study on these regional disparities.

Andhra Pradesh government has launched initiatives to provide land records, property taxes, birth and death data, and applications for certificates. Similarly Tamil Nadu provides citizen services in Tamil and English languages

on land records, birth and death certificates, subsidy schemes, college admission forms and examination results. In Kerala, Karakulam Panchayat has developed a Knowledge Village Portal. An electronic citizen database has been created for more than 20 million Kerala citizens in the form of electoral identify cards. The state government has also introduced interactive voice response systems in their citizen interaction, such as for distributing election results.

Other states like Madhya Pradesh, Haryana, West Bengal and Gujarat have also taken significant steps in launching e-government services.

One of the main objectives of Indian Space Research Organization (ISRO) is to promote the application of space technology for socio-economic development of the people in India specially in the rural areas. These programmes have made significant contribution to bridging the digital divide.

One of the early programmes of ISRO was the Satellite Instructional Television Experiment (SITE). In this experiment conducted during 1975-76, 2400 TV sets were installed in 24 isolated villages of selected six states of India – Rajasthan, Bihar, Orissa, Madhya Pradesh, Karnataka and Andhra Pradesh. These programmes were produced in local languages in addition to programmes in Hindi. The programmes were based on developmental issues like agriculture, animal husbandry, dairy, poultry, health, family planning, education and environment. These programmes were transmitted through satellite and received through Direct Reception System (DRS). SITE is described as “the biggest socio-technological experiment of the world”. SITE amply demonstrated that development communication is possible on a large scale in areas where it is most needed.

Another landmark experiment was the Kheda Communications Project (KCP). As a part of SITE a low power TV transmitter in Pij village of Kheda district of Gujarat was set up to relay local programmes on developmental

issues. 550 community TV sets were installed in about 400 Kheda villages. The experiment continued for about 18 years. KCP aimed at reaching the unreached through a local broadcast approach. The prime target audiences were the lower socio-economic segments of rural areas.

More recently conducted Jhabua Development Communications Project (JDCP) had two major components – broadcasting and interactivity. The broadcasts of evening development programmes initially reached viewers of 150 village panchayats of Jhabua district through 150 Direct Reception System (DRS) centres. The scope was eventually extended to cover over 1000 village panchayats of Jhabua, and adjoining parts of Dhar and Barwani districts. Talkback terminals were installed in 12 block headquarters of Jhabua for the training of district and block level functionaries using interactive training mode through satellite. The presently on-going project was started in 1996. A significant feature of JDCP was that it made a departure from one-way broadcasting to two-way interactive communication (Joshi, 2002). This obviously goes a long way in bridging the divide.

ISRO's Training and Development Communication Channel (TDCC) was formally inaugurated in 1995. It is a dedicated interactive communication channel for providing training to a variety of users. It uses one-way video and two-way audio teleconferencing for training of field level development functionaries, school teachers, etc. It is also used "to monitor the progress of development work and to get feedback from the grassroots levels".

Apart from government department and agencies, the Non-Government Organisations (NGOs) have also significantly contributed to spread of ICT based content. NGOs play a key role in bringing the Internet to rural areas. An NGO called Voices in Karnataka is setting up a community Internet access for persons with disabilities. In Maharashtra, Internet facilities are set up to provide the latest global agricultural market rates to benefit the

farmers. Literally hundreds of such examples abound to illustrate the important role of modern ICTs playing a significant role of bridging the digital divide.

9.3 SUMMARY:

- The digital division is the division between people with access to digital technologies and people with no access to digital technologies.
- For developing countries like India, Digital division is all about knowledge gap, inequality of access, highly imbalanced distribution of ICTs and related equipment in different regions including the unequal access to different age groups.
- The digital divide is the "Differences based on race, gender, geography, economic status, and physical ability in access to information, the Internet and other information technologies and services; and in skills, knowledge, and abilities to use information, the Internet and other technologies.
- Digital Divide Index (DDI) is used to measure the degree of 'ICT-ization' or presence of ICT. The DDI takes into consideration a combination of 'info-density' and 'info–use'. Info-density refers to the ICT capital and ICT personnel, and their role in the productive capacity of the economy. It includes ICT networks, machinery and equipment, as well as ICT skills.
- The spread of IT in India is far from equal and it flows from the top to the bottom very slowly and unevenly.
- Digital divide has basically four main aspects. These are: Level of technology, Penetration and availability (Reach), Use and Consumption (Access), and Socioeconomic effect (Impact).

- The fast pace of evolution of information technology requires any participant in the Information Society to continually improve one's knowledge. In addition, mastering the Internet, one needs formal training, but knowledge also develops through learning by doing, one can improve it by trying things out, sharing one's problems and seeing what others are doing. All this will contribute to a lifelong learning society where people will have to continuously learn to master these constantly changing technologies, and therefore to be able to participate in their society.
- The Information and Communication Technologies are the most modern means of Information exchange and Communication. These are satellites, cable television; Internet; personal computers; mobile telephones; facilities of audio-video teleconferencing, etc.

9.4 KEY WORDS:

Digital Divide: "The term 'digital divide' describes the fact that the world can be divided into people who do have access to and people who don't have access to - and the capability to use - modern information technology, such as the telephone, television, or the Internet. The digital divide exists between those in cities and those in rural areas. It also exists between the educated and the uneducated, between economic classes, and, globally, between the more and less industrially developed nations".

Digital Divide Index: Digital Divide Index (DDI) is used to measure the degree of presence of ICT. The DDI takes into consideration a combination of 'info-density' and 'info–use'. Info-density refers to the ICT capital and ICT personnel, and their role in the productive capacity of the economy. It includes ICT networks, machinery and equipment, as well as ICT skills.

Information and Communication Technologies: These are the most modern means of Information exchange and Communication. These ICTs are satellites, cable television; Internet; personal computers; mobile telephones; facilities of audio-video teleconferencing, etc.

9.5 SELF-ASSESSMENT QUESTIONS (SAQs)

6. What is digital divide? Discuss in detail giving examples.
6. Discuss the digital division scenario in India.
6. Write a note on how digital division is measured.
6. What factors affect digital division?
6. Discuss in detail some major initiatives to bridge digital divide in India.

9.6 REFERENCES / SUGGESTED READING:

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PRIVACY AND SECURITY ISSUES AND INFORMATION TECHNOLOGY

Writer: Sh. M.R. Patra
Lecturer,
Dept. of C. M. & T.
Guru Jambheshwar University of Science and Technology,
Hisar, (Haryana).

Vetter: Prof. Manoj Dayal
Dean, Faculty of Media Studies,
Guru Jambheshwar University of Science and Technology,
Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Information technology has thrown the world wide open. It has been able to actually realize the concept of *Global Village* as conceptualized by Marshal McLuhan. It has made it possible the concept of virtual offices. IT has shrunk this world. It has over come the barriers of both time and space.

IT and particularly the Internet has become a platform for inter-personal communication, group communication and mass communication. More importantly, loads of data are transferred using IT-enabled tools and techniques.

How ever, IT has created many controversies. Two of the most controversial issues related to IT are *privacy and security*. We shall discuss these issues in this lesson. The lesson structure is as follows:

10.0 Objectives
10.1 Introduction
10.2 Presentation of Content
10.2.1 Privacy and IT
10.2.2 Errors and Accidents in the Fields of Computers and IT
10.2.3 Natural and other Hazards in the Fields of Computers and IT
10.2.4 Crimes Against Computers and Communications Systems
10.2.5 Crimes Using Computers and Communications
10.2.6 Various Computer Worms and Viruses
11.2.7 Criminals in the Fields of Computers and IT
10.2.8 Safeguarding Computers & Communications
10.3 Summary
10.4 Key Words
10.5 Self-Assessment Questions (SAQs)
10.6 References/Suggested Reading

10.0 OBJECTIVES:

Computers and information technologies have emerged as major tools that help us do things effectively and efficiently. But both these fields have certain problem areas. Privacy and security issues are a major concern in the fields of computers and information technologies. In this lesson we shall discuss

some privacy and security issues with regard to computers and information technologies.

The objectives of this lesson are:

- ***To Know About Privacy and IT***
- *To Know About Errors and Accidents in the Fields IT*
- ***To Know About Natural and other Hazards in the Fields of Computers and IT***
- ***To Understand about Crimes Against Computers and Communications Systems***
- ***To Understand About Crimes Using Computers and Communications***
- ***To Know About Various Computer Worms and Viruses***
- ***To Know About How Criminals Operate in the Fields of Computers and IT***
- ***To Understand How to Safeguard Computers & Communications***

10.1 INTRODUCTION:

Computers and information technologies have brought about an overwhelming evolution in all most every field. Today computers and IT have become omnipresent. They are present everywhere – at offices, at home, in factories, in shops. Computers and IT are also being considered omnipotent. The present day computers along with the IT facilities are fast, highly efficient, and uniquely multifaceted.

While computers have changed our working procedures, IT has changed our perception about working styles. At the same time certain issues have raised their ugly head. One such major concern is that of privacy. Another major issue is that of security in the fields of computers and information technologies. There are many major privacy and security issues in the fields of computers and information technology. These are discussed below.

10.2 PRESENTATION OF CONTENT:

Privacy and IT

Errors and Accidents in the Fields of Computers and IT

Natural and other Hazards in the Fields of Computers and IT
Crimes Against Computers and Communications Systems
Crimes Using Computers and Communications
Various Computer Worms and Viruses
Criminals in the Fields of Computers and IT
Safeguarding Computers & Communications

10.2.1 PRIVACY AND IT:

Privacy is the right of people not to reveal information about them. Privacy is an individual's right to be left alone. There are many private and personal things and information about us that we do not want to reveal to any body. It is obvious that we want these private things and information to remain private and not be made public.

Some people with malicious intentions try and collect such information for the purpose of black mailing. But equally frustrating, if not equally dangerous, are those people who sell private information for a profit. These people are called privacy invaders. They collect information from the different forms that we fill up at different times, like credit card applications, bank applications, etc.

Recently there have been many cases of where employees of BPO service providers selling sensitive private information.

Surveillance:

Another major area of concern is surveillance. People are some times kept under surveillance for security reasons. When done by police or other security agencies for the purpose of investigation, it can be justified. But often surveillance is unjustified and is surely a breach into the individual's privacy.

Today many advanced and miniaturized gadgets are available for surveillance. These include small cameras that can be fitted in to pens, tiepins, shirt buttons, etc or can also be hidden in walls. There is miniature audio recording equipment also. The mobile revolution has resulted in both audio and video-recording devices in built into mobile phones. This has made recording under cover possible with out the knowledge of person being filmed. The recent rise in obscene MMS cases is a result of this.

10.2.2 ERRORS & ACCIDENTS IN THE FIELD OF COMPUTERS AND *IT*:

In general, errors and accidents in computer systems may be classified as *human errors, procedural errors, software errors, electromechanical problems,* and *"dirty data" problems*.

Human Errors:

Often there are some "unintended effects of technology". This means unexpected things people do with technical equipment and systems. Among the ways in which people can complicate the workings of a system are the following.

- Humans often are not good at assessing their own information needs. For example, many users will acquire a computer and communications system that either is not sophisticated enough or is far more complex than they need. This could lead to complications.
- Humans act on their perceptions, which in modern information environments are often too slow to keep up with the equipment. Decision influenced by information overload, for example, may be just as faculty as those based on too little information.

Procedural Errors:

Some major computer failures have occurred because people do not follow procedures. A few years back, Nasdaq, America's second largest stock market, was shut down for two and half hours by an effort, ironically, to make the computer system user-friendlier.

Software Errors:

Errors often occur because of problems with the software like "software glitches" or "software bugs". A software bug is an error in a programme. Such a bug does not allow the system to work properly. Smaller problems can be solved easily. But major problems can render systems nonfunctional.

Electromechanical Problems:

A computer system has some mechanical parts. These mechanical parts, such as printers can have problems. Similarly electrical systems, such as circuit boards, don't always work. They may be faultily constructed, get dirty or overheated, wear out, or become damaged in some other way. Power failures can shut a system down. Power over charge can also burn out equipment.

Modern systems are made up of thousands of parts, all of which interrelated in many ways. Thus "normal accidents" are inevitable. That is, it is almost certain that there will be some minor faults. Combinations of minor failures could some times amount to something catastrophic. Indeed, it is just such collections of small failures that led to catastrophes such as the blowing up of the Challenger space shuttle in 1986.

Dirty Data problems:

Data-entry operators around the world feed a continual stream of raw data into computer systems. All raw data is not good data. Some times some of these data could be incomplete, outdated, or otherwise inaccurate. A lot of problems are caused by this kind of “dirty data.” It is thus advisable that you check your records – credit, medical, and school records so that you can make any corrections to them before they cause you complications.

10.2.3 NATURAL AND OTHER HAZARDS:

Some system problems merely lead to temporary system failure. But major hazards can wreck the entire system. Examples are natural hazards, and civil calamities and terrorism.

Natural hazards:

Major hazards of the natural kind that are harmful to property and people are also harmful to computers and communications systems. These include natural disasters like fires, floods, earthquakes, tornadoes, hurricanes, etc.

Natural hazards can disable all kinds of electronic systems that under normal circumstances we take for granted. Without power and communication connections, no electronic or IT-based system will work. Systems like personal computers, automated teller machines, credit-card verifiers, and office computers will be useless in case of natural calamities.

Civil Calamities and Terrorism:

Wars and insurgencies seem to take place in many parts of the world. Also we are not immune to civil unrest. Nor are we immune to acts of terrorism. The 2001 hijacked plane crashes into the World Trade Center and the Pentagon caused major breakdowns to their computer systems. The Pentagon alone has 650,000 terminals and workstations, 100 WAN

connections and 10,000 LAN connections. Thankfully, the September 11, 2001, terrorist attack damaged only a few of them.

10.2.4 CRIMES AGAINST COMPUTERS & COMMUNICATION SYSTEMS:

There are two types of computer crimes. It can be an illegal act perpetrated against computers or telecommunications. Or it can be the use of computers or telecommunications to accomplish an illegal act.

Crimes against information technology are generally related to theft. People from outside and inside including employees can and some times do steal hardware, software, computer time, cable or telephone services, or information stored in the systems. Other illegal acts are related to malice and destruction.

Theft of Hardware:

Hardware theft can range from shoplifting an accessory in a computer store to removing a laptop or cellular phone from someone's car. Professional criminals may even steal shipments of microprocessor chips, etc.

Theft of Software and Music:

Generally, software theft involves illegal copying of programmes or software piracy, rather than physically taking someone's disks, etc. Software makers secretly search for illegal users and sellers. They also look for organizations that "soft lift". These are companies, colleges, or other institutions that buy one copy of a program and make copies for many computers.

Co-workers and others report many such pirates to the “software police,” who have the special assignment of looking for such illegal activities and take necessary action.

Another type of software theft is copying or counterfeiting of well-known software programs. These pirates often operate in China, Taiwan, Mexico, Russia, and various parts of Asia and Latin America. In these countries, most of popular computer software is copied illegally and sold at cheaper rates all over.

Theft of time and services:

The theft of computer time is more common than one might think. Probably the biggest instance is people using their employer’s computer time to play games, do online shopping or stock trading, or search for pornography on the Internet.

For years “phone thieves” have troubled the telephone companies. For example, they have found ways to get into company voice-mail systems, then use an extension to make long-distance calls at the company’s expense. They have also found ways to tap into cellular phone networks and dial for free.

Theft of Information:

"Information thieves" infiltrate into computer systems of various organizations, steal confidential personal records, and sell the information. Thieves also break into computers of the major credit bureaus and steal credit information. They have then used the information to charge purchases or have resold it to other people.

Crimes of Malice and Destruction:

Sometimes criminals are more interested in creating nuisance. They believe in abusing or vandalizing computers and telecommunications systems than in profiting from them. Such thieves break into other's computer systems and destroy important information or leave obscene messages.

10.2.5 CRIMES USING COMPUTERS & COMMUNICATIONS:

Just as a car can be used to perpetrate or assist in a crime, so can information technology. For example, computers can be used to counterfeit currency notes, certificates, passports and driving licenses.

In addition, economic and commercial fraud has come to cyberspace. Many people now use online services to manage their stock portfolios through brokerages hooked into the services. Scamsters have followed, offering

nonexistent investment deals and phony solicitations, and manipulating stock prices.

10.2.6 WORMS & VIRUSES:

Worms and viruses are forms of high-tech maliciousness. There are about 57,000 known worms and viruses, not to mention others that could afflict you in the future. Researchers say they typically discover between 500 and 800 new ones every month.

A worm is a program that copies itself repeatedly into a computer's memory or onto a disk drive. Sometimes it will copy itself so often that it will cause a computer to crash. Three recent examples are Code Red, SirCam, and Nimda. The Code Red worm primarily affected Microsoft Windows NT and 2000 systems that function as web servers. It even tried to attack the White House web site and many public web sites. The SirCam worm was passed through infected Outlook e-mail attachments; it sent copies of itself to all addresses in the user's e-mail address book. Like Code Red, the Nimda worm attacks Windows NT or 2000 machines. It reportedly entered more than a million computers in the United States, Europe, and Asia, congesting Internet traffic and resulting in some computer shutdowns.

A virus is a “deviant” programme, stored on a computer hard drive, which can cause unexpected and often undesirable effects, such as destroying or corrupting data. The famous e-mail Love Bug (its subject line was *I Love You*), which originated in the Philippines and did perhaps as much as $10 billion in damage worldwide, was both a warm and a virus. A variation on the Melissa worm, it spread faster and caused more damage than any other bug before it. Worms and viruses are passed in two ways:

The first way is via an infected disk, perhaps obtained from a friend, cyber café, etc.

The second way is via a network, as from e-mail or an electronic bulletin board, and the Internet. This is why, when taking advantage of all the free games and other software available online, you should use virus-scanning software to check downloaded files.

The virus usually attaches itself to your hard disk. It might then display annoying messages (“I Love You”, etc.) or cause Ping-Pong balls to bounce around your screen and knock away text. More seriously, it might add garbage to your files, then erase or destroy your system software. It may evade your detection and spread its havoc elsewhere, since an infected hard disk will infect every floppy disk used by the system.

If you look in the utility section of any software store, you will see a variety of anti-virus programmes. **Anti-virus software scans a computer's hard disk, floppy disks, and main memory to detect viruses and, sometimes, to destroy them.** Such virus watchdogs operate in two ways. First, the scan disk drives for "signatures," characteristic strings of 1s and 0s in the virus that uniquely identify it. Second, they look for suspicious virus-like behavior, such as attempts to erase or change areas on your disks. Examples of antivirus programs are *Symantec's Norton Anti-Virus, McAfee Virus Scan, Panda Anti-Virus Platinum, and Computer Associates' E Trust EZ Antivirus for Windows, and Virex for Macintosh systems*.

10.2.7 COMPUTER CRIMINALS:

Many people are involved in information technology crime. Out of these, over 80% may be employees, the rest are outside users, hackers and crackers, and professional criminals.

Employees:

Seventy five to 80% of computer crimes happens from inside. Most of these involve credit cards, telecommunications, employees' personal use of

computers, unauthorized access to confidential files, and unlawful copying of copyrighted or licensed software.

Employees may use information technology for personal profit, or steal hardware or information to sell. They sometimes do it for revenge.

Outside Users:

Suppliers and clients may also gain access to a company's information technology and use it to commit crimes. This becomes will increase as electronic connections such as intranets and extranets become more commonplace.

Hackers and Crackers:

The term **hacker** is one of the most overused terms in the field of IT. This term is generally applied to anyone who breaks into a computer system. Some people think it means almost any computer criminal. In reality, there is a difference between hackers and crackers, although the term cracker has never been popular.

Hackers are people who gain unauthorized access to computer or telecommunications systems, often just for the challenge of it. Some

hackers even believe they are performing a service by exposing security flaws. Whatever the motivation, network system administrators take any kind of unauthorized access as a crime.

Crackers are people who illegally break into computers for malicious purposes-to obtain information for financial gain, shut down hardware, steal software, or alter or destroy data.

Professional Criminals:

Organized criminals steal information technology on a larger scale. They also use stolen technology for illegal purposes. For instance, databases can be used to keep track of illegal gambling debts and stolen goods. Not surprisingly, the illegal *satta* operation has gone high-tech, with bookies using computers, mobile phones and fax machines in place of betting slips and paper. Some *satta* organizations now have their own web sites.

Information-technology crime has become more sophisticated. So have the people charged with preventing it, Major police departments and other crime fighting organizations have sophisticated cyber expertise and personnel. Industry organizations such as the Software Publishers Association are getting very strict with software pirates. Commercial software piracy is now a major crime, punishable by up to five years in prison and

heavy fines. Police departments now have officers patrolling a “cyber beat.” They regularly surf online bulletin boards and chat rooms looking for pirated software, stolen trade secrets, child molesters, and child pornography.

In 1998, the U.S. Defense Department created the Computer Emergency Response Team (CERT). This organization has no power to arrest or prosecute. How ever, CERT provides round-the-clock international information and security-related support services to users of the Internet. Whenever it gets a report of an electronic crime, whether on the Internet or on a corporate e-mail system, CERT stands ready to lend assistance. It helps the organization under attack, helps fight the cyber crime, and evaluates the system afterward to protect against future break-ins.

10.2.8 SAFEGUARDING COMPUTERS & COMMUNICATIONS:

From developers to common users, every body is concerned about security of computer systems. **Security is a set of safeguards for protecting information technology against disasters, systems failure and unauthorized access that can result in damage or loss.** There are three components of security. These are:

- Identification and access
- Encryption

- Protection of software and data

Identification & Access:

There are three ways a computer system can verify that the user has legitimate right of access. Some security systems use a mix of these techniques. The systems try to authenticate the user's identity by determining *what the user has, what the user knows,* or *who the user is.*

What the User Has – Cards, Keys, Signatures, Badges: Most of the electronic or IT-enabled cards like credit cards, debit cards, and cash-machine cards have magnetic strips or build-in computer chips that identify the user. Most computer systems require you to punch in the user card for identification and authentication before allowing access.

What the User knows- PINs, Passwords, and Digital Signatures: Access to one's bank account through an automated teller machine (ATM) is through the PIN number.

A password is a special word, code, or symbol required to access a computer system. Passwords are considered one of the weakest security links. Passwords and PINs can be guessed, forgotten, or stolen. Experts recommend that never choose a real word or variations of your name, birth date, or those of your friends or family. Instead you should mix letters,

numbers, and punctuation marks in an oddball sequence of no fewer than eight characters. One good password is *2b/or NOT 2b%*.

Who the User is - Physical Traits: Some forms of identification can't be easily faked. These include one's physical traits. **Biometrics tries to use physical traits in security devices.** *Biometrics* is the science of measuring individual body characteristics. The most commonly used physical traits for security purposes are fingerprints and palm prints.

Besides these, other biological characteristics read by biometrics devices are computerized "finger imaging", voices, the blood vessels in the back of the eyeball (retinal scan), the lips, and even the entire face.

Some computer security systems have a "call-back" provision. In a call back system, the user calls the computer system, punches in the password, and hangs up. The computer then calls back a certain pre-authorized number. This measure will block anyone who has somehow got hold of a password but is calling from an unauthorized telephone.

Encryption:

Encryption is the altering of data so it is not usable unless the changes are undone. Good encryption systems are practically unbreakable, even experts

can not crack it. One such system is PGP or *Pretty God Privacy*. Another encryption system is DES *or Data Encryption Standard*.

Encryption experts also use powerful mathematical concepts to create coded messages that are not easy to break. Encryption is clearly useful for some organizations, especially those concerned with trade secrets, military matters, and other sensitive data. A very sophisticated form of encryption is used in most personal computers and is available with every latest model web browser. In fact, encryption has made online shopping or stock trading more safe and secure.

Protection of Software and Data:

Organizations do a lot to protect their programmes and data. Such measures include educating employees about making backup disks, protecting against viruses, etc. There are other security procedures also.

Control of Access: Access to online files is restricted to those who have a legitimate right to access, because they need them to do their jobs. Many organizations have a system of transaction log books for recording all accesses or attempted accesses to data.

Audit Controls: Many networks have audit controls for tracking which programmes and servers were used, which files opened, and so on. This

creates an audit record of how a transaction was handled from input through processing and output.

People Controls: Because people are the greatest threat to a computer system, security precautions begin with the screening of job applicants. Resumes are checked very strictly. In another control measure, people are not allowed to wander freely into areas not essential to their jobs.

Manual and automated controls, input controls, processing controls, and output controls are used to check if data is handled accurately and completely during the processing cycle. Printouts, printer ribbons, and other waste that may contain passwords and trade secrets are destroyed

10.3 SUMMARY:

- Errors and accidents in computer systems include human errors, procedural errors, software errors, electromechanical problems, and “dirty data” problems.
- Natural hazards can disable all kinds of electronic systems that under normal circumstances we take for granted. Without power and communication connections, no electronic or IT-based system will work. Systems like personal computers, automated teller machines, credit-card verifiers, and office computers will be useless in case of natural calamities.
- There are two types of computer crimes. It can be an illegal act against computers or telecommunications or it can be the use of computers or telecommunications to accomplish an illegal act.
- Information thieves infiltrate into computer systems of various organizations, steal confidential personal records, and sell the information.
- Computers can be used to counterfeit currency notes, certificates, passports and driving licenses.
- A worm is a program that copies itself repeatedly into a computer’s memory or onto a disk drive. Examples are Code Red, SirCam, and Nimda.
- A virus is a “deviant” programme, stored on a computer hard drive, which can cause unexpected and often undesirable effects, such as destroying or corrupting data. A famous virus is the e-mail Love Bug. Worms and viruses are passed, through discs or through networks.

- Many people are involved in information technology crime. Out of these, over 80% may be employees, the rest are outside users, hackers and crackers, and professional criminals.

10.4 KEY TERMS:

Privacy: It is the right of people not to reveal information about themselves. Privacy is an individual's right to be left alone. There are many private and personal things and information about us that we do not want to reveal to any body. It is obvious that we want these private things and information to remain private and not be made public.

Surveillance: Another major area of concern is surveillance. People are some times kept under surveillance for security reasons. When done by police or other security agencies for the purpose of investigation, it can be justified. But often surveillance is unjustified and is surely a breach into the individual's privacy.

Errors: Errors and accidents in computer systems may be classified as *human errors, procedural errors, software errors, electromechanical problems,* and *"dirty data" problems*.

Crimes against computers & Communications systems: There are two types of computer crimes. It can be an illegal act perpetrated against computers or telecommunications. Or it can be the use of computers or telecommunications to accomplish an illegal act.

Crimes against information technology are generally related to theft. People from outside and inside including employees can and some times do steal hardware, software, computer time, cable or telephone services, or information stored in the systems. Other illegal acts are related to malice and destruction.

Worms: A worm is a programme that copies itself repeatedly into a computer's memory or onto a disk drive.

Viruses: A virus is a "deviant" programme, stored on a computer hard drive, which can cause unexpected and often undesirable effects, such as destroying or corrupting data.

Anti-virus software: Anti-virus software scans a computer's hard disk, floppy disks, and main memory to detect viruses and, sometimes, to destroy them.

Computer criminals: Many people are involved in information technology crime. Out of these, over 80% may be employees, the rest are outside users, hackers and crackers, and professional criminals.

Hackers: Hackers are people who gain unauthorized access to computer or telecommunications systems, often just for the challenge of it.

Crackers: Crackers are people who illegally break into computers for malicious purposes-to obtain information for financial gain, shut down hardware, steal software, or alter or destroy data.

Computers security: Security is a set of safeguards for protecting information technology against disasters, systems failure and unauthorized access that can result in damage or loss.

Encryption: It is the altering of data so it is not usable unless the changes are undone. Good encryption systems are practically unbreakable, even experts cannot crack it.

13.4 SELF-ASSESSMENT QUESTIONS (SAQs):

1. Explain some of the errors, accidents, and hazards that can affect computers.
1. What are the principal crimes against computers? Explain in detail.
1. What are some crimes using computers? Elaborate with examples.
1. Describe some types of computer criminals. Give suitable examples.

10.6 REFERENCES / SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams, Stacy C. Sawyer and Sarah E. Hutchinson; Irwin Publishing; Chicago; 2003
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- Information Technology in Action; Ed. Richard Y. Wang; PTR Prentice Hall; New Jersey; 1993

Paper: Social Implications of Information Technology

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Lesson no: 11

INFORMATION TECHNOLOGY

IN

ARTS AND CULTURE

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Information technology has contributed phenomenally in many fields. From health care and medicine, automation, agriculture, industrialization, transportation, to media and entertainment; IT has contributed immensely. Some of the most visible of IT related developments are in the field of media and entertainment. Similarly, there have been many IT related developments in the fields of arts and culture.

It is a general perception that IT and arts are not related at all. Thus IT cannot contribute to the fields of arts and culture. But there have been significant contributions of IT in both arts and culture. We shall discuss these developments in this lesson. The lesson structure is as follows:

11.0 Objectives
11.1 Introduction
11.2 Presentation of Content
11.2.1 Arts Defined
11.2.2 IT in Performing Arts
11.2.3 IT in Music
11.2.4 IT in Dance
11.2.5 IT in Theatre
11.2.6 IT in Fine Arts
11.2.7 IT in Photography
11.2.8 IT in Cinema and Television
11.2.9 IT and Entertainment Games
11.3 Summary
11.4 Key Words
11.5 Self-Assessment Questions (SAQs)
11.6 References/Suggested Reading

11.0 OBJECTIVES:

Information technologies have brought about the great positive in various fields. Even the fields of arts and culture have not escaped the influence if IT. In fact, these two fields have undergone revolutionary changes because of IT. In this lesson we shall discuss the impact of IT on arts and culture, more specifically the changes brought about in the arena of entertainment. The objectives of this lesson are:

- *To understand Arts*
- *To know about the role of IT in Performing Arts*
- *To know about the role of IT in Music*
- *To know about the role of IT in Dance*
- *To know about the role of IT in Theatre*
- *To know about the role of IT in Fine Arts*
- *To know about the role of IT in Photography*
- *To know about the role of IT in Cinema and Television*
- *To know about the role of IT and Entertainment Games*

11.1 INTRODUCTION:

What computers can do for Arts? Can information technologies do anything for the performing arts? What computers can do for theatre? Can information technologies do anything for the cinema and television? Well, here are the answers.

In performing arts, the computer is useful in organization, record keeping, reproduction, and simulation. In music, *MIDI (Musical Instrument Digital Interface)* is the interface from the instrument to the computer. Once MIDI has turned the music into digital form, the computer can process it. In dance*, DOM (Dance on Microcomputer) notation* and *Life Form*s have allowed dance movements and choreography to be created and preserved on computer for future dancers to study and then re-create.

Theatre uses computers and information technologies for designing sets, controlling lighting, and creating special effects. In fine arts, painters and sculptors use computers as an artistic instrument or a visualization tool. Computers have been important in saving, restoring, and studying works of art from the past. Photography has been changed by the use of digital cameras and computers to manipulate the digital output from those cameras.

11.2 PRESENTATION OF CONTENT:

Computers can affect Art, but the ultimate expression of the emotion is in the hands of the human artist. Computers and information technologies can help in a variety of ways to create movie magic. They can merge several pictures to create a scene that never occurred, or add scenery and people that weren't there. Animation that uses computers versus animation drawn by hand can save thousands of hours of labor and months in development time.

Now we know what roles do computers and information technologies play in the field of Art. We shall discuss these roles in detail in the following pages. In this lesson, we shall explore the many ways that computers and information technologies are used in the field of art. We shall discuss how artists, craftsmen, and artisans use computers. We shall also focus on how computers are being used in the entertainment industry. The content of this lesson shall be presented as follows:

- *Arts Defined*
- *IT in Performing Arts*
- *IT in Music*
- *IT in Dance*
- *IT in Theatre*
- *IT in Fine Arts*
- *IT in Photography*
- *IT in Cinema and Television*
- *IT and Entertainment Games*

11.2.1 ART DEFINED:

Art, at its simplest, is expression of emotions and feelings. In its various forms art creates verbal and visual images. Art provokes emotional responses in others. Fine arts forms are meant for self-expression. Commercial arts or

functional arts are different from fine arts. On the other hand, communication arts are concerned with communication.

Art is all about emotions and feelings. It is about visualization and creation by giving proper shape to the images in one's mind.

Computers, on the hand, are machines. Computers lack emotions and feelings. Because the computer is incapable of emotions, it cannot create art on its own. The computer can, however, be a powerful tool in the hands of an artist. Similarly artists extensively use all the information technologies for a wide variety of purposes.

11.2.2 INFORMATION TECHNOLOGIES IN PERFORMING ARTS:

Performing arts require, as the name implies, a human performance. The computer can play a role in these arts forms by being a useful tool in organization, reproduction; and record keeping. More over, computer can be a powerful tool for learning the performing arts. In the musical forms, the different notes, ragas, etc can be recorded and stored on computers. These can be put in various formats or modules. Students can easily retrieve these for learning.

Similarly, for the various dance forms also computer can be used as a learning tool. The different mudras, poses, and movements, etc are photographed and stored in modular formats. Computers offer the facility of frame-by-frame analysis of various performances. Students can follow the dance steps very easily by going through this frame-by-frame analysis.

11.2.3 INFORMATION TECHNOLOGIES IN MUSIC:

In the area of music, there has been more experimentation with the computer. Programming has been developed to use the computer as the performer. Considerable amount of success has been achieved in this area.

Where would music be today without synthesizers and other computer equipment such as MIDI and soundboards? Today's music sounds very differently from the music of the 1950s and 1960s, specifically because of the use of computers.

A synthesizer or electronic keyboard uses FM (Frequency Modulation), sampling, or wave guiding technology to produce a sound pattern. This sound pattern may be simple (sounding like one instrument) or complex (sounding like several instruments). The sound pattern is sent into the computer through MIDI (Musical Instrument Digital Interface). MIDI is a standard for the cabling and hardware that connect computers and electronic instruments and for the method used to pass the sound pattern between these devices.

Music is regulated electronically through MIDI, and MIDI data can be generated through a MIDI-capable-keyboard, wind instruments, guitars, or percussion controller.

MIDI data can also be generated through a sequencer or a special software programme.

When the musician plays a song on an electronic instrument, each note is sent through the MIDI to the computer along with the note's length, the tempo, pitch, etc. These are converted in to digital form. In digital form in the computer, the MIDI file for the song can be changed easily.

Musicians commonly use MIDI standards for creating music for television or movies, or for adding music and sounds to video or computer games or multimedia presentations.

To process music, the computer may need a sound card, or soundboard. The sound card is inserted into an expansion slot of a PC. Macintosh computers often come with a sound card build in. The card has outlets, called jacks, through which a microphone or speakers are connected to the sound card and therefore into the computer. The sound card converts

analog sounds, such as sounds from a microphone, into digital signals to be processed by the computer; then the sound card converts the signals back into analog signals for the speakers. Sound cards are often the central connection points for multimedia hardware.

11.2.4 INFORMATION TECHNOLOGIES IN DANCE:

Dance choreographers usually don't record dance. They just create dance movements. The teacher or choreographer often passes on dance movements to the learner. If a teacher forgets movements, they could be lost forever. There are ways of noting choreography, as in case of music, but the task can be extremely time-consuming.

The technology of video recording can miss nuances in timing and spatial relationships. The application of the computer to this problem has resulted in a dance notation called DOM (Dance on Microcomputer) notation. DOM produces an animated figure performing the dance routine. A program called Life Forms creates a three-dimensional figure; the choreographer can experiment with this figure and then save the best movements.

With the help of Life Forms, the choreographer develops the three stages of the dance-creating the sequence, integrating with the other dancers, and doing time adjustments- by using dance software programmes like the Sequence Editor, the Stage View, and the Time Line. These software programmes are used to record and replay a figure performing the routine in various stages.

Individual movements are created and recorded using the Sequence Editor. This editor also allows slow down, speed up, rotation of view, and stop action any time during the routine. After several figures' routines have been recorded, they can be integrated and viewed with Stage View; which also

allows rotation and tilt for viewing at any angle. Time Line allows each dance sequence to be adjusted in relative time.

11.2.5 INFORMATION TECHNOLOGIES IN THEATRE:

Computers today support many of the sophisticated stage presentations in theatres. Three major uses of computers in the theatre are the design of the sets, the control of the lighting, and the production of special effects.

Set designers start with rough sketches from the director, playwright, and set designer. The designers use computer-aided-designing (CAD) programs to design the sets in detail. Set designers then use software that converts a set of CAD drawings into a three-dimensional drawing so that the director can preview all the sets before construction begins.

This software shows views of the sets from all the viewing angles the audience may have. Changes are easily made until everyone is satisfied. Construction is then based on the CAD drawings.

Lighting is important to theatre and can make or break a theatre performance. Often sets are painted screens, and incorrect lighting makes them invisible to the audience. Lighting must follow the action on the stage and the timing of the performance. To do that, the basic lighting controls are put into the computer; then the lighting technician lets the computer do all the predictable things and needs to worry only about the unpredictable events.

Special effects, such as ghosts, fog, or lightning, can do a great deal to improve a stage presentation. You are aware of the special effects in movies and on television. Theatre special efforts are not as complex as those, but they can set the mood or create the focus the director wants in key places.

11.2.6 INFORMATION TECHNOLOGIES IN FINE ARTS:

Painting, sculpture, and architecture are major fine art fields. These have been used for human expression since the beginning of civilization. Today, the computer is used as a tool to help create pieces of art and to help recover, restore, and protect works of art by the old masters.

Creating Art: The computer can be used as an art medium. Artists can use software like Macintosh's MacDraw and Mac Paint to create "freehand" art. The computer is a tool, just as a paintbrush or pencil is a tool. In sculpture, a CAD drawing can help the creator visualize the project from all angles before creating the sculpture itself.

Restoring Art: Computer is usually used to catalogue and analyze various art forms. Information technologies are used for simulation. Art restorers had hoped that the capabilities of the computer could be applied to the problems of saving the works of the old masters. A lot of work has been done in this regard. Thousands and thousands of arts pieces like paintings; sculptures, etc. have been restored using computers. The restoration of Michelangelo's frescoes in the Sistine Chapel proved the value of the computer. But there has been heavy criticism of the use of computers in art restoration.

Techniques developed by NASA to enhance satellite photographs sent from space made possible the capability of the computer to "see" beneath centuries of grime, oxygenation, and even abuse.

A technique called computerized infrared reflectoscopy has been developed for art restoration.

Organizations like Olivetti, Fiat and IBM are actively involved in developing software and other techniques for art restoration. Italy is the major centre of expertise in the area of art restoration using computers.

Are Computers and IT Improving The Arts?

The expression of emotions and feelings through music, dance, theatre, painting, sculpture, and other art forms is at least as old as mankind's recorded history. In many cases, art works are all that exists of a society or community's history.

Art is expression. Art is education. Art is entertainment. Art records the passage of time.

Is the computer a necessary tool for artistic expression? Shakespeare's plays have been entertaining audiences for several hundred years without using computer. Bach and Mozart created their music without the need of a synthesizer or MIDI.

The question for today's artists in this: Is the computers making the artists better able to express themselves, or is it distracting them from their art? Time will have to be the judge.

11.2.7 INFORMATION TECHNOLOGIES IN PHOTOGRAPHY:

Normal everyday cameras are easy to handle. But these have many problems. The range of these cameras is very limited. There is a lot of time gap before the photos are developed. There are no good storage facilities. Multiple developments lead to loss of resolution.

All these problems can be solved with a digital camera. We can take several shots. Then, using either the floppy disk from the electronic camera or photo CDs from his photo CD camera, we can load the pictures into a PC. There we can easily manipulate the pictures any way we want. The old saying that "the camera doesn't lie" is changing. Cameras, or specifically pictures, can say anything you want, true or not.

This new photography technique may one day make the old family picture album obsolete. The pictures can be put on CD-ROM and shown on

television monitors or a computer monitor. Even old photographs can be preserved this way, by using a scanner. Now the family history can be safe from time, flood, and other damage.

11.2.8 INFORMATION TECHNOLOGIES IN CINEMA AND TELEVISION:

Forrest Gump, a Hollywood blockbuster of 1994, illustrates several ways the movie industry uses computers. The most obvious effect was to insert star Tom Hanks, who played Forrest Gump, into historical film footage. Gump appears with U.S. Presidents Kennedy, Johnson, and Nixon, as well as with other important figures.

Similar attempts have been made in India in films like Appu Raja, Hindustani, etc. Recently Mughal-e-Azam was digitally altered to make the black and white classic into a color film.

How then computers are used in cinema? The computer can merge separate shots. The computer first breaks down the scenes digitally, then manipulates the elements in the scenes, and finally reconstructs the scene to include the desired elements. A similar technique enabled Hanks to appear in a scene with an explosion. Again, two shots were digitally merged. Another digital effect in Forrest Gump involved digitally erasing the legs of Gary Sinese, the actor playing an amputee.

The digital manipulation of elements in a scene is called morphing, a special effect created by computer animation that smoothly transforms characters into other shapes. The morphing programs enable moviemakers to establish the starting image and the ending image; then the program creates the intermediate frames necessary to change the picture. The technique was developed at Industrial Light & Magic Company with the use of large, powerful workstation computers.

Special Effects: One of the major results of using computer technology in movie and television production is the reduction in costs. In the young Indiana Jones series, George Lucas used computer technology to generate backgrounds for “period pieces” and augment the crowd scenes. As a result, Lucas spent $10,000 for scenes that would normally cost $30,000 to $40,000.

Animation: When the Disney Studio made Snow White and Cinderella in the early days, each production took more than two years and hundreds of animators and illustrators. Computer-generated animation provides faster results and requires less manpower. Most Disney animation movies now use computer-generated background, but humans still draw the characters.

The computer also enables the merging of live action and animation, as demonstrated by the Mask, starring Jim Carry. Although Hollywood has been making movies that combined live action and animation since Gene Kenny danced with Jerry the Mouse, movies like the Mask have taken the process to the point that part of Jim Carrey, his heart was animated, and the rest was real Jim Carrey.

On –Demand Television: Merging cable television with telephone service is the next big area of expansion in the entertainment industry, according to executives of companies like Time Warner, AT&T, and Viacom. In Britain, American telephone companies have teamed up with British cable TV companies to wire the country for voice, data, and video. In the future, this capability will enable subscribes to call into a computer database and order movies or shows “on demand” Today, you must wait until the movie you want is available and then request access to it. The on-demand television system in Britain is serving as an example for a system in the United States.

Implementation of interactive television in the United States will be one more step in building an Information Superhighway. The cable television companies, the telephone companies, and the computer game companies are moving towards a system that can connect most American homes with a computer network using the cable television connection.

Shopping, games, financial news, and stock information are other options you may have access to through the network., The cable, PC, and television hookup become your entrance onto the I-way.

11.2.9 INFORMATION TECHNOLOGIES AND ENTERTAINMENT GAMES:

Using the computer for games and interactive entertainment is a major area of computer development. Game systems-from Sega Genesis and Nintendo to multimedia games such as Wing Commander III have proved the importance of IT in the entertainment game field.

Multimedia Entertainment: CD-ROM has given the world the latest in game playing by providing a higher level of integration of sound and graphics. Myst was the first big selling CD-ROM game. Movies are recorded on CD-ROM and then played on a PC so that movie segments can be included in a game. Until recently, the technology was too slow to be useful. A recent development, however, has improved the controlling of motion pictures being played from CD-ROM by personal computers.

The idea of computer games creating innovations in computer technology is not new. Computer games have been around as long as computer programmers.

Games for the Young Child: Games often provide the early introduction of computers to young children. Children enjoy using the computer, when games

are fun and educational, parents can encourage their child's interest in the computer through games. Many computer games build some of the same skills that reading builds, such as maintaining focus, problem solving, and developing imagination.

These games also build skills in using a keyboard and a mouse, knowing the limits and restrictions of breakable equipment, and developing the hand-eye coordination appropriate for using computers-all skills necessary in life. Just like books, movies, and television, however, some games are not appropriate for children. Parents need to guide their children to products that teach the lessons they feel their children should learn.

11.3 SUMMARY:

- In performing arts, the computer is useful in organization, record keeping, storage, and reproduction.
- In music, MIDI (Musical Instrument Digital Interface) is the interface from the instrument to the computer.
- In dance, DOM (Dance on Microcomputer) notation and Life Forms have allowed dance movements to be created and preserved on computer.
- Theatre uses computers for designing sets, controlling lighting, and creating special effects.
- In fine arts, painters and sculptors use computers as an artistic instrument or a visualization tool.
- Computers have been important in saving, restoring, and studying works of art from the past.
- Photography has been changed by the use of digital cameras and computers to manipulate the digital output from those cameras.

- Computers can affect Art, but the ultimate expression of the emotion is in the hands of the human artist.
- Computers can merge several pictures to create a scene that never occurred, or add scenery and people that weren't there.
- Animation that uses computers versus animation drawn by hand can save thousands of hours of labor and months in development time.

16.3 KEY TERMS:

Art: Art is expression of emotions and feelings. In its various forms art creates verbal and visual images. Art provokes emotional responses in others. Fine arts forms are meant for self-expression. Commercial arts or functional arts are different from fine arts. On the other hand, communication arts are concerned with communication. Art is about visualization and creation by giving proper shape to the ideas and images in one's mind.

Art and Computers: Computers are machines. Computers lack emotions and feelings. Because the computer is incapable of emotions, it cannot create art on its own. The computer can, however, be a powerful tool in the hands of an artist. Similarly artists extensively use all the information technologies for a wide variety of purposes.

MIDI: In music, MIDI (Musical Instrument Digital Interface) is the interface from the instrument to the computer. MIDI is a standard for the cabling and hardware that connect computers and electronic instruments and for the method used to pass the sound pattern between these devices.

Creating Art through Computers: The computer can be used as an art medium. Artists can use software like Macintosh's MacDraw and Mac Paint to create "freehand" art. The computer is a tool, just as a paintbrush or pencil is

a tool. In sculpture, a CAD drawing can help the creator visualize the project from all angles before creating the sculpture itself.

IT and Restoration of Art: Computer is usually used to catalogue and analyze various art forms. Art restorers, to solve the problems of saving the works of the old masters, also use computers. Thousands and thousands of arts pieces like paintings; sculptures, etc. have been restored using computers. The restoration of Michelangelo's frescoes in the Sistine Chapel proved the value of the computer. A technique called computerized infrared reflectoscopy has been developed for art restoration.

21.4 SELF-ASSESSMENT QUESTIONS (SAQs):

5. Write a detailed note on the impact if IT in the field of music.
5. What changes have come in the fields of cinema and television because of IT? Elaborate.
5. Write a detailed note on the impact if IT in the field of entertainment games.
5. What changes have come in the field of dance because of IT? Elaborate.
5. Write a detailed note on the impact if IT in the field of theatre.

21.4 REFERENCES / SUGGESTED READING:

- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003
- Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams, Stacy C. Sawyer and Sarah E. Hutchinson; Irwin Publishing; Chicago; 2003
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- Information Technology in Action; Ed. Richard Y. Wang; PTR Prentice Hall; New Jersey; 1993

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Lesson no: 12

ETHICAL ISSUES AND INFORMATION TECHNOLOGY

Writer: Sh. M.R. Patra

Lecturer,

Dept. of C. M. & T.

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana).

Vetter: Prof. Manoj Dayal

Dean, Faculty of Media Studies,

Guru Jambheshwar University of Science and Technology,

Hisar, (Haryana)

Converted in to SIM format by: Sh. M. R. Patra

LESSON STRUCTURE:

Information technology helps us dream new dreams and realize them. From comfort to convenience, from speed to safety, from connectivity to efficiency, science and technology have helped us achieve almost every thing we wanted. Information technology has achieved a lot in many fields ranging from health care and medicine, automation, agriculture, industrialization, transportation, to media and entertainment.

But with the phenomenal developments in the field of IT, there are concerns arising. These concerns relate to certain issues. Some of these issues are very disturbing. Most of these issues are moral or ethical in nature.

In this lesson we shall discuss about the moral issues related to information technology. Specifically, we shall discuss about the ethical aspects of information technology. The lesson structure is as follows:

19.0 Objectives

12.1 Introduction

12.2 Presentation of Content

12.2.1 Ethics Defined

12.2.2 Broad Ethical Standards

12.2.3 Ethics for Computer and IT Users

12.2.4 Ethics for Computer and IT Professionals

12.2.5 Ethics for IT Business

12.2.6 Codes of Conduct for Computer and IT Use

12.3 Summary

12.4 Key Words

12.5 Self-Assessment Questions (SAQs)

12.6 References/Suggested Reading

12.0 OBJECTIVES :

Ethical issues related to information technologies are of great concern today. From computer users to software developers, every body is concerned about the ethical aspects of IT. The broad objective of this lesson is to give an overview of the ethical issues related to information technologies. The specific objectives are as follows:

- *To Understand Ethics*
- *To Understand about Broad Ethical Standards*
- *To know about Ethics for Users of Computer and IT*
- *To Understand about Ethics for Computer- and IT-Professionals*

- *To Understand about Ethics for IT Business*
- *To know about the Ethical Codes for Computer and IT Use.*

19.0 INTRODUCTION:

TODAY COMPUTERS AND INFORMATION TECHNOLOGIES HAVE BECOME HIGHLY ACCESSIBLE. THESE ARE HIGHLY AFFORDABLE AND EASILY AVAILABLE. MORE AND MORE PEOPLE ARE USING COMPUTERS AND INFORMATION TECHNOLOGIES IN MANY DIFFERENT SITUATIONS BECAUSE OF THIS OPEN AND FREE ACCESS.

Computers and information technologies have facilitated speed, efficiency and interconnectedness along with interactivity. But on the other hand, computers and information technologies have also brought to fore many controversial issues. One such issue is that of ethics. While most people use computers and information technologies for good and positive purposes, many people also use these for ulterior and nefarious reasons also. Misuses of hardware, software piracy, content piracy, unauthorized access, etc. are some of the ethical issues that baffle us today.

In such a scenario when misuse is more of a norm than an exception, it is important that we understand the various ethical issues related to the uses of computers and information technologies.

19.0 PRESENTATION OF CONTENT:

So far in the previous lessons, we have discussed about the positive sides of IT. But there are negative aspects also. Many people, specifically doctors, psychologists, social scientists, and IT professionals; are voicing their concerns about the misuse of IT. The concern areas include excessive use, misuse, privacy, security, etc. This lesson is an attempt to provide an understanding about the various ethical issues related to the uses of

computers and information technologies. The content of this lesson shall be presented as follows:

- *Ethics Defined*
- *Broad Ethical Standards*
- *Ethics for Computer and IT Users*
- *Ethics for Computer and IT Professionals*
- *Ethics for IT Business*
- *Codes of Conduct for Computer and IT Use.*

12.2.1 ETHICS DEFINED:

Ethics is all about good practices. Ethics is nothing but doing the right things. Ethics is the branch of philosophy that deals with the determination of what is right or wrong good or bad. To behave ethically is to do things in accordance with a set of pre-decided ethical principles. These ethical principles are based, ultimately, on moral values. These are proposed and decided by the society in general or by certain professional organizations.

Right from the beginning of civilization, man has fought with the dilemma of choosing between good and bad or evil practices. It is basically a choice between immediate, individual benefits on one hand and the greater good of larger groups or society at large. There are conflicting philosophies with regard to ethical practices. These wide varieties of philosophies complicate the situation.

Over the centuries, philosophers have proposed many competing and contradictory theories of ethical conduct.

Most of the earlier philosophers believe that ethical behavior must be grounded in absolute moral principles, such *as "Behave toward others as you want them to behave toward you.*" Others believe that ethical behaviors are required because they lead to the greatest good for the greatest number of people. Still others believe that ethics must be founded in religious values.

12.2.2 ETHICAL STANDARDS IN THE FIELD OF *IT*:

Computers and IT raise special ethical problems. But people who work with computers and IT tend to avoid the theoretical issues. Computer and IT professionals prefer to set practical guidelines for ethical behavior.

Many attempts have been made to formulate ethical principles for computer professionals. Various IT professional organizations have developed codes of the ethical values of their members.

Here is a collection of some codes that are common to many codes of ethics that are developed by various IT professional organizations. This common Code of Ethics and Professional Conduct contains eight general moral imperatives.

According to these values, an ethical person does the following:

- Contributes to the improvement of society and well being of human lives.
- Takes care not to harm others (developers and users).
- Speaks the truth and values trust.
- Treats others (developers and users) with fairness.
- Honors the intellectual property rights of others.
- Gives proper credit when using the intellectual property of others.
- Respects the right of other individuals to privacy.
- Honors confidentiality.

Many computer professionals believe that these basic values can provide clear guidance for ethical computer and IT use.

12.2.3 ETHICS FOR COMPUTER USERS:

Most of us are under the impression that using a personal computer does not raise ethical issues. But unfortunately, but even simply using a personal computer does sometimes raise ethical concerns. Almost every computer user faces with an ethical

dilemma concerning software piracy. Anther ethical issue before computer users is pornography. Then there are ethical issues related to the Internet and unauthorized access to computer systems.

Software Piracy: One of the most important ethical issues concerns before computer users is the duplication of computer programs. Some programs are offered free. Such software is said to be in the public domain and one can legally use such ***public domain software***. The software is free because the person who created it chose to make it available free to everyone.

There is another type of software called ***shareware***. Shareware is usually copyrighted, and the creator offers it to anyone to copy and try out. In return, the creator asks the user to register and pay for the software if the user continues to use it. Most shareware providers then send software upgrades and corrections to registered users.

Most software, however, is ***copyrighted software***. These are legally protected against copying or being used without paying for it.

Software piracy involves making illegal copies of copyrighted software. Software piracy is a criminal offense.

Generally, software companies do not object to your making a back-up copy of their software, in case a disk or file is later damaged. Most software is designed in such a way that it can be copied or installed on your hard disk for you to use. Many software publishers allow you to copy software to your desktop computer and your laptop.

However, you cannot make copies to give to other people or to sell. If software is on the computers in an institution's computer lab, you may not copy it onto disks for your use elsewhere.

Organizations with many computers can buy software for all the computers at a reduced price per unit. This agreement, called *a site license*, is a contract with the software publishers; the contract allows multiple copies of

software to be made for use in the organization. Taking copies outside the organization is a violation of the contract.

Now a question arises. Does copying software really do any harm? Yes! Writing a software package takes a long time and a great deal of talent and effort. A team of programmers, analysts, and other experts creates most software packages. These experts need to be paid a salary for writing the programmes.

Often the time between the start of the project and the time money starts to come in from sales is two to four years or longer. If people copy the software from someone else instead of buying their own copies, the software publishers will not earn enough money to make the effort worthwhile. This fact can discourage companies from developing new, exciting software. Software piracy adds to the cost of software packages and inhibits the development of new software.

Unauthorized Access: Most organizations using computers face a serious problem in the form of unauthorized access. Generally all computers and computer networks have some kind of security set up. Many organizations add extra security measures to make their systems more secure and prevent unauthorized access.

It is obvious that no one wants outsiders to enter their computer systems. But wide varieties of people try and often gain unauthorized access in to others computer systems. These people include computer *hobbyists, hackers* and *crackers*.

Most of us use computers for doing certain jobs. But for some people, the computer is a means of showing their superior skills. A **computer hobbyist** is someone who enjoys pushing his or her computer skills to the limit. Often that means trying to get past the security precautions that prevent

unauthorized access to computer systems. In most countries around the world, unauthorized computer access is a crime.

The term **hacker** was originally coined to refer to computer users who experimented with computer programs to test their limits. When some of these users began to experiment with illegally accessing systems, the news media used the term hacker to mean people who attempt to gain unauthorized access to computer systems. The term **cracker** has been proposed to refer to this computer criminal, with hacker applied to the ethical computer user.

Some crackers have argued that breaking into a company's database proves that it is vulnerable. And they say that it is a legitimate behavior. However, for most people unauthorized access is difficult to justify.

Crackers say that no one is being hurt because of their unauthorized access. But that is a small consolation to the people who are trying to store confidential or sensitive information on a computer system.

A cracker who alters or vandalizes important data related to the health of patients in a hospital records system may endanger lives. Whether or not harm is done, cracking is wrong because it violates the ethical principle of respecting the privacy of others.

Ethical Issues with Public and Private Networks: Online information services such as CompuServe and America-Online have mushroomed in last one decade. Internet as a public network has become accessible to many people in every nook and corner of the world.

With an ever-increasing growth in the spheres of public and private networks, the question of appropriate material for posting online has become an issue. The most volatile issue is pornography, now often called cyber-porn. The question is whether adults have the right to publish pornography on these online systems? This is because minors can easily gain access to such material. The biggest problem area is the Internet.

Private network services like CompuServe, Prodigy, and America-Online have established guidelines for their users and they have the means to enforce those limits. The Internet, however, was designed to have no single authority and has no capability for enforcing rules or standards.

The fact that the Internet is an international network adds to the complexity. People from countries with stricter laws and codes will be at the mercy of people from countries with more relaxed laws and codes, as long as no method exists to restrict material from the network.

To many people, the strength of the Internet is its open forum – the fact that it cannot be censored. But this very fact is causing the biggest concern for many people. This is simply because the Internet cannot be policed and controlled effectively.

Currently, the best way for parents to protect their children from cyber-porn is to control access at home. For individuals who want to avoid material they do not choose to see can also do the same. The most common way is to simply avoid the places on the Internet where cyber-porn is located. But this is easier said than done.

There are many tools available for controlling access to the Internet. One tool to aid in this effort is ***PICS***, or ***Platform for Internet Content Selection***, a voluntary ratings system that is widely endorsed by companies contributing to the Internet.

A second tool is ***filtering software*** available at many software outlets. Some packages are **Cyber Patrol, CYBER-sitter, Internet Filter, Surf-Watch, Net Nanny,** and **Web-Track**. Purchasing, installing, and registering these packages help to frequently updates lists of sites to be avoided.

12.2.4 ETHICS OF THE COMPUTER PROFESSIONALS:

So far we have discussed about ethical issues related to general computer users. A more serious case is that of computer professionals. There is a saying in the field of computers and IT with regard to safety and security of computing systems that “The hardest person to protect against is a knowledgeable employee.” The big question here is how to protect computer systems from those who build it or work on it on a daily basis.

The person who built your security system knows its weaknesses. Computer professionals including programmers, systems analysts, computer designers, and database administrators not only know how to build, run and repair computer systems; they also can misuse it if they want.

> Computer professionals have so many opportunities to misuse a computer system that ultimately the only protection is for the computer professional to act ethically. Computer professionals have been aware of this problem for as long as they have been working on computers; therefore, computer professional organizations have developed codes of ethics for the profession.

Ethical Codes for Computer Professional: There are many ethical issues related to misuses by computer professionals. The most important are ***competency*** and ***professional responsibility***.

Most organizations expect their computer professionals to be competent. This is because incompetence or inefficiency can often cause serious damages to the computer systems. **Competency** requires a professional to technically efficient and up-to-date. Computer professionals should keep up with the latest developments in the industry. Because the computer industry encompasses so many areas, and advancements are occurring constantly, no individual can be competent in all areas. Therefore, the code requires professionals to keep up with their areas of specialization to seek help from other experts when facing something unfamiliar.

Professional Responsibility, on the other hand, involves doing the best possible job even though the user may not immediately recognize the

difference between the best job and a poor job. This means making sure that a programme is as correct as possible, even if no one else is likely to find bugs or shortcomings for months – or even years. Professional responsibility also means informing the purchasing company if a programme could have an adverse effect on the public.

A third aspect of professional responsibility is honoring the *privacy* of the company when leaving a job. When leaving a company, a professional does not take programmes he or she developed for the first company, not does the professional tell the new company about projects being developed by the other company.

A computer professional has access to the company's greatest assets, that is, its data and the equipment to manipulate the data. Professionals also have the knowledge to use these assets properly or to misuse them. Most companies do not have the resources to check on the actions of their computer experts. To keep the data safe and correct, the company is dependent, to some degree, on the ethics of the computer professionals.

Programmer Liability: Even the most ethical programmer can produce a program with errors. Most complex programs have so many possible combinations of conditions that to test the program for every combination is not feasible. In some cases, the tests would take years; in other cases, no one can think of a test for all the possibilities. All experienced programmers know that all programs of any size have bugs.

Programmer liability arises out of the need to determine whether the bugs were inevitable or the result of negligence on the part of the programmers. That is why there are several levels of peer review of software and programmes to be sure that every effort has been made to eliminate the bugs in the programme.

12.2.5 ETHICS FOR BUSINESSES:

A business or organization has to protect its data from loss or damage, from misuse or error, and from unauthorized access. Otherwise, the organization can not survive and work effectively. To protect data from loss, an organization must have proper security and backup procedures

Protecting data from misuse or error is difficult for any organization. This is because IT misuses are of many types and are done by many kinds of people. One type of misuse is not using the appropriate software or not using software properly. A company or organization has a responsibility to maintain the data that is as complete and correct as is reasonably possible. For all data to be absolutely correct is impossible, but whenever an error is discovered, it must be corrected as quickly as possible.

We all get junk mail. Junk mail is mail set to you without your requesting it. It includes advertisements, contests, offers of services, and occasionally free samples. How do the advertisers get your name and address? They buy lists of e-mail addresses from various sources. This is also misuse of data. When an employee or company fails to keep data confidential, it could cause serious problems.

A breach of confidentiality occurs when an employee sells data about a person or organization in the database and uses the information outside the specific job. Many companies have developed specific rules of conduct for their employees and actively enforce them. For example, employees of many large organizations around the world, when found using data outside of their specific job, are subject to immediate dismissal.

12.2.6 CODES OF CONDUCT FOR COMPUTER AND *IT* USE:

Several organizations have tried to codify ethical practices into a set of "commandments" for computer users and computer professionals alike. The most common and important commandments are:

- *One shall not use a computer to harm other people.*
- *One shall not interfere with other people's computer work.*
- *One shall not snoop around in other people's computer files.*

- *One shall not use a computer to steal. One shall not use a computer to create or give false witness.*
- ***ONE SHALL NOT COPY OR USE PROPRIETARY SOFTWARE WITH OUT PAYING FOR IT.***
- ***ONE SHALL NOT USE OTHER PEOPLE'S COMPUTER RESOURCES WITHOUT AUTHORIZATION OR PROPER COMPENSATION.***
- ***ONE SHALL NOT APPROPRIATE OTHER PEOPLE'S INTELLECTUAL OUTPUT.***
- ***ONE SHALL THINK ABOUT THE SOCIAL CONSEQUENCES OF THE PROGRAM BEFORE WRITING OR DESIGNING A SYSTEM.***
- ***ONE SHALL ALWAYS USE A COMPUTER IN WAYS THAT SHOW CONSIDERATION AND RESPECT FOR FELLOW HUMAN BEINGS.***

19.0 LESSON SUMMARY:

- Ethics concerns right and good actions as against bad or evil practices.
- Computer professionals stress the values of contributing to the improvement of society, avoiding harm to others, respecting the truth and the privacy of others, behaving fairly, honoring confidentiality and honoring the intellectual property rights of others as well as giving credit when using those intellectual properties. Copyrighted software is legally protected against copying. Software piracy or copying copyrighted software is a serious offense.
- Public domain software is offered free to anyone.

- **SHAREWARE IS SOFTWARE THAT IS COPYRIGHTED BUT AVAILABLE TO COPY AND TRY OUT. IF YOU KEEP IT, YOU SHOULD PAY A REGISTRATION FEE.**
- **HACKERS ARE COMPUTER ENTHUSIASTS WHO TRY TO TEST SOFTWARE AND HARDWARE TO ITS LIMITS. THOSE HACKERS WHO TRY TO GET UNAUTHORIZED ACCESS TO SYSTEMS OR DATABASES ARE CALLED CRACKERS.**
- **THE INTERNET HAS CREATED NEW ISSUES OF FREEDOM OF SPEECH AND THE TRANSMISSION OF PORNOGRAPHY OR CYBER-PORN. THERE ARE LAWS TO CONTROL THE PORNOGRAPHY, BUT THERE ARE MANY PROBLEMS IN ENFORCING THE PROPOSED BANS.**
- **TWO MAJOR PROVISIONS OF THE CODES ARE COMPETENCY AND PROFESSIONAL RESPONSIBILITY. COMPETENCY REQUIRES THAT PROFESSIONALS KEEP UP WITH THE LATEST DEVELOPMENTS IN THEIR AREAS OF EXPERTISE; THE PROFESSIONAL RESPONSIBILITY REQUIRES DOING THE BEST JOB POSSIBLE EVERY TIME.**
- **ANOTHER MAJOR ASPECT OF PROFESSIONAL ETHICS IS THE LIABILITY OF PROGRAMMERS. BECAUSE AN ERROR IN A PROGRAMME COULD BE DEVASTATING, PROGRAMMERS MUST FOLLOW ALL REASONABLE STEPS TO ENSURE THE CORRECTNESS OF THEIR PROGRAMMES.**

- **BUSINESS ORGANIZATIONS HAVE AN ETHICAL MANDATE TO PROTECT THEIR DATA FROM LOSS OR DAMAGE, FROM MISUSE OR ERROR, AND FROM UNAUTHORIZED ACCESS.**

19.0 KEY TERMS:

Ethics: Ethics is all about good practices. Ethics is nothing but doing the right things. Ethics is the branch of philosophy that deals with the determination of what is right or wrong good or bad. To behave ethically is to do things in accordance with a set of pre-decided ethical principles. These ethical principles are based, ultimately, on moral values.

Software Piracy: **One of the most important ethical issues concerns before computer users is the duplication of computer programs. Some programs are offered free.**

19.0 SELF-ASSESSMENT QUESTIONS (SAQs):

8. Why is ethics a major issue in the field of information technology? Elaborate.
8. Discuss the major areas of ethical concern in the IT field.
8. What security measures are available to safe guard against theft and crimes in the field of IT?

12.6 REFERENCES/SUGGESTED READING:

- **Using Information Technology: A Practical Introduction to Computers and Communications; Brian K. Williams and Stacy C. Sawyer; Tata McGraw-Hill Publishing Company Limited; New Delhi; 2003**

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- **Information Technology: The Breaking Wave; Dennis P. Curtin, Kim Foley, Kunal Sen, and Cathleen Morin; Tata McGraw-Hill; New York; 2002**
- **Information Technology in Action; Ed. Richard Y. Wang; PTR Prentice Hall; New Jersey; 1993**