COMPUTER FOR DIGITAL ERA

Dr N. Krishnan
Dr V. Balamurugan
Dr P. Arockia Jansi Rani

COMPUTER FOR DIGITAL ERA

(Mandatory Learning Course for the undergraduate and integrated post graduate student of ManonmaniamSundaranar University)

E-CONTENTS

Authored by

Dr. N. Krishnan, Dean, Faculty of Science

Dr. V. Balamurugan, Professor/ CSE

Dr. P. Arockia Jansi Rani, Associate Professor / CSE

MANONMANIAM SUNDARANAR UNIVERSITY

Tirunelveli – 627 012

Tamilnadu, India

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Preface

Manonmaniam Sundaranar University, Tirunelveli has introduced a two credit course "Computer for Digital Era" as a mandatory learning course for the under graduate and integrated post graduate students who are undergoing the programmes during the academic year 2017-18 onwards. The course is the brainchild of our honourable Vice Chancellor Prof. K. Baskar which aims to provide a computer literacy to all the students and to create awareness about the several schemes of government which uses digital connectivity for the maximum benefits. It is expected that the students will in turn, spread the knowledge to their neighbours and thereby empower the society digitally. Thus the university fulfils a part of its social responsibility.

The contents of the course are meticulously framed and the materials are prepared well, keeping the credit hours in mind. This e-material can be used as a reference and guidelines and the course teachers have the complete freedom to add more on the content in alignment to the course educational objectives. The outcomes can be measured using the theoretical and practical knowledge of the students.

Unless the people know the initiatives of the government, the scheme cannot be successful. Therefore sufficient sensitization needs to be created by the course teachers among their counterparts. The authors will be happy to receive the comments and feedback from the faculty members, students and other stakeholders. A book on the "Computer for Digital Era" will be released soon. Till that time the stakeholders are requested to use the content in the present form.

Dr. N. Krishnan

Dr. V. Balamurugan

Dr. P. Arockia Jansi Rani

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Abbreviations

1-Fundamentals of Computer

1.1   The Role of Computers in Modern Society

In today's world, the computers are widely used by all to solve complex, scientific, business administrative and day to day problems. They have played a major role in automating many industrial and business domains. They make people life easier and comfortable. Anything that the computers do is just as the result of human instructions. They execute the instructions using the hardware as well as software, no matter whether they are Correct or wrong.

The use of computer saves a lot of time and it makes all the governmental and business services available at one's hand reach. The main advantages of using computers are:

1. High processing speed
2. High backup storage
3. Parallel processing
4. User friendliness
5. Sharing of resources
6. Affordable cost
7. Reduction in man power and
8. High accuracy

The advancement in the computing technology such as internet, data analytics, cloud computing, multimedia applications, mobile computing changed the way of the governance in India. Today they play an important role in the **e-governance** activities like digital India projects and they are used in almost all the fields like agriculture, medicine, policing, finance, education, etc.

Further, the information systems are deployed in almost all the industries. **Information systems** such as Management Information System, Decision Support System effectively utilize the database storage and retrieval process. They provide sophisticated user interface so that any naïve employee can use it with minimum training. Also, preparation of reports is easy and time saving in these systems. Therefore, they are useful to the managers and high level of executives of any industries.

The advent of **internet** and **World Wide Web** (WWW) in the 90s, has changed our lives tremendously and it helps us to connect with the other part of the world. As a result, all the government and business organisation invariably own their web portal for promoting their business. As a result, the information pertaining to the organisations are showcased effectively to their stakeholders.

With the use of **big data analytics** it is possible to extract the potential knowledge from the database and to predict the future. The advent of **cloud computing** technology allows us to share the resources at lower cost.

1.2   Block Diagram of Digital Computer

Computer System:

A set of components that are integrated together which receive the well-defined input and process it to yield the expected outcomes. The above definition is applicable to any kind of system including the computer system. The Fig. 1.1 illustrates the three components of a system.
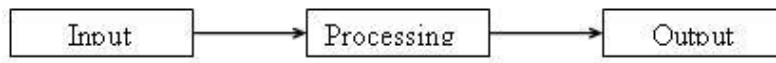
Fig. 1.1 System

Blocks of a Computer System:
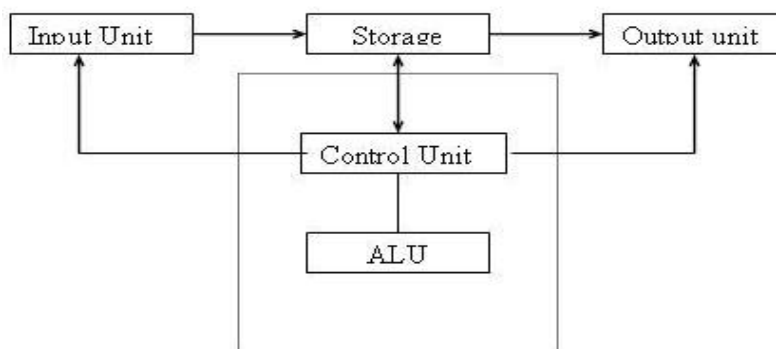
Fig. 1.2 Blocks of Computer System

A computer system has several components, as illustrated in the fig. 1.2 Each block is explained in the following paragraphs:

1. Input Unit:

The process of feeding the data and Instructions to the processing unit through some devices such as Keyboard, Mouse etc. is called Input. These devices translate the user input into the electronic impulses which can be easily understood by the processor.

2. Processing Unit:

The user input is fed into the processor or Central Processing Unit (CPU) for further processing. This unit is the brain of computer system as it does all the calculations, problem solving and controls all elements of the computer. The CPU consists of the following three distinct units namely.

i. Storage:

This holds the data in terms of program and files. The data stored can be accessed and used whenever required by the CPU for further processing. This memory unit is usually referred as primary storage section. The units in which memory unit is measured are known as Bytes. Byte is the space required to store 8(bit) characters or alphabet or digit.

ii. Control Unit:

This unit coordinates the activities of all the elements of computer. It decodes the instructions given by the user and sends the commands and signals that determine the sequence of other instructions. This unit does not process data but it acts as the central system for data manipulation, as it controls the flow of data.

iii. Arithmetic and Logic Units:

This unit performs arithmetic operations such as addition, subtraction, multiplication and division. It also does logical operations such as AND, OR, NOT, etc and also the relational operations such as comparison of numbers.

3. Output:

The process of decoding the processed result in a user understandable format is called Output. The commonly used output devices are Printers, Monitor, Projector, etc.

1.3   Working Principle of Computer

The Computer receives the input from the users through the user interface, provided by the operating system. Operating system is software that is to be installed immediately after the purchase of computer. Other softwares are installed over the operating system. The input is sent to the main memory by the operating system and based on the instructions of the software and operating system the data is processed by the processor. To do that the instructions are converted into machine understandable format by software called compiler which are associated with the application software. The Operating System acts as a bridge between User and Hardware. Common operating systems include Windows, Mac OS and Linux. The operating system in a computer manages the resources by controlling the hardware elements including the hard disk, memory, processor, input and output devices. At the opposite end, the operating system acts as an interface and allows the user to control the computer. The processed data is sent to the output device through the OS and the application software.

An input device provides interface between the user and the operating system. Input devices are capable of converting data into electrical form which can be recognized by computer. A computer can have several input devices. The primary input devices on a computer are the keyboard and mouse.

The most common input device is the keyboard. Keyboard consists of a set of typewriter like keys that enable the user to enter the data into the computer. They have alphabetic keys to enter letters, numeric keys to enter numbers, punctuation keys to enter comma, period, semicolon, etc., and special keys to perform some specific functions. The keyboard detects the key pressed and generates the corresponding ASCII (American Standard Code for Information Interchange) codes which can be recognized by the computer.

Mouse becomes most popular device after the advent of Graphical User Interface (GUI). It is a cursor-control device having a small palm size box with a ball at its base but now the ball is replaced by the optical sensors, which senses the movement of the mouse and sends electrical signal to the CPU when the mouse moves or its buttons are pressed.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, It can also be used to enter the text or numbers with the help of virtual keyboard but the disadvantage is the text cannot be entered at a faster rate like keyboard.

Output is the result that comes out of a computer after the processing of input. An output device is mainly used for presenting information to the user. Monitors and printers are commonly used output devices.

Monitor is a commonly used output device, sometimes called as display screen. It provides a visual display of data. Monitors are connected with the CPU. The smallest dot on the screen that can be displayed is called a pixel (picture element). The resolution of the screen improves as the number of pixels is increased. Most of the monitors have a 4:3 width to height ratio. This ratio is known as 'aspect ratio'. The resolution of the monitor determines the quality of the display. Some popular resolutions are 640 x 480 pixels, 800 x 600 pixels, 1024 x 768 pixels and 1920 x 1080 pixels. High resolution monitors provide better clarity.

Printer is an output device that prints text or images on paper or other materials. The printers can be categorised into several categories based on the technology, speed and quality. Based on the techniques there are two main types of printers viz. impact printers and non-impact printers. Impact printers include all printers that print by striking a print head on the Paper. Impact printers use a print head containing a number of metal pins which strike the ink ribbon placed between the print head and the paper. Line printers, dot matrix printers are some of the impact printers. Non-impact printers use the printing heads which spread the ink on the paper without hitting hard. Non-impact printers include laser printers, inkjet printers and thermal printers.

1.4 Types of Computers and Their Specifications

Types of Computers

Computers can be classified into following three types, based on Principle of Operation and Configuration.

- Analog Computers
- Digital Computers
- Hybrid Computers

Analog Computers

An analog computer operates on continuous range of values such as electric voltage, current, etc during its operations. They are built with discrete electronic components like transistors, diodes etc. They are large in size and lacks in accuracy. An analog computer is illustrated in the Fig. 1.3.

Digital Computers

Digital Computers use binary values in which the voltage variations are either 0 or 1. Each variation is called as bit. The digital computer is designed using digital integrated circuits which have two levels for Input and Output as already told.

Fig. 1.3 Analog Computers

Digital Computers perform the operations in a speedy manner and also with high accuracy. Further, they are capable of solving many complex problems. Hence digital computers have an increasing use in the field of design, research and data processing.

Based on the purpose of usage, the digital computers can be classified into two types viz. general Purpose and specific purpose digital computer

General Purpose Digital Computer

The digital computers that are used for several general purposes are called as general purpose digital computers.

Specific Purpose Digital Computer

The digital computers which are used for single specific purpose is called as Specific Purpose digital computer.

Hybrid Computers

We know that, both analog and digital computer has its own advantages. By combining the advantages of both, a new type of computer called hybrid computer is formed. The **digital** component does the logical and numerical operations and the **analog** component solves differential equations and other mathematical equations.

Based on Performance, Speed, Size, and the Cost, the computers are classified as follows:

- Super Computers
- Mainframe Computers
- Mini Computers
- Micro computers

Super Computers

Super Computers are the most Powerful, Large in size, High price and High speed systems. It is used in the sectors where the decisions need to be taken instantaneously. It has the power of processing billions of instruction per second. It is normally used in domains like Stock market, weather forecasting, etc.

Mainframe Computers

Mainframe Computers are the computers which can process millions of instructions per second. They are large in size. They are used to process voluminous data in banks, airlines, railways, etc.

Mini Computers

The mini computers are the one which is small in size and it has low power, low cost and low speed. They are used in the day to day operations where minimum amount of calculations are needed.

Micro Computers

The Micro Computers are the one which is small in size when compared to other Computers. The micro Computers are came into existence due to the invention of micro processor. It is very cheap when compared with other computers. The Micro Computers are became smaller which can be easily fit in our hands.

1.4.1 Computer Specifications:
Specifications are key features which a computer possesses. They represent the inherent qualities of a system which we refer. While buying a computer one must know the purpose of usage, price range, durability, etc. Some of the common specification to be considered while purchasing a computer is given below:

- Processor speed
- Size of the Random Access Memory
- Size of the Hard disk
- Provision for Network Interface Card
- Provision for WiFi Interface
- Provision for Bluetooth services
- Display size and resolution
- Port Connectivity such as USB 2.0 or USB 3.0
- Additional Memory Slot
- Audio/ Video Connectivity
- CD/ DVD / Blue Ray Disk Drive and their specifications

Processor

The processor is a chip which processes the basic instructions that drive a computer. The four primary functions of processor are Fetching, Decoding, executing and writing back to storage. It can be said as brain of computer. Some of the manufactures of processors are Intel, AMD, etc. In the recent period there are many processors built in a single chip. Some of the multiple processor chips are dual core, core2 duo, Quad core, penta core, etc.

The following are the four main components in Processor:

- Arithmetic Logic Unit(ALU)
- Floating Point Unit(FPU)
- Register
- Cache Memory

Arithmetic Logic Unit

The Arithmetic Logic Unit (ALU) is a part of processor where we can perform mathematical calculations such as addition, subtraction, multiplication and division and also the logic operation such as AND, OR, NOT, etc.

Floating Point Unit

The Floating Point Unit (FPU) is also known as Math co-processor or numeric coprocessor. It is a specialized coprocessor that manipulates numbers more quickly.

Register

Register is a part of micro processor which hold instructions and other data for ALU operations. Registers supply the Operands to the Arithmetic Logic Unit (ALU) and store the result of operation.

Cache Memory

It is an electronic memory in the processor that saves time while fetching a data from the Random Access Memory (RAM). It holds the frequently used data and there by reduce the execution time. The size of cache memory is small when compared to the RAM and the cost is high compared to the other types of memory. The maximum transfer rate at L2 cache is approximately 1,064 Mbps.

Random Access Memory

Random Access Memory (RAM) is a primary data storage which holds data and instruction at the time of execution. It is the working memory of the computer. A Random Access Memory is a volatile memory and it can hold the data till it receives the power.   The following are the several categories of RAM:

- SRAM
- DRAM
- SDRAM
- DDR SDRAM

SRAM

SRAM can be expanded as Static Random Access Memory which uses multiple transistors, typically four to six for each memory location.

DRAM

DRAM can be expanded as Dynamic Random Access Memory which has memory cells with a paired transistor and capacitor. The main disadvantage of DRAM is its constant refreshing.

SDRAM

SDRAM can be expanded as Synchronous Dynamic Random Access Memory which takes advantage of burst mode concept to improve performance. The maximum rate L2 cache is approximately 528 Mbps

DDR SDRAM

DDR SDRAM can be expanded as Double Data Rate Synchronous Dynamic Random Access Memory is just like SDRAM except higher bandwidth or greater speed.

Hard Disk Drive

HDD can be expanded as Hard Disk Drive. The Hard Disk is an external storage area where the programs and data are stored permanently. In HDD the data in the disk are accessed using a reading head which moves front and back when the disk rotates. HDD is a non-volatile memory where the storage disks are magnetized.

Types of Hard Disk Drive

Currently, there are four types of HDD are available. They are
- Parallel Advanced Technology Advancement(PATA)
- Serial Advanced Technology Advancement (SATA)
- Small Computer System Interface (SCSI)
- Solid State Drives (SSD)

Parallel Advanced Technology Advancement

PATA can be expanded as Parallel Advanced Technology Advancement is a standard for attaching hard disk drive into computer systems. The name itself reveals that the HDD is based on parallel signalling Technology. The connections for PATA devices are made using 40 pin connectors. The maximum workable length of PATA is 46 Centimetre. The Signal Voltage of PATA is 5V.

Serial Advanced Technology Advancement

SATA can be expanded as Serial Advanced Technology Advancement is also a standard for the attaching the hard disk into computer systems. The name reveals that it is based on serial signal processing technology. The connections are made through 7 pin data cable. The signal voltage is 0.25 V. The fig. 1.4 shows the SATA and PATA drives.

Small Computer System Interface (SCSI)

SCSI can be expanded as Small Computer System Interface is also a standard for attaching the hard disk into peripheral systems more flexibly than the previous parallel data transfer data transfers. The speed of operations in SCSI is faster than other HDD. The main disadvantage of SCSI is not all devices support all levels of SCSI.

Fig. 1.4 SATA and PATA Drives

Solid State Drives

Solid State Drives are also called as Solid State Disk. A traditional HDD consist of spinning disk with a mechanical arm called as actuator. An SSD on other hand has an array of Semiconductor memory organized as a disk drive.

1.4.2 Server:

A server is a special purpose computer which serves the data when requested by other computers. The computer that requests the server for data is known as Client. A server program awaits and fulfils the request of the client. To fulfil the request the server must have the capacity in terms of memory space, parallel input/output process, high speed processor, security features, etc.

Types of Servers

The Server are categorised based on the purpose of their usage. Here there are some servers they are

Application Server

An application server is a program in a distributed network that provides logic to the application program

Web Server

A Web server is a Computer program that serves the requested page to the web client. The web client is just a web browser which requests the page to the server.

Proxy Server

A proxy server is an intermediary device between client and end device. So there will be no need to access the server.

Virtual Server

A virtual server is a program running on a shared network that is configured in a way that it makes an illusion to every user that they have full access over the server.

File Server

A file server is a program responsible for the management of the data files on the central storage so, that the computers on the same network can access them.

Database Server

Database server is widely used in Industries for storing voluminous data.

1.4.3 Desktop Computers:

The Desktop Computer is a personal computer which has several components viz. monitor, key board, mouse, central processing unit, power supply unit, etc, called peripherals that are connected together. Apart from the in-built power supply unit, the desk top computers need external power supply unit for their safety. The external power supply unit is known as Uninterrupted Power Supply (UPS). UPS provides power to the Computer. There are two kinds of UPS viz. Online UPS and Offline UPS. The cost of the online UPS is high as this kind of UPS supply power through the battery even when supply is available. The UPS that are used with our desktop has 0.5 KVA output.

Advantages of Desktop Computers

- Desktop Computers have more versatility
- Cost of desktop computers is low
- Desktop computers have higher storage
- The processor of Desktop Computers are Faster

Disadvantage of Desktop Computers

- Desktop computers are large in size
- The portability of desktop computer is low

1.4.4 Laptop:

Laptop Computer is the one which doesn't have separable Components. All the components are connected under hood. So, that it is a whole package. The size of laptop computer is small. So, that it can be easily displaced from one place to another.

Advantages of Laptop

- Easily portable
- Small in size
- Built-in power supply

Disadvantages of Laptop

- Low storage and processing power when compared to Desktop.
- High Cost

1.4.5 Tablet:

Tablet Computer is a portable PC. It generally has an operating system that is used in mobile phones. It has touch screen monitor. Tablet computers can do what other PC can do, However, it lacks some input and output capabilities. The mouse is replaced by the stylus or finger. There are no external/ built-in key board and the input can be supplied through touch screen which has virtual keyboard.

Advantages of Tablet

- It is more portable than the Laptop
- Very small in size
- It can be used as a mobile
- The price is much less than the lap top

Disadvantages of Tablet

- It lacks in some Input and Output Capability
- Less facilities when compared to desktop

1.4.6 Smart Phones:

A smart mobile Phone can do much operations of a computer. It is a hand held personal computer with mobile operating system. The size of Smart Phones is even smaller than the tablet computers. It also can do what a PC can do. However, it lacks some input and output facilities. Touch screen monitor is used in smart phones.

Advantages of Smart Phone

- It is more portable than the Tablet
- The size is much reduced in Smart Phone
- It can also be used as a mobile communication device
- The price is much reduced than the Tablet

Disadvantages of Smart Phone
- It lack some Input and Output facility
- User needs to be trained on Mobile operating system

1.4.7 Port: The Port in the computer will act as an interface between the connecting device and connected device. These ports act as interface between the devices so, that we can share the information or data through the ports.

Types of Port
- Serial Port
- Parallel Port
- USB Port
- VGA Port

Serial Port

The Serial Port is the one which is used to connect external modems and older computer mouse. In Serial port the data travels at the speed of 115 kilo bits per second. There are two versions in serial port, they are

- 9 Pin Serial Port
- 25 Pin Serial Port

Parallel Port

The parallel port is used to connect Printer and scanner. The Parallel Port is also called as Printer Port. The parallel port has 25 pins

USB Port

The USB can be expanded as Universal Serial Bus. The USB Port was introduced in 1997. By USB we can connect all kind of external USB devices such as external hard disk, pen drive, peripheral devices, etc.

VGA Port

The VGA can be expanded as Video Graphics Array. This port is used to connect the Monitor to the CPU. The VGA port has 15 holes. It is similar to the Serial Port. But serial port consist of pins VGA port has holes.

1.5   Setting up a Computer

Step 1

Unpack the monitor, CPU, UPS and other input and output devices from the box. Remove the plastic covering or protective tape. Keep the computer in a ventilated room so that we may avoid the heating issues.

Step 2

Connect the monitor and CPU by using a VGA cable and tighten the screws if it has

Step 3

Then, Connect the Keyboard to the CPU if the Keyboard uses the USB port connect it to the USB port on the CPU. Otherwise if the keyboard has PS/2(round) Connector then, connect it to the Purple PS/2 port on the CPU

Step 4

Next, connect the mouse and determine whether it uses the USB or PS/2 connector. If it uses USB connector, plug into the USB port of the CPU. Otherwise connect it to the green PS/2 port on the CPU

Step 5

If we have external speakers or headphones, we can connect them to the audio port which will be in green in colour. If we have mic connect it to the pink port. Otherwise connect it in the blue port which is for both headphone and mic

Step 6

Then, connect the Power supply cables from CPU and Monitor to the UPS which act as Power Source. If there is no UPS connect it directly to the wall outlet.

Step 7

Finally, connect the UPS into the wall outlet.

1.6   Computer Maintenance

Computer maintenance is the practice of keeping computers in a good state of repair.

- A computer containing accumulated dust may not run properly. Therefore keep the computer away from dust.
- Carry your laptop in a protective case or bag
- Always shut down your laptop after every use
- Keep the screen and keyboard clean and dry
- Keep the laptop on a flat surface
- Back up your data regularly
- Install antivirus software, keep it updated, and perform scans regularly.
- Set strong passwords and remember them.
- Don't allow any other person to know your passwords
- Keep the desktop of the system free from storing unnecessary files
- Delete unwanted programs and files, and avoid installing the program which are unknown free open source programs
- Update operating systems such as Windows/ Linux OS regularly.
- Avoid Pirated software.
- Keep track of your software CD/DVDs and license keys.
- Don't apply force while plugging the connectors
- Read the instructions before installing any software

2- Computer Essentials

2.1   Computer overview

As we have seen in the previous chapter, a computer is an electronic data processing device, which receives, stores input data, processes it, and delivers the output in a required format.

- Operating Systems viz. Windows, Android , Linux, Unix, etc
- Programming languages such as C, C++, java, etc
- Applications such as MS Word, VLC Media Player, Paint, etc

Software

- I/O devices
- Motherboard
- Hard Disk
- DVD,...
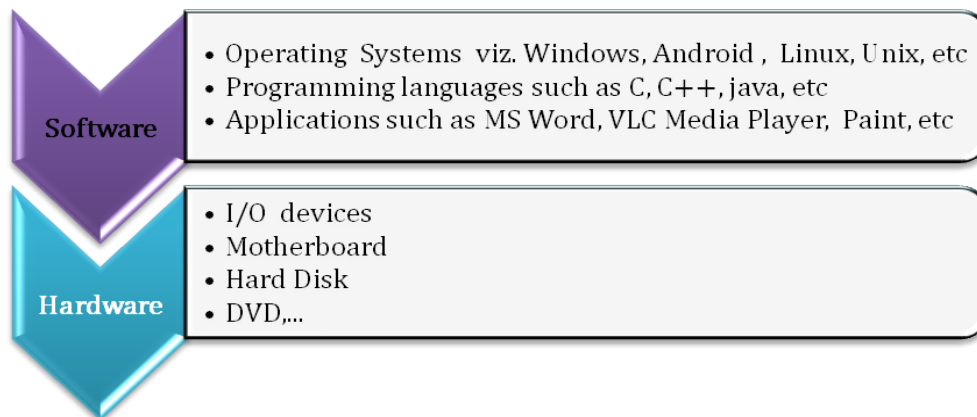
Hardware

Figure2.1 Components of a Computer System

Fig2.1 represents the basic components of a computer system which includes Hardware and Software.

1. Hardware refers to the physical components of a computer
2. Software refers to the intangible components i.e. computer programs that are executed using hardware

2.2   Types of Software

The theory of software was first proposed by Alan Turing in 1935. The word software was first used by John Tukey in 1958. Computer Software refers to the set of instructions that enables the user to interact with the computer, its hardware, or perform tasks. Software can be broadly categorized in two ways either Function based or License based. Various categories of software are shown in fig2.2.

Figure2.2 Types of Software

2.2.1 Function-based Classification:

A) System Software:

Software that can interact with hardware directly and act as an interface between user applications and hardware. An interface is needed for the users, since hardware devices can understand only the machine language and users use English, Tamil, Hindi, French, etc. Therefore, system software converts user instructions into machine readable instructions. Examples include Operating systems, database managers, compilers, BIOS, device drivers, etc.
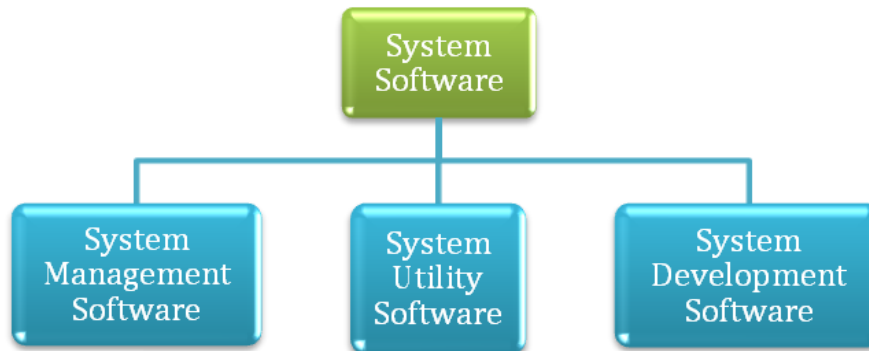
Figure 2.3 System Software

B) Application Software:

Software, developed using any programming languages for the use of naive users. On other hand application software is a set of one or more programs designed to implement a task or to solve a specific problem. Fig. 2.4 illustrates the variety of application software widely used in our day to day life. These include the office packages, browsers, multimedia players, etc.

Figure 2.4 Application Software

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Classification of Application Software:

Application Software can be classified into two types viz. General Purpose Programs and Special Purpose Programs, as illustrated in Fig. 2.5.
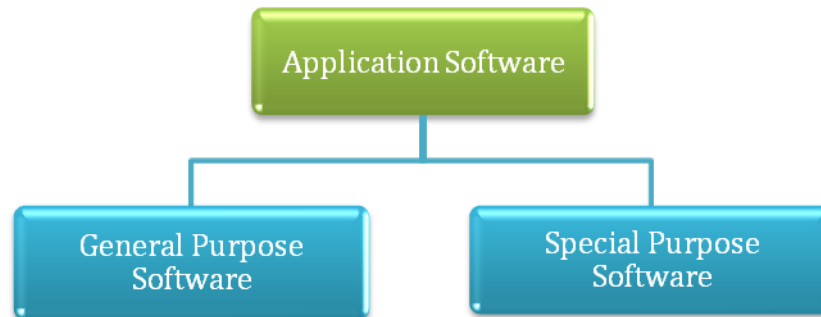
Figure 2.5 Types of Application Software

General Purpose Software:

Ready-made Software that can be used by any user for performing general day to day tasks such as listening music, drafting a letter, carrying out mathematical calculations, etc. The examples for these kinds includes MS Word, MS Excel, MS Power Point, VLC media player

Special Purpose Software:

Software that is developed to meet specific requirements such as medical imaging, space research, forensic investigations, automatic controls in vehicles and used by the specialised users are known as special purpose software.

2.2.2 License-based Classification :

A) Proprietary Software:

Software that can be used only by the licensed users. Examples include Windows, MS Office, Visual Studio, etc where we need the license key to make use of the software. Shareware is a type of proprietary software, which is offered on a "try before you buy" basis. Fig.2.6 illustrates some of the proprietary software.

Figure 2.6 Proprietary Software

B) Open Source Software:

Open-Source Software (OSS) is computer software with its source code made available with a license in which the copyright holder provides the rights to study, change, and distribute the software to anyone and for any purpose. Open-source software may be developed in a collaborative public manner. These programs are developed using High Level Languages. Examples include Linux, Libre Office, Google Chrome, My SQL, etc. Figure 2.6 Proprietary Software

provides examples of the two categories of License-based Software.

Figure 2.7 Free Open Source Software

Freeware :

Software that is offered at free of charge without the freedom to modify the source code. Free Software Foundation (FSF) defined free software as software that can be freely used, modified, and redistributed with only one restriction: any redistributed version of the software must be distributed with the original terms of free use, modification, and distribution.

Free and Open Source Software (FOSS):

It is a software that can be classified as both freeware and open-source software. FOSS is freely licensed to read, copy, share, and change the software in any way, and the source code is openly shared so that people are encouraged to voluntarily improve the design of the software. Examples for FOSS are shown in fig 2.7.

Table2.1. Categorical Proprietary and Open Source Software

Type of Software	Proprietary Software	Open Source Software
Operating System		
Office Package		
Web Browser		
e-book management		
Media Player		
Image Editor		
Database Management		

2.3   Operating system

An Operating System, also abbreviated as OS is system management software that manages the computer hardware resources, peripherals and storage space. It also provides a basis for application programs and acts as an interface between computer user and computer hardware. Fig2.8 shows some examples of operating systems that we widely use in our practical life. Windows is one of the popular operating systems used by many people on their desktop computers Also, we have Linux and Ubuntu which are open-source operating systems that are widely used in desktop and laptop computers. Apart from these there are many other operating systems such as MAC, Unix, Android, etc available in market. iPhones use iOS operating systems. Android is used in the mobile devices.

Figure2.8 Operating Systems

Initially, when a computer is bought from the vendor the system may not have any software installed over it. At that time the computer is preloaded with system software called Basic Input Output System (BIOS). We need to install an operating system and the device drivers of the peripherals over the BIOS. Then the application software is installed over the OS. While invoking application software the OS has to provide the resources for the execution of application software. The fig 2.9 illustrates the user interaction process.

1. Hardware
2. BIOS
3. OS & Device Driver
4. Application Software
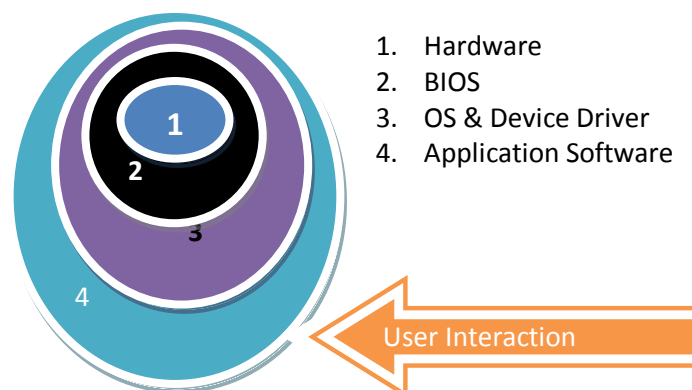
Figure2.9 User Interaction Process

During the user interaction process the software is loaded in the main memory by the OS by allocating memory space. The application software cannot avail the hardware resources directly as it is not designed to do so. To do the further operations the OS supplies the resources such as memory space, Input / Output Bus, ALU, printer, display, etc by interacting with the BIOS where BIOS is the system software that is designed to provide

Therefore, in the presence of OS, all that the user has to do is, just to double click on the application icon or symbol and then the operating system takes care of supplying the resources. The main functionalities of OS are as follows:

2.3.1 Loading and Execution: The user application resides at hard disk; and it is required that any program which is to be executed should reside in the main memory (RAM). OS is responsible for loading application and also for supporting the process execution.

2.3.2 Providing interface: User interface controls how we input data and instruction and how information is displayed on screen. The operating system offers two types of interface to the user:

i) Graphical User Interface:

It interacts with the visual environment to communicate with the computer. It uses windows, icons, menus and other graphical objects to issue commands. e.g. Microsoft Windows, Linux

ii) Character User Interface:

In this category the users communicate with the computer by typing commands. e.g. DOS, Unix, etc.

3- Windows Operating System

The most popular desktop Operating System around the world is Microsoft Windows. According to the research published recently, there are about 83 percent of desktop computer users choose Microsoft Windows as their operating system. Microsoft Corporation is an American multinational software corporation headquartered in Redmond, Washington. It develops, manufactures, licenses, and supports a wide range of products and services related to computing. Microsoft Windows is a series of graphical interface operating systems developed by Microsoft. Table 3.1 provides the basic information about Microsoft Windows.

3.1   Significance of Windows OS

Before the release of Microsoft Windows, Microsoft users were using the single-task command line operating system MS-DOS where the users need to be trained on several commands for executing the operations. Windows OS eliminates the need to memorize commands by providing an interface, known as Graphical User Interface (GUI). GUI enables the use of a mouse to navigate through various menus, icons, buttons, and dialog boxes. Generally, Microsoft names most of its products with one word, for example, MS-DOS, Windows, etc. The Windows OS allows the users to have multiple windows for carrying out multiple tasks simultaneously.
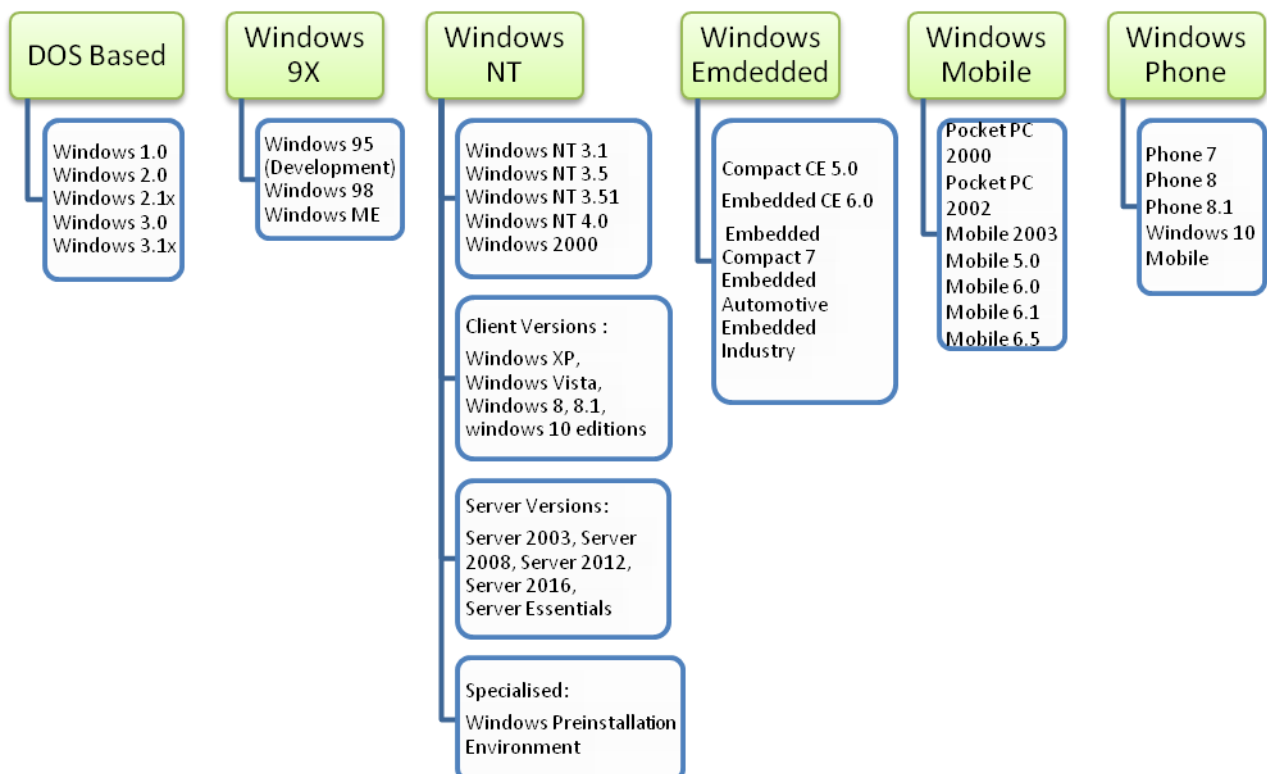
Fig. 3.1 Windows Family

The detailed list of various windows versions released by Microsoft is given in fig 3.1. Microsoft introduced an operating environment named Windows on November 20, 1985 as a

graphical operating system shell for MS- DOS in response to the growing interest in graphical user interfaces (GUI). There have been many versions of Windows since then, but the recent ones include Windows 10 (released in 2015), Windows 8 (2012), Windows 7 (2009), Windows Vista (2007), and Windows XP (2001).

The most current version of Windows for end users is Windows 10. Windows 10 was released by Microsoft as part of the Windows NT family of operating systems. It was released on July 29, 2015. It is the first version of Windows that receives ongoing feature updates.

3.2   Starting with Windows OS

There are several process or procedures involved in the starting the Windows OS. Since Windows is not an open-source, only Microsoft has the exact procedure for starting their OS which will not be shared to all generally. But, EVERY OS must start with some basic set of stuff to do, which almost every OS has in common. In this part of this book, let us look into the booting procedure of an operating system.

There are several steps such as Power On Self Test (POST), boot files loading, Master Boot Record (MBR) reading, Kernel initialization, etc involved in starting the OS. Once all the steps are executed and the operating system is safely loaded into RAM, the boot process relinquishes control to the OS. The OS then proceeds to execute any pre-configured start up routines to define user configuration or application execution. Now, the computer is ready for use.
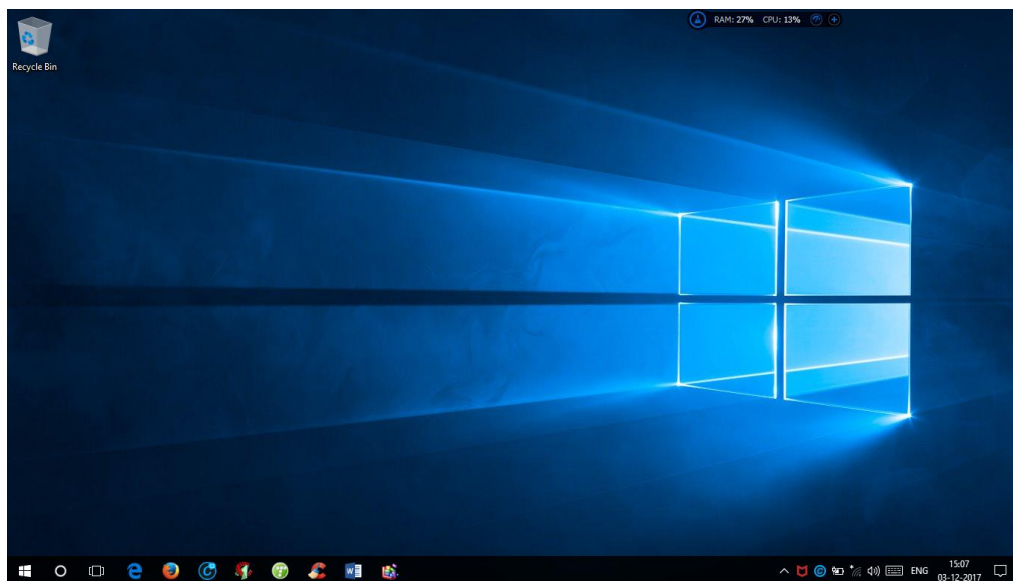
Figure 3.2 Windows desktop

A desktop view of the Windows OS is shown in fig 3.2. The taskbar runs along the bottom of the Windows desktop and includes everything from the start button on the left to the clock on the right. There is a start (window) button, Cortana (search) button, task view button, Microsoft's new Microsoft edge browser, etc. are available in the task bar. On the bottom right, you have the notification area which includes useful information like the time and date if you have multiple

language keyboards and installed on your computer. You have the ability to connect to Wi-Fi; if you click the Wi-Fi icon, it'll show you all of the Wi-Fi points that are nearby you.

All opened apps are also available in the task bar. To include an app in the task bar for quick access,

- Select the App
- Right click on it
- Choose the option 'pin to task bar' from the pop up

You can switch from desktop to the start screen by clicking the start button.
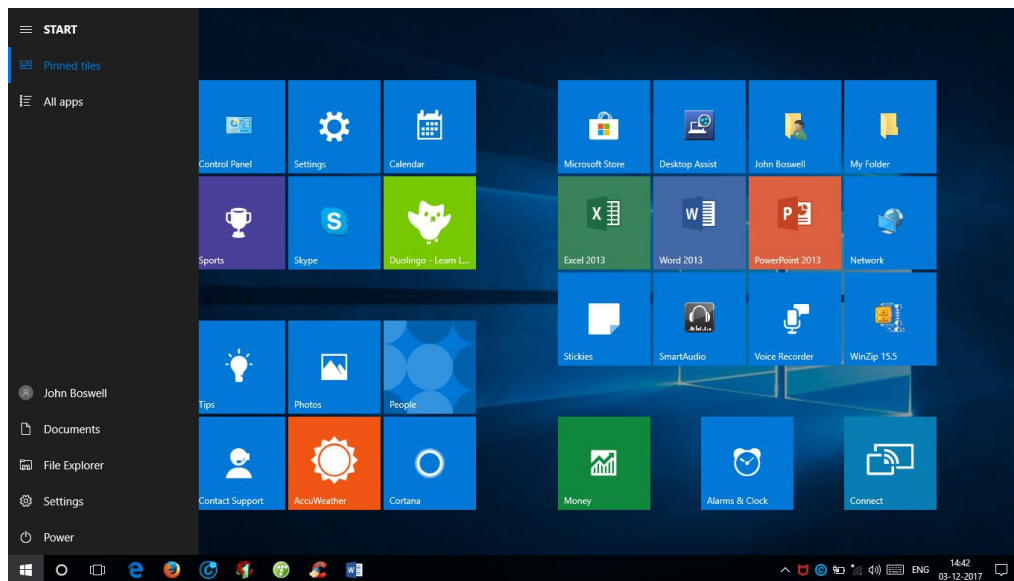
Figure3.3. Windows 10 Start Up Screen

The Start menu has been part of Windows from its old version windows 95 to the Windows 7. In Windows 8 the start menu is completely reformed and it is replaced with the Start screen. Because of users dissatisfaction the start button is back with Windows 10. But, it is a hybrid of the Windows 7 Start menu and the Windows 8 Start screen. In Figure 3.3, there is a Windows 7 style Start menu on the Left and the frequently used and recently installed apps in the middle section which is similar to the start screen of Windows 8.

Using the power app in the start menu we can shut down the computer or restart it; it is also possible to have other options like sleep and hibernate.

The settings app is a more simplified and easy to use version of the old windows control panel. Microsoft is gradually moving as many settings as possible to the new interface so that there is a single user experience across desktops, laptops, tablets and phones.

We can make changes to the network and Internet connections; personalize the background imaging colors; Personalization helps to set up bluetooth devices, printers and make changes to the user accounts. We can see the name of the currently logged in account in the start menu; if we right-click on the account name we will get a menu with several options; we can select sign out option to

log out of the current account and log in using a different account; we can select lock option to lock the computer with this user logged in; nobody would be able to use the computer without the password for this account or another account on this computer; we can select change account settings option to manage our account.

File Explorer App is available in the Start menu of the start up screen; It is a file management application for Microsoft Windows; click on the app to browse through the files and folders on your computer.

The right side of the Start menu in the windows start up screen has a Windows 8 style Start screen with dynamic tiles. Tiles are representations of apps. There are Windows 10 Universal apps to use live tiles without even having to open the apps. There is a news app which shows a slideshow of the latest current news and the weather app shows the current weather conditions, calendar and mail - after these apps are set up they will begin to show updates; these tiles can be rearranged by selecting and holding on the tile and then dragging it around the menu. Windows 10 Universal apps will run on all Windows 10 devices including Windows desktop, laptop, Windows Phone, tablet and the Xbox.

Onedrive is a free online storage for Microsoft that comes as part of every Microsoft account. Microsoft says it's like an extra hard drive and it's safer than using USB flash drives. Onedrive is integrated directly into Windows 10 and it comes with 15 gigabytes of online storage for free accounts.

3.2.1 Cortana: Cortana is just at the right of the start menu as shown in fig 3.4. It is an intelligent digital assistant; Cortana is Microsoft's answer to Google now; Cortana is able to recognize natural spoken language and provide assistance; Cortana can search the web, search your computer, help you with calling and texting calendars, reminders, note-taking, alarms, maps and directions, local business questions, weather and flight information, weight measure and currency conversions, stock and finance and much more.
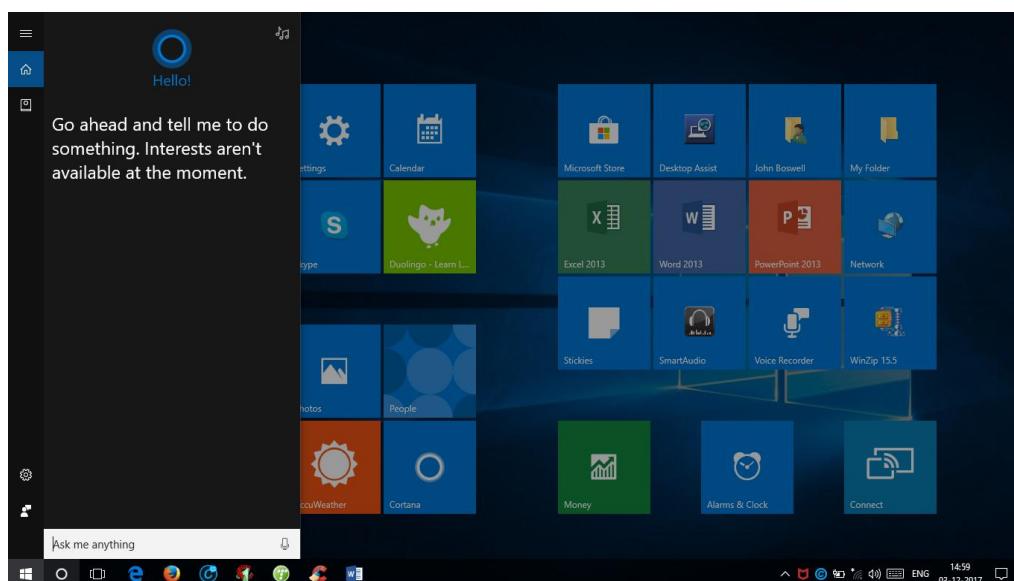
Figure 3.4 Cortana

3.2.2 Virtual desktops: Virtual desktops View, as shown in Figure 3.5 is a new feature in Windows 10. Previously all applications you open would open on the same desktop. And, it is inconvenient to play and work with the same computer at a time. The Task View button located just to the right of Cortana on the taskbar, allows you to create multiple virtual desktops each with their own open applications; you could have one virtual desktop running your business applications like Word and Excel and have another virtual desktop running Facebook and Twitter;
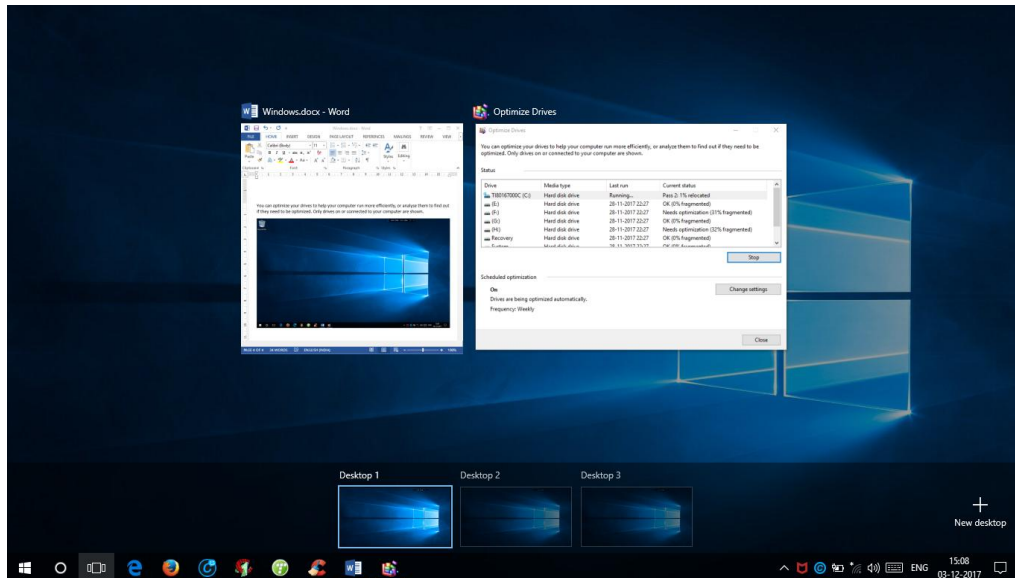
Figure 3.5 Virtual desktops

3.2.3 Microsoft edge browser: Microsoft has replaced the default web browser included with Windows; the default web browser since Windows 95 was Internet Explorer; Microsoft developed a new edge browser keeping in mind the speed and modern technologies.
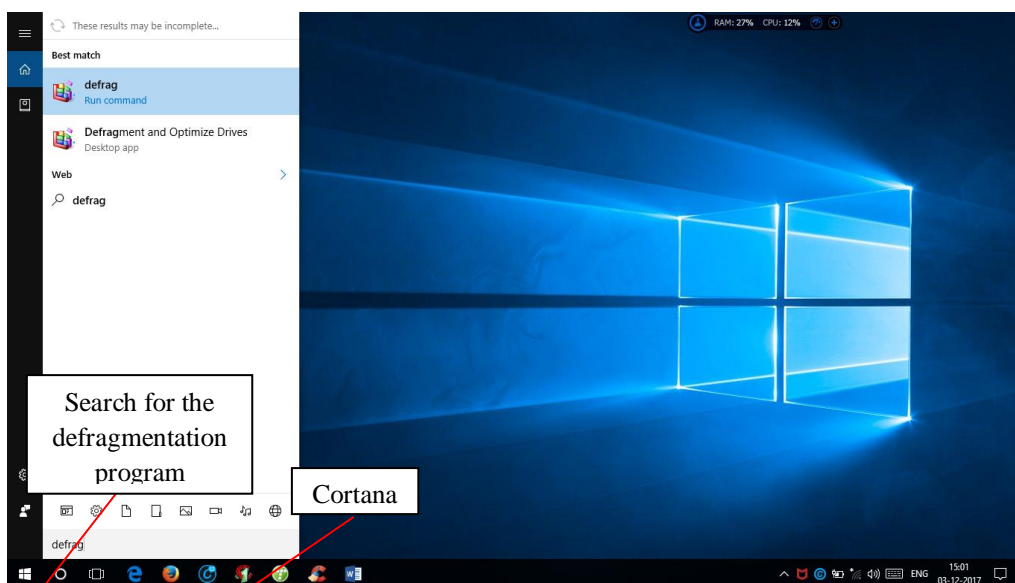
Figure 3.6 Searching the defragmentation program using Cortana

3.2.4 Disk Defragmenter:
We can optimize our drives to help our computer run more efficiently, or analyse them to find out if they need to be optimized. Cortana, as shown in figure 3.6 can be used to search this program. Disk Defragmenter is a utility in Microsoft Windows designed to increase access speed by rearranging files stored on a disk to occupy contiguous storage locations, a technique called defragmentation. Defragmenting a disk minimizes head travel, which reduces the time it takes to read files from and write files to the disk. As of Windows 10, the program has been renamed to Defragment and Optimize Drives. Figure 3.7 illustrates the screen shot view of the Disk Defragmention.

However, in 2014, Microsoft admitted losing the majority of the overall operating system market to Android, because of the massive growth in sales of Android smart phones. This comparison however may not be fully relevant, as the two operating systems traditionally target different platforms.
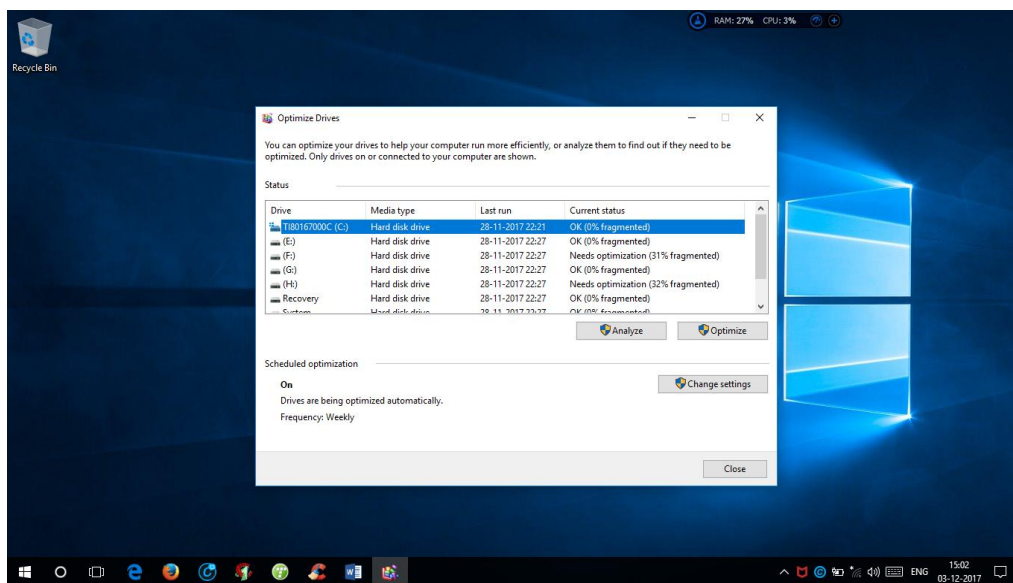
Figure 3.7 Disk Defragmentation

3.2.5 Keyboard Shortcut:
Keyboard Shortcut provides access to computer software, applications and files easily using a set of one or more keys. Keyboard shortcut is an alternate means for invoking certain commands that would otherwise be accessible only through a menu, a mouse.

Word, Internet Explorer, File Explorer, Firefox, Excel, Chrome, etc. are few example programs or files that are invoked through keyboard shortcuts. Few of the Windows Shortcut Keys are listed in Table 3.1.

Table 3.1 Windows Shortcut Keys

Sl. No.	Windows Shortcut	Purpose
1.	Windows Key + F	Open - search for files and folders
2.	Windows Key + D	Display / hide – desktop
3.	Windows + Break	Open - System Properties dialog box
4.	Windows Key + E	Open – Explorer
5.	Windows Key + R	Open - Run menu
6.	Windows Key + Up Arrow	Maximize - current window
7.	Windows Key + Down Arrow	Minimize - current window
8.	Alt + F4	Quit - active application or close current window
9.	Alt + Esc	Switch between programs - in the order they were opened
10.	Alt + Tab	Switch between open programs
11.	F1	Open - Help menu for active application
12.	Ctrl + Shift + Esc	Open - Task Manager
13.	Ctrl + Esc or Windows Key	Open - Start menu

3.3   Mobile Operating System

A mobile operating system is an operating system that operates a smart phone, tablet, or other mobile devices. Android is a mobile operating system based on the Linux kernel and now developed by Google. Android OS uses touch inputs to manipulate on-screen objects, and uses virtual keyboard. It is the most widely used operating systems and it is the highest selling mobile operating system in the recent periods. Android is an open source software and therefore anyone can use it to build their own applications.

The company Android Inc was founded in Palo Alto, California by a team of four members namely Rich Miner, Nick Sears, Chris White and Andy Rubin in Oct 2003. In 2005, the company was acquired by Google along with the developing team. That team felt that Android could be offered to third-party mobile phone manufacturers at free of cost and that the company could make money by offering other services including mobile applications (apps). In 2007, Android became the member of a consortium called the Open Handset Alliance (OHA), in which the other members were HTC and Motorola, chip manufacturers such as Qualcomm and Texas Instruments, and carriers including T-

Mobile. The Android OS has been developed using C/C++ and Java. The recent version is "Oreo" which was released on December 2017.

3.3.1 Features of Android:

a) Battery power - Doze is a feature used to turn off the all the applications when not in use in order to save battery. Doze improves battery life by deferring CPU and network activities when a user leaves a device unplugged, stationary, and with the screen turned off.

b) Data saver - This feature aims to make your smart phone to use less data. When Data Saver is turned on, apps in the background won't be able to access mobile data.

c) Multitasking – Android phones can run many applications simultaneously. We can browse Face book while listening to a song or watch movie while texting.

d) Multi-window – This feature allows two apps to be run simultaneously in split-screen mode; The Recent apps button is available on the bottom left of the mobile. From the Recent apps screen, press and hold the first app you want to run in multi-window mode. Then, open another app from recent apps screen in the secondary window. Press the recent apps list for few seconds to restore the primary app to full screen.

e) Notifications - Android's notifications feature allows us to view mails, messages and other notifications easily. There is no need to go into a messaging app or mail anymore. You can reply to messages, see other replies and conduct your business without even leaving the app you were already in. So, you no longer need to launch the app to send a quick response.

f) Quick Settings - You can rearrange your Quick Setting tiles so that you can get to what you want faster.

g) Display size - It is possible to change the size of the text and all the display elements like icons and images in the smart phone

h) Text-to-speech - This feature allows us to listen to an article/message or any content. if you have an Android device. Do the following to hear incoming information rather than viewing it:

Go to Settings -> Accessibility -> turn on the Text-to-Speech Output option.

i) Variable text-to-speech speed option allows users to set speech speed and pitches from a wider range.

j) Work mode - Work mode allows you to turn on and off your device's work apps and notifications for a better work-life balance.

k) Emergency information - This feature allows storage of information such as name, blood type, allergies and an emergency contact in the smart phone so that emergency responders can view this information even in the lock screen of the device.

Do the following set up for storing your Emergency Contacts.

Open apps → select contacts → option button → Groups → ICE- Emergency Contacts → Edit → Add members

l) Device Safety - This feature allows you to locate and block your smart phone without losing your data via the link given in your mobile if the smart phone is lost.

Do the following to set this feature in your device:

Go to Settings →Lock Screen and Security → Device administrators, and check the boxes: Remotely locate this device, and Allow remote lock and erase.

m) Smart phone access with head movements – There may be situations when you just have to use your device but your hands are otherwise occupied or it is too cold outside to take your warm gloves off. This feature allows us to access the device with head movements instead of fingers. Install a free app called EVA Facial Mouse to use this feature.

n) Secret Game - Starting with Android 2.3 Gingerbread, Google puts a small secret present for users into all their devices. However, finding it may prove to be quite difficult. Go to Settings and choose About phone or About tablet. Quickly tap Android version several times, and when a small marshmallow shows up on the screen, quickly tap it again, and get a special mini-game. But you need to install an app to access it.

3.3.2 Android and its versions: The initial versions of Android include Version 1.0 and 1.1. But Google has considered Version 1.5 as the first popular version that highlighted the true power of its platform and named it as Cupcake Android 1.5.

Every Android version after 1.5 has been released with definite code names named after yummy desserts. Surprisingly, these names have been chosen in an alphabetical manner and there is no official explanation available for this naming convention. The several versions of the android OS is furnished below:

- ➢ Cupcake Android 1.5 (April 2009)
- ➢ Donut Android 1.6 (September 2009)
- ➢ Éclair Android 2.0/2.1 (October 2009)
- ➢ Froyo Android 2.2/2.2.3 (May 2010)
- ➢ Gingerbread Android 2.3/2.3.7 (Dec 2010)
- ➢ Honey Comb Android 3.0 (Feb 2011)
- ➢ Ice Cream Sandwitch Android 4.0/4.0.4 (Oct 2011)
- ➢ Jelly Bean Android 4.1/4.3 (July 2012)
- ➢ Kitkat Android 4.4 (Oct 2013)
- ➢ Lollipop Android 5.5 (Nov 2014)
- ➢ Mashmallow Android 6.0 (Oct 2015)
- ➢ Nought Android 7.0 (August 2016)
- ➢ Oreo Android 8.0 (December 2017)

Know your Android Version:

To find out the version of Android that is currently running on your device, do the following steps:

1. Press the Settings Button from the home screen

2. Select the Settings option

3. Scroll down and select About Phone

4. Scroll down to Android Version

The small number under the heading is the version number of the Android operating system on your device.

4 - Microsoft Office Package

4.1   Database

Database is a structured/ non-structured collection of data, stored in a computer using data management software in order to transform data into useful information
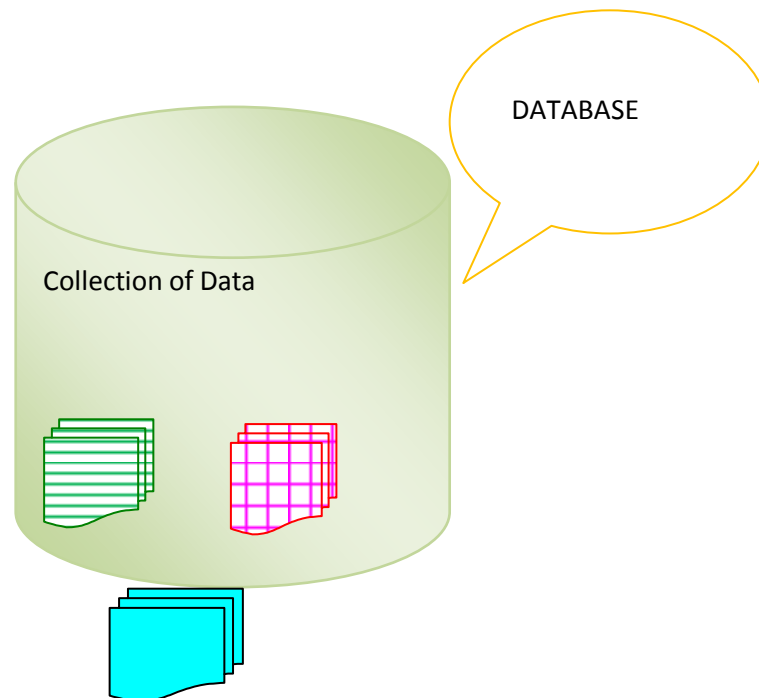
Figure 4.1 A Typical Database

In a database, data is held in tables, which are made up of rows and columns. Each table has one or more columns, and each column is assigned a specific data type, such as an integer number, a sequence of characters (for text), or a date. Each row in the table has a value for each column.

4.1.1 Characteristics of database tables:

- No significance to the order of the rows or columns

- Each row contains one entry for each column

- Each entry in a given column has the same data type

A typical fragment of a database table containing student information is given in Table 4.1. One can see that the fields such as student id, student name and student mark are used to characterise a student and it has values of similar data types

Table 4.1 Student Table in a Database

		Fields (characteristics of records)		
Records (row entry details)	➡	Std_id ⬇	Std_name ⬇	Std_mark ⬇
	➡	CSE18C01	LEE	680
	➡	CSE18C02	TEEN	575
	➡	CSE18C03	BEN	620
		CSE18C04	DON	498

(Table label: Table)

.

4.1.2 Database Management System and its Functions:

Database → Collection of Data

Management → Activities related to the manipulation of data viz. Insertion, deletion, modification, etc

System → Computer-software application that interacts with end-users, other applications, and the database itself to capture and analyze data

Create   Read   Update   Delete   Extract

Figure 4.2 Functions of DBMS

Figure 4.2 shows what a database management is? and also, the services provided by DBMS. The database is a collection of tables. The services can be classified into five main functional groups:

1. Creation – Database creation by adding fields and records

2. Update – Insertion, modification, and deletion of the actual data (records/field names…)

3. Querying – Retrieval of data in a form directly usable or for further processing by other applications; (i.e) searching, sorting, printing / display of records based on a criterion, creating forms and reports

4. Administration – Database maintenance, data security, data integrity, Registering users, monitoring users, monitoring performance, and data recovery in the event of unexpected system failure.

The ultimate purpose of a database management system is to organize and transform data into information to support decision-making process. Database Administrator (DBA) is responsible for the maintenance of database. He is responsible for storage planning, database design, installation, configuration, data backup and data recovery.

4.1.3 Examples of DBMS: Database management systems Software include DB2, MySQL, Oracle, PostgreSQL, SQLite, SQL Server, MS Access and Sybase.

Microsoft Access

Microsoft Access is a desktop version of database system, developed by Microsoft. It helps users to create and maintain databases to certain extent for their personal use. It is a powerful database package that covers almost all the activities of a major DBMS.
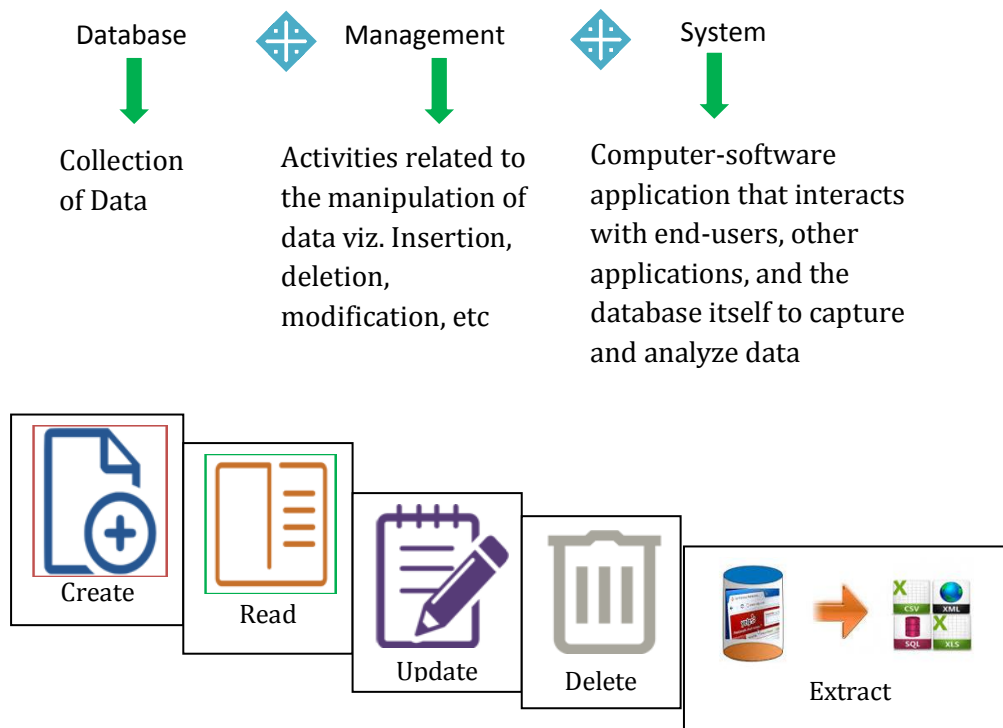
MySQL

MySQL is one of the most popular DBMS on the web. It is an open source DBMS. It enables multiple users to access multiple databases. The software runs on multiple platforms. For example it supports most of the UNIX and Windows platforms.

SQL Server

SQL Server is a database server developed by Microsoft. It is designed to handle databases with millions of records. It can be run on the same computer or on the other computers across the network. SQL is a standard language for storing, manipulating and retrieving data in databases.

Oracle

The Oracle database is developed by Oracle corporation. It is mainly used in online transaction processing (OLTP), Data Warehousing (DW) and mixed (OLTP & DW) database activities. The maximum size of an Oracle database is 8 million terabytes.

4.1.4 Database Applications: Applications of databases include banking, finance, business, organization and education.

Educational Institutional Management Information System

Currently, universities and colleges implement online admissions, online examinations, online result publication. Student's registrations details, programs and courses, fee details, results, grades and all the other related information are stored in database.

Library Management System

DBMS is used to keep a record of all the books in a Library; it is also responsible for maintaining all the information related to book issue details, book title / name / author search and availability of the book.

Banking

Banking include tracking of credit /debit transactions, customer - record maintenance, various bank statement generation, etc. Bank transactions are online now just because of DBMS that manages them. Customers can access the bank sitting at home.

Telecom

Telecom departments store call details, billing details, network usage, customer details etc. And, the amount of data is huge which keeps updating every millisecond. Certainly, DBMS is a boon to this department to store data, update data and generate various reports.

Industry

Companies have employees and they make products for sales. DBMS is used to keep records of employee data, products and sales particulars.

4.1.5 Managing Database:

Activity 1: creating database using Microsoft Access

A Microsoft Excel spreadsheet or Microsoft Access is good example of desktop database programs. These programs allow users to create, store, update, secure, and retrieve data when needed. Let us now understand the method of creating a database and accessing it using Microsoft Access.

Let us see the design of a Student Register database containing a table named StudentRecord with 6 fields/columns and 11 student records/rows. Also let us discuss the form design with navigation buttons. Finally, we'll see how create and use queries to retrieve relevant records those meet the search criteria.

Database design procedure

1. Open the application - Microsoft Access from windows start-up screen

2. Click on the blank database option on the home screen, after that give the database a name, for eg. StudentRegister. This step creates a database with an empty table by default.

3. Click on the table name and select the design view option from the View Menu as shown in Figure 4.3 and give the table a name, for eg. Student Record

4. Add the desired fields along with their data type as shown in Figure 4.4. The data-type of each field in the database determines the type of data that will be accepted in the database.

5. The lookup wizard allows the user to define fixed multiple values for a field in the table. To do this, click on the respective data type column (say, for eg., the data type for 'programme') and select the lookup wizard option; A popup window appears on the screen; enter suitable values using this option (Figure 4.5Figure). Now, if you view the table in the

'view mode' and click on the specific field, fixed multiple choices appear for that field (Figure 4.6)

6. Field attributes other than data-type, for eg. Field size, format, default value etc., can be set using the Field Properties Pane in the bottom of the window.

Figure 4.3 View Menu

Figure 4.4 Table Creation
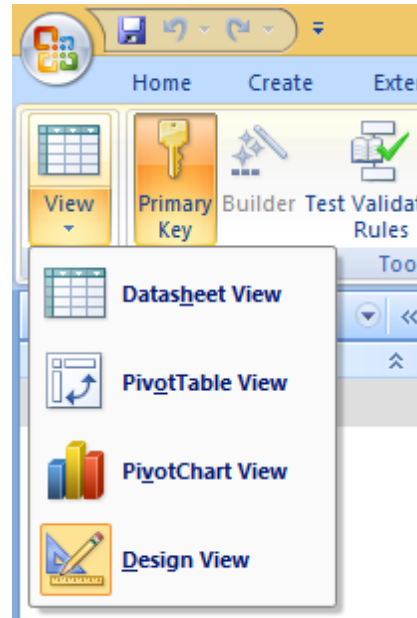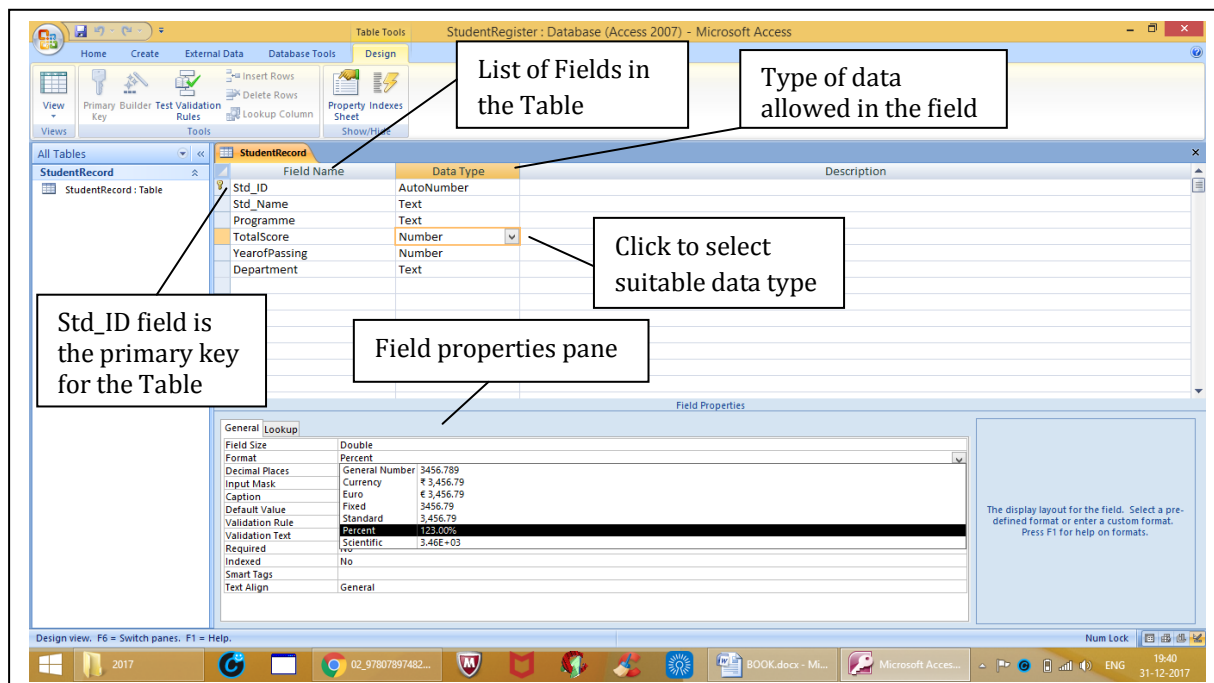
To select a programme from the list of ME, MCA and M.Sc. from the programme field, do the following:

a) Click the datatype option of the field named 'Programme' and select 'lookup Wizard…' in the StudentRecord:Table which is opened in the design view.

b) Proceed further to enter the lookup column values namely ME, MCA, MSc and then click ok.

c) Now click the 'database view' option from the view menu. Click the programme filed of any record to enter a value. Now, a dropdown list will pop out, from which you can select your choice.
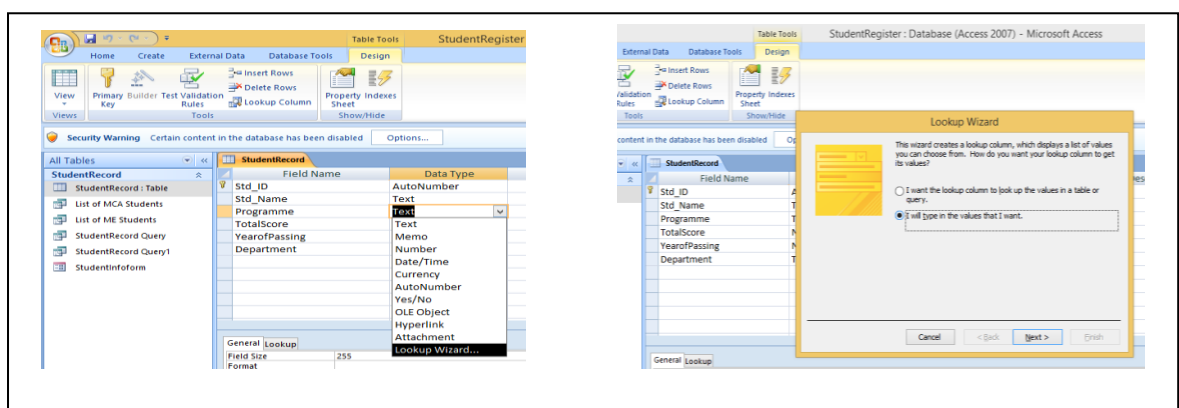
Figure 4.5 Lookup wizards to enter the list of multiple choices

Figure 4.6 StudentRecord Table in the Database View mode after lookup wizard settings for the 'programme'field

7. Set one of the fields with unique properties as the 'primary key' so that records from the tables can be searched using this field (primary key) value. To change the primary key, select the specific field (table in the design view) and then click the 'primary key' button (Figure 4.7Figure).
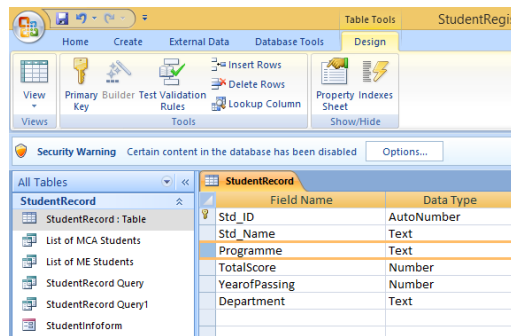
Figure 4.7 Primary key selections

8. Now that a table has been stored in the Access database

9. Open this table in the 'database view' mode using the view menu and enter records as shown in Figure 4.8
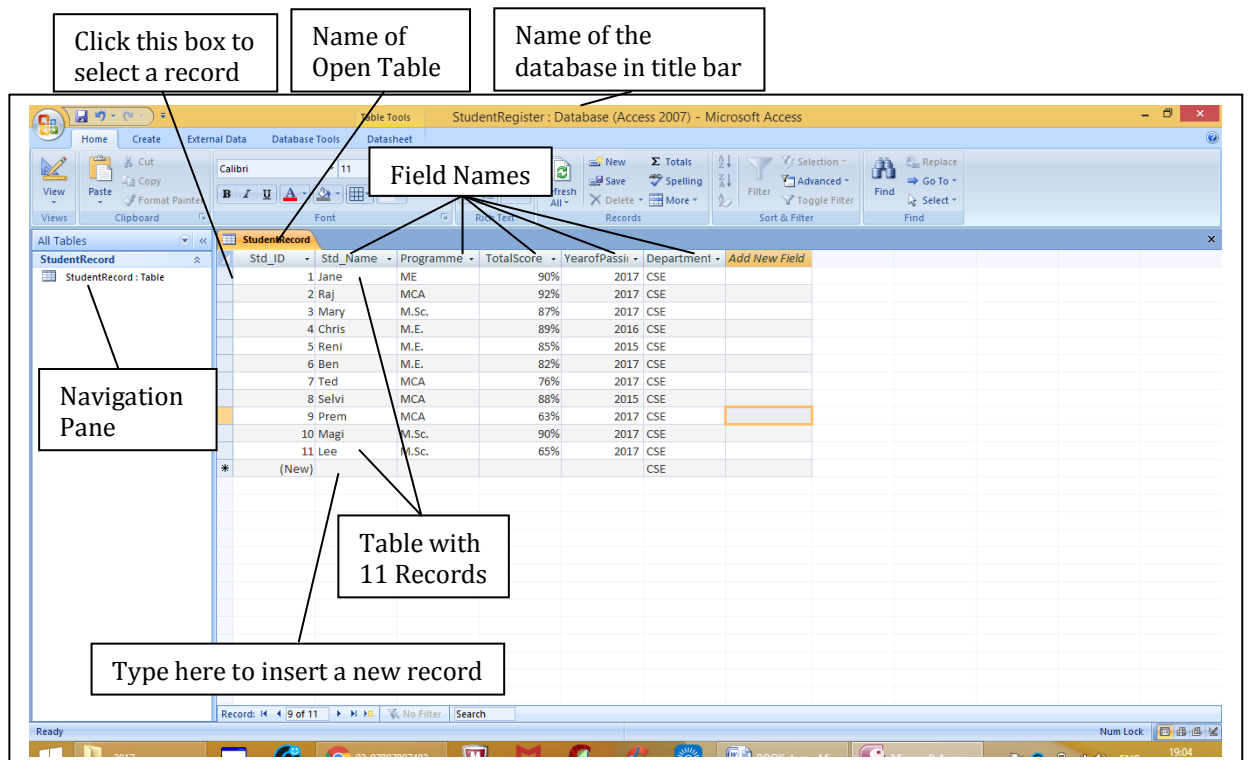
Figure 4.8 StudentRecord:Table

10. Creating Queries

Now, let us see how to create and use queries with Access database. Queries are just an alternate name for searches.

1. Open the Table named StudentRecord
2. Click 'Query Wizard' button in the Create Tab
3. Select 'simple queries', choose the table and select all data (fields names)
4. Click, Next →default→ 'I will modify the query design'→finish

This is the design view in which you can pass the queries. To search the list of students who pursue ME, type 'ME' in the cell corresponding to the column 'programme' and row 'criteria'.

11. Query Execution

1. Click the 'run' button in the design menu to execute the query. The search result will be displayed as shown in Figure 4.9.
2. Click the save button to save this query with a name, say, list of ME students
3. Obtain the result for the query as shown in Figure 4.10.
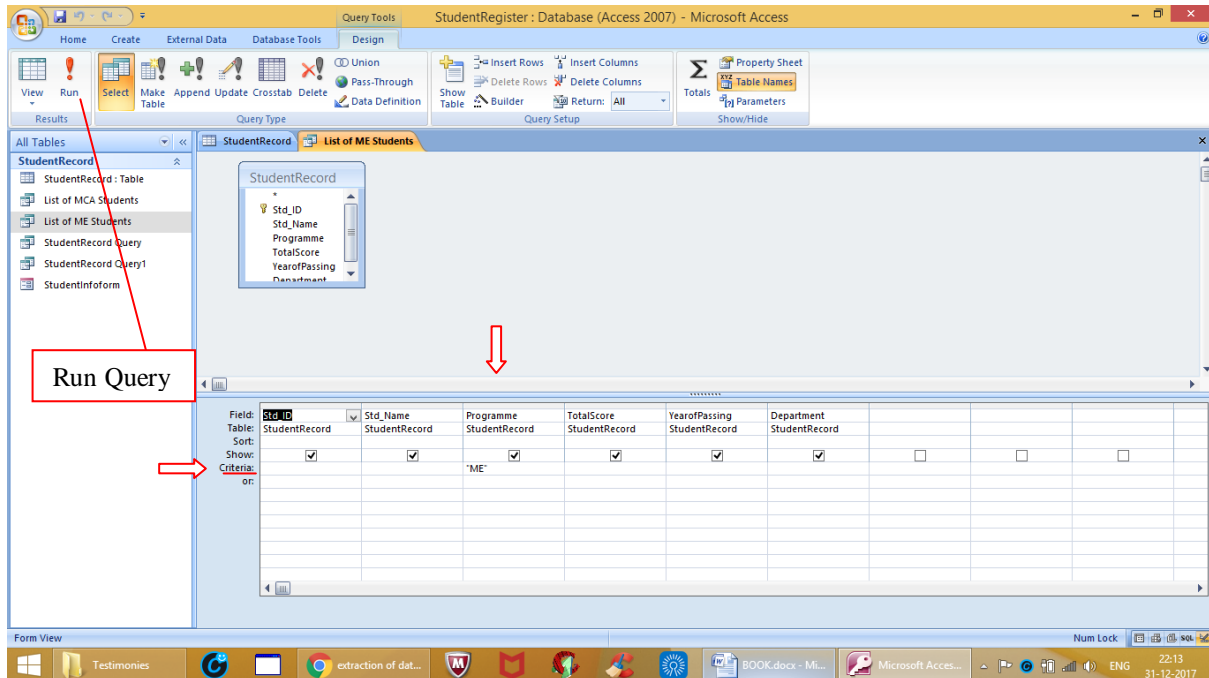
Figure 4.9 Query Execution
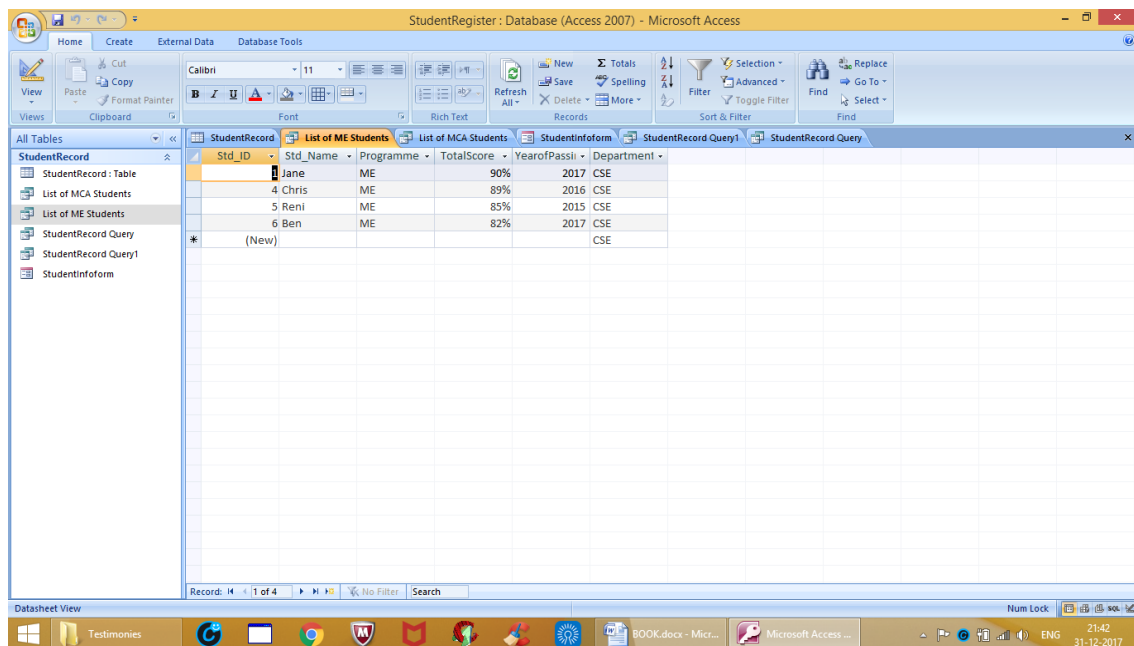
Figure 4.10 Resultant Table Based on the search criteria

4.2   Basic Office Automation Tools

Office automation helps to automate / computerize existing office procedures. It refers to the computer network with a set of software used to digitally create, store, manipulate, and communicate official information needed for accomplishing basic tasks. The functions of office automation systems include data processing and communication systems. Microsoft word and excel are examples for data processing software; e-mail, facsimile, voice mail and video conferencing are examples for data communication software. Let us discuss MS word and excel in this chapter.

4.2.1 Microsoft Word: Microsoft Word is a computer program used to create, edit, and format text documents. It is one of the sophisticated word-processing programs available. Word is used to create a wide range of official and personal documents, from the simplest letter to the most complex report.

Features of Microsoft Word:
1. Launch Microsoft Word and open a blank document
2. Save the document even before you start typing anything; To do this, click the 'file' menu, select 'save as' and choose the location where you want to save the file.
3. The 'home' tab is MS Word's standard view(Figure4.11)
4. The Page Layout Tab is used for page setup and paragraph settings such as Margin, Orientation, Size and Columns
5. The 'styles' section in the Home page contains different styles of page formatting. When you type, your layout will automatically match the format selected. It also allows you to change the color scheme, watermark, and paragraph spacing of the document (Figure4.12).
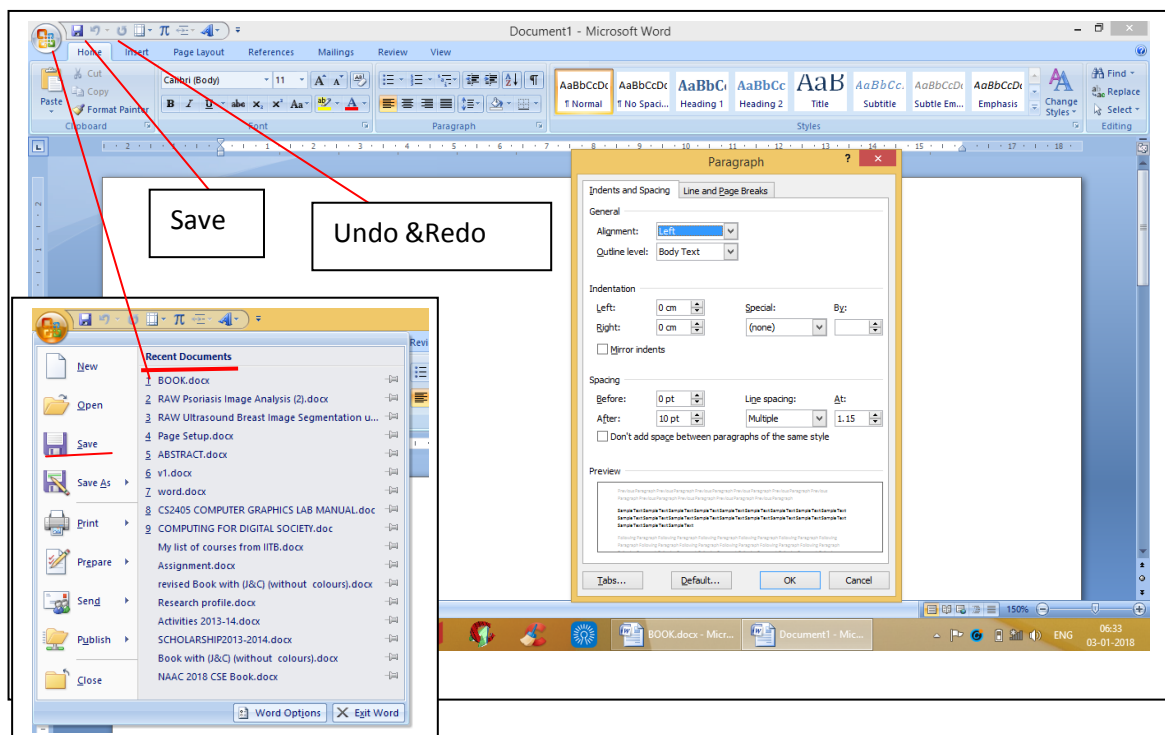
Figure4.11 Microsoft Word
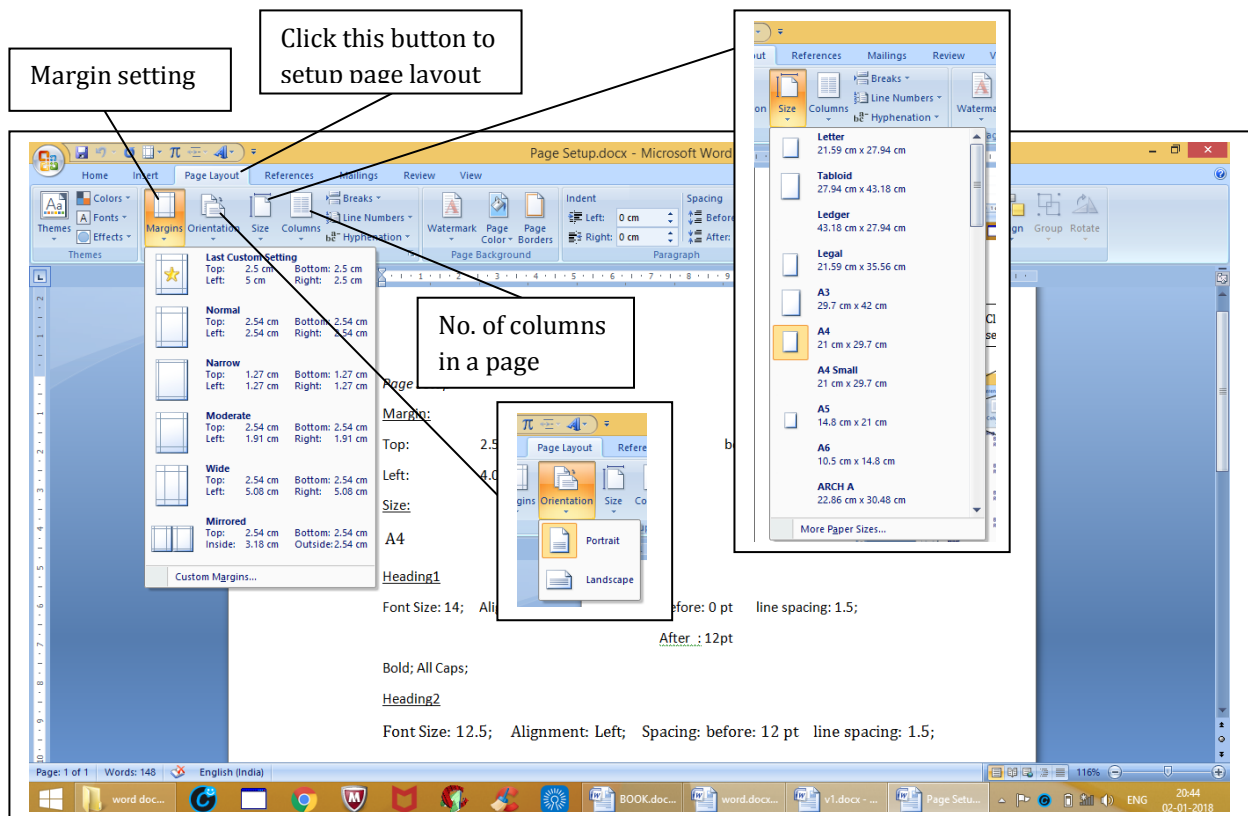
Figure4.12 Microsoft Word – Page Layout view

The author recommends the following Page Setup (Figure4.13) details for report writing:

- ✓ Custom Margin:

  Top   : 2.5cm;   Bottom : 2.5cm;

  Left   : 4.0cm;   Right   : 2.5cm

- ✓ Size: A4

- ✓ Heading1

  Font Size: 14;   Alignment: Center;   Spacing: before: 0 pt; After: 12pt;

  Line spacing: 1.5; Bold; All Caps;

- ✓ Heading2

  Font Size: 12.5;   Alignment: Left;   Spacing: before: 12 pt; After: 0 pt;

  Line spacing: 1.5; Bold; All Caps; Character spacing may also be set.

- ✓ Heading3

  Font Size: 13;   Alignment: Left;   Spacing: before: 6 pt;   After: 0 pt

Line spacing: 1.5; Bold; Sentence case;

✓ Heading4

Font Size: 12.5;   Alignment: Left;   Spacing: before: 6 pt; After: 0 pt

Line spacing: 1.5; Bold; Sentence case;

✓ Paragraph:

Font Size: 12.5; Alignment: justified; Spacing: before: 0 pt; After: 0 pt

Line spacing: 1.5; Regular; Sentence case;

✓ It is best to use a serifed font (such as Times) for body text and a sans serif font (such as Arial) for figures such as graphs
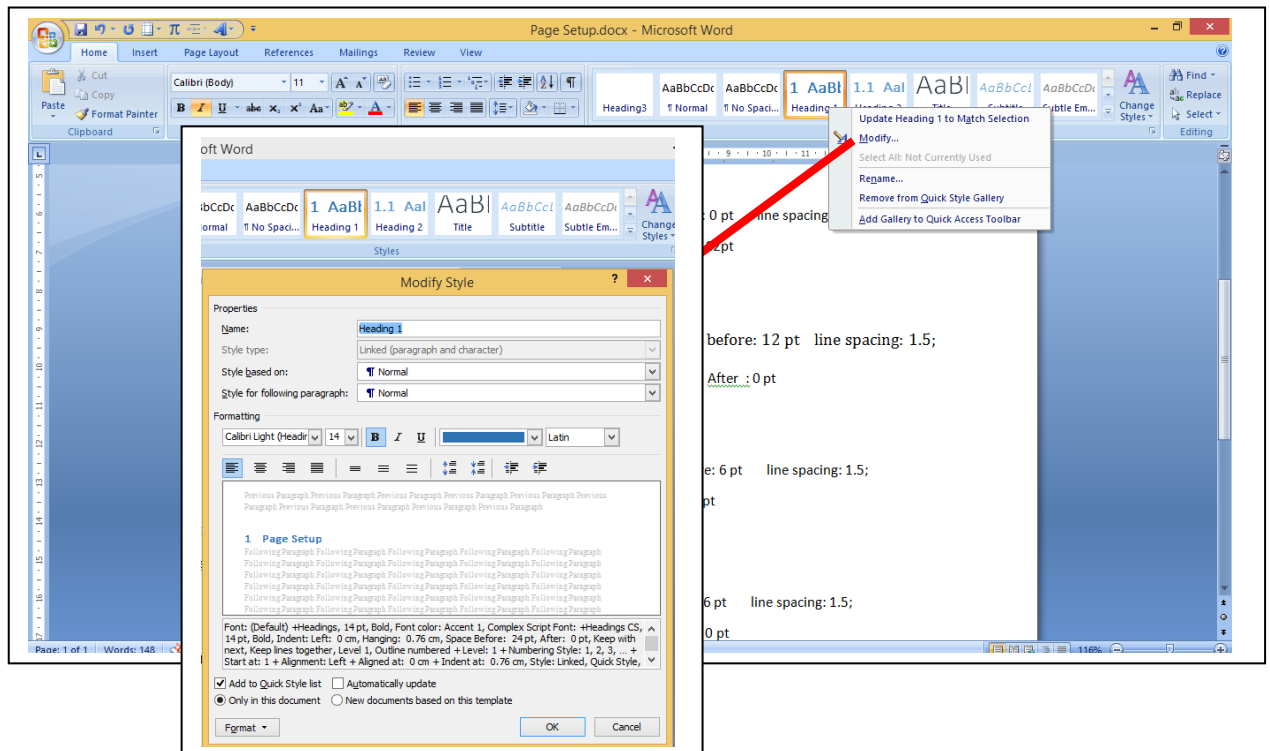
Figure4.13 Microsoft Word – page setup

6. The References Tab contains options to add Table of Contents, Footnotes, Bibliographic Information, Indexes and Citations.

7. With proper page setup it is easy to generate Table of Contents (Figure 4.14). To do this, first type the document following the page set up instructions, then goto 'References' tab → Table of Contents → insert new table → select a format of your choice and then click ok.

8. In a similar way, indexes and citations can be created for the bibliographic information (Figure 4.1616). It is also possible to generate list of figures and tables (Figure4.17). These

features in MS word are a blessing to the researchers for documentation and article preparation.
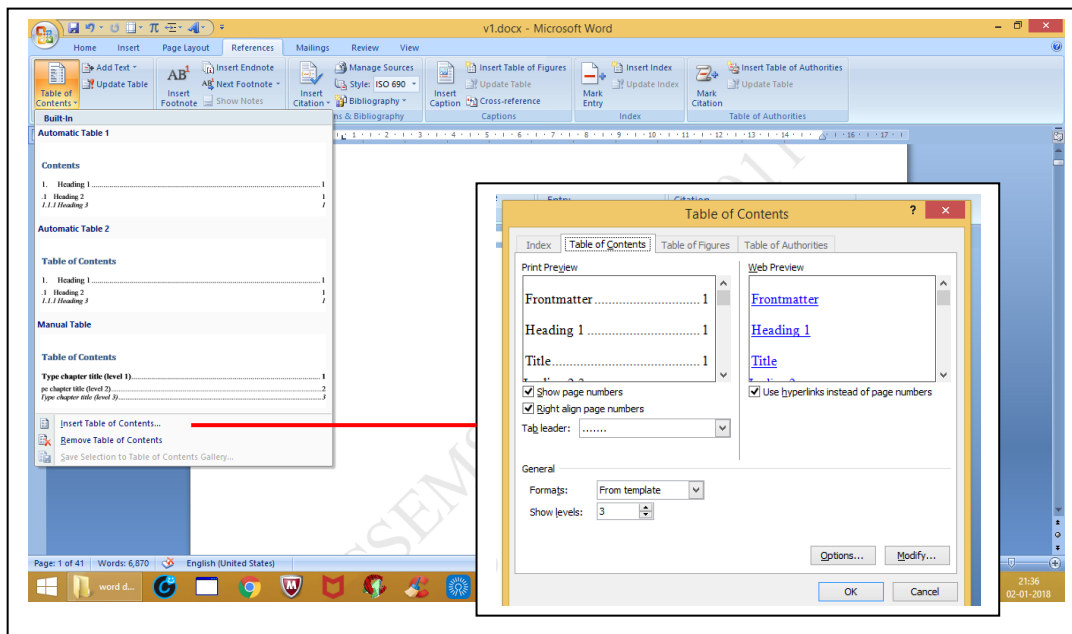
Figure 4.14 Microsoft word – Table of Contents settings
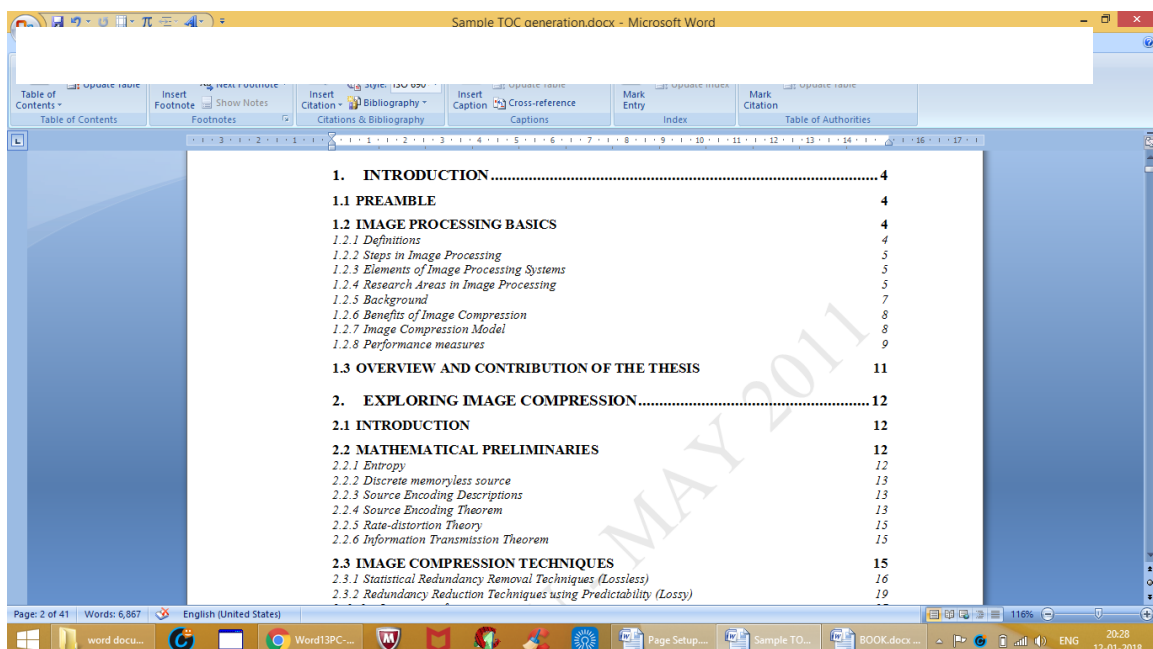
Figure 4.15 Example for Table of Contents generation
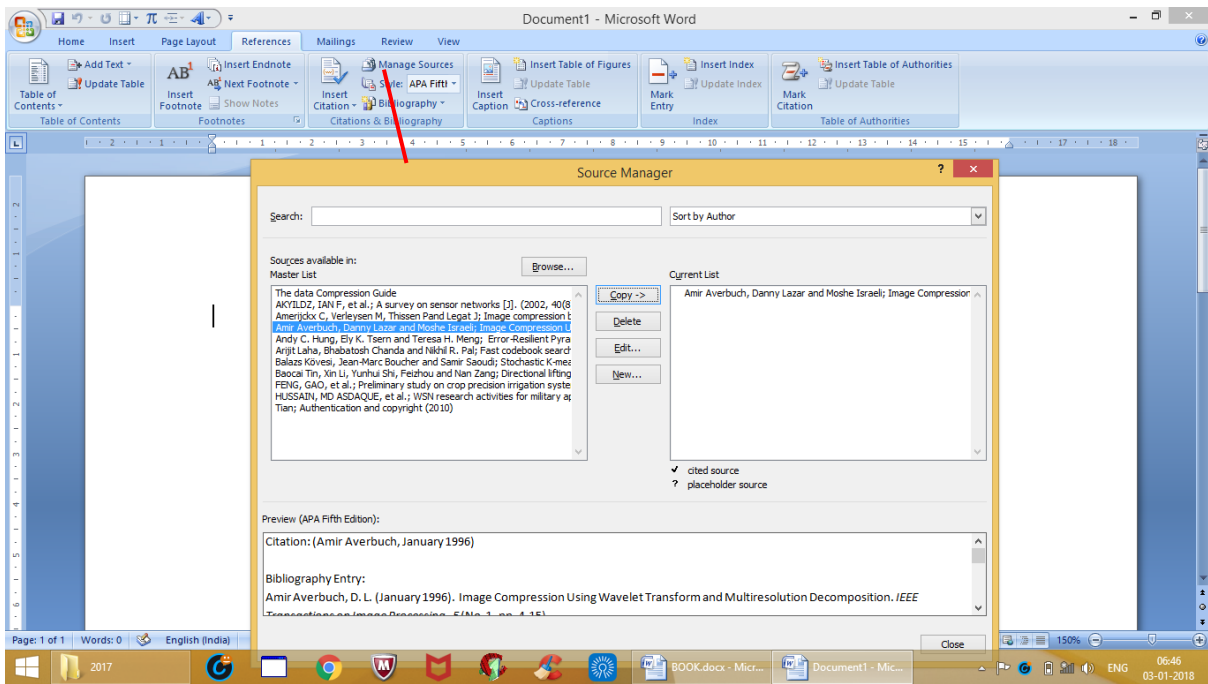
Figure 4.16 Bibliography Creation
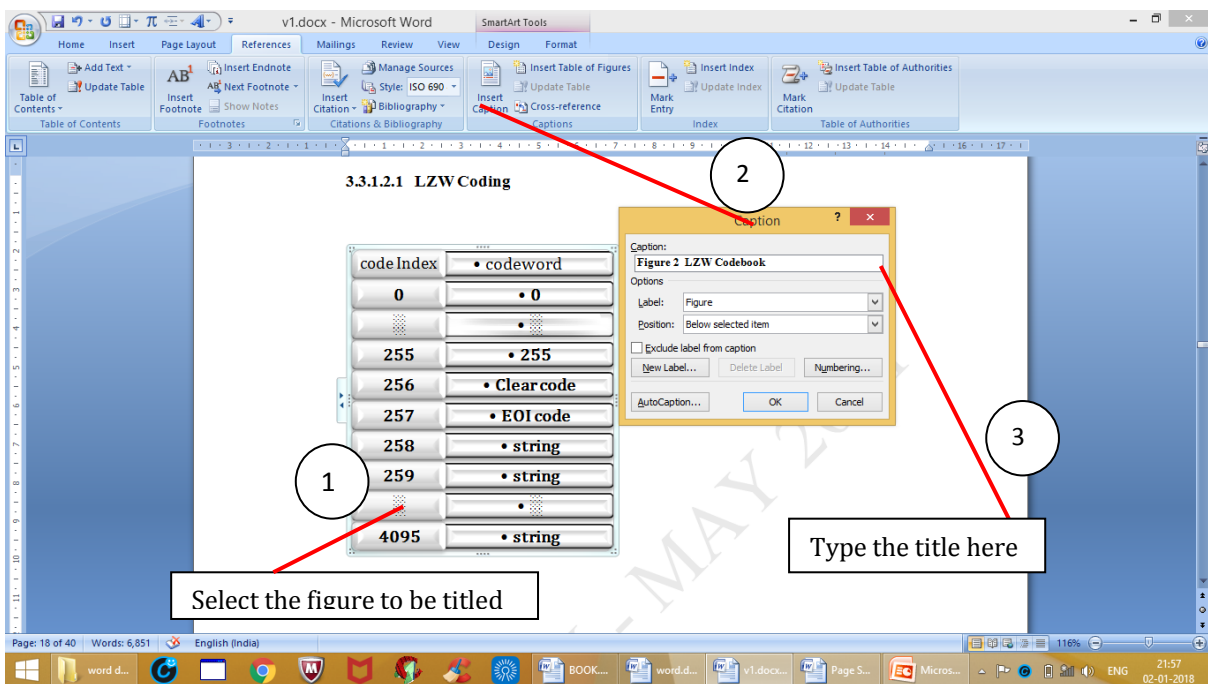
Figure4.17 Inserting Caption to Figures

9. To insert equations, goto the insert tab and click 'Equations'; Built-in equations pop up. It is also possible to insert a new equation by selecting the 'insert new equation' option;
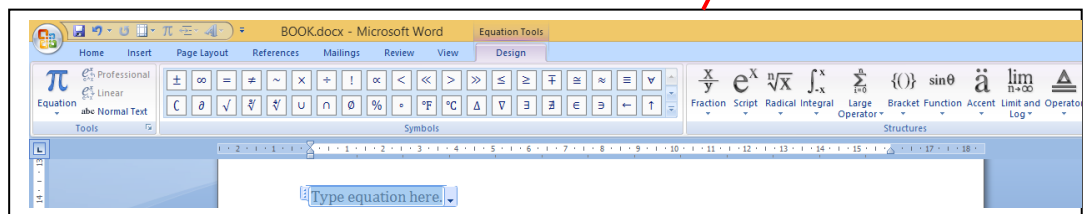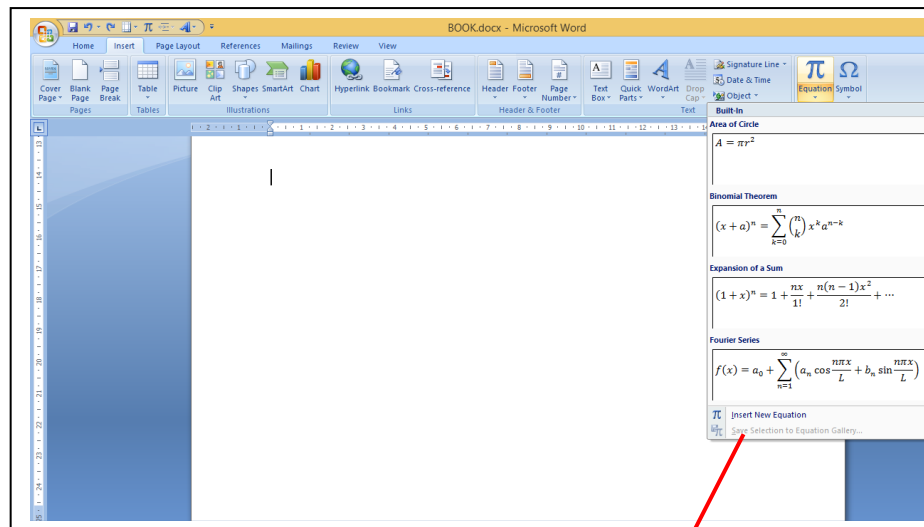
Figure 4.18 Inserting Equations

10. The format tab is used to edit pictures (Figure 4.19). There are many features available to format a picture. The feartures include brightness & contrast adjustment, compress picture, picture effects, rotate picture, crop, text wrapping, etc.
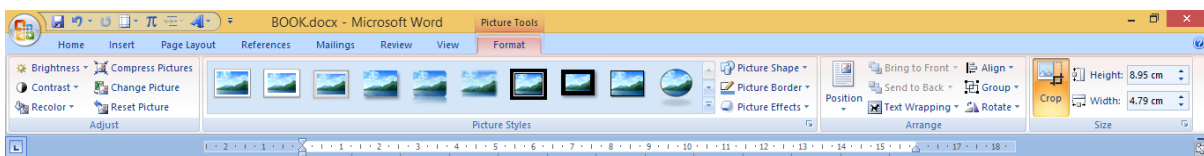
Figure 4.19 Formatting Pictures

11. The find and replace option (Figure 4.) is used to search for the text to be replaced in the document and replaces it with the replacement text.
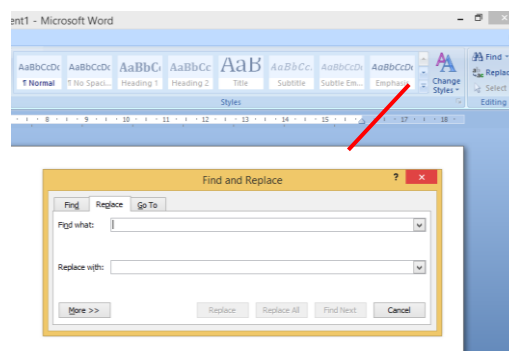
Figure 4.20 Find and replace option

12. To add shapes of different kind, click insert tab and select the desired shape from the 'shapes' option (Figure 4.).
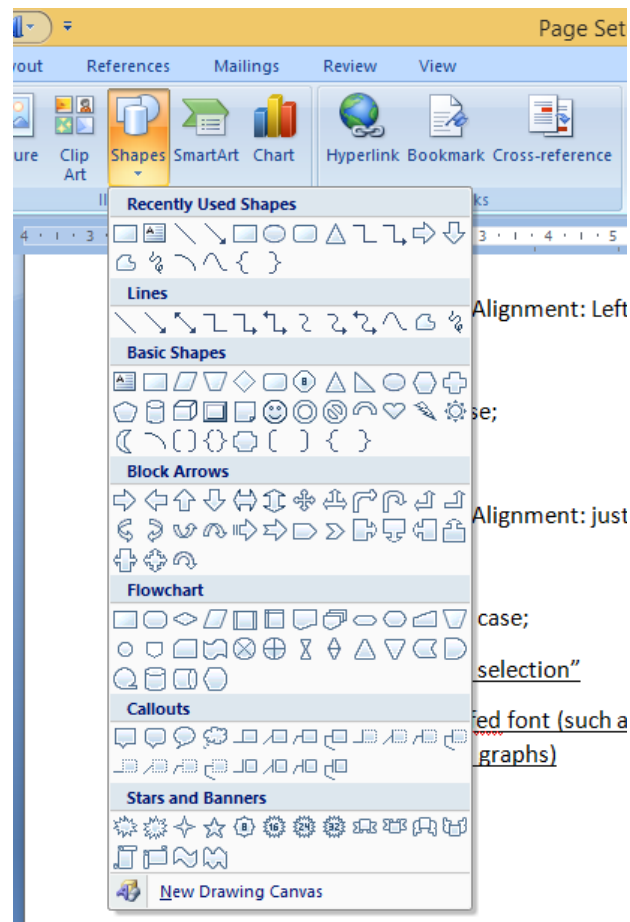
Figure 4.21 Microsoft Word – inserting shapes

13. Word art (Figure 4.) is another interesting feature which is used to type text artistically.
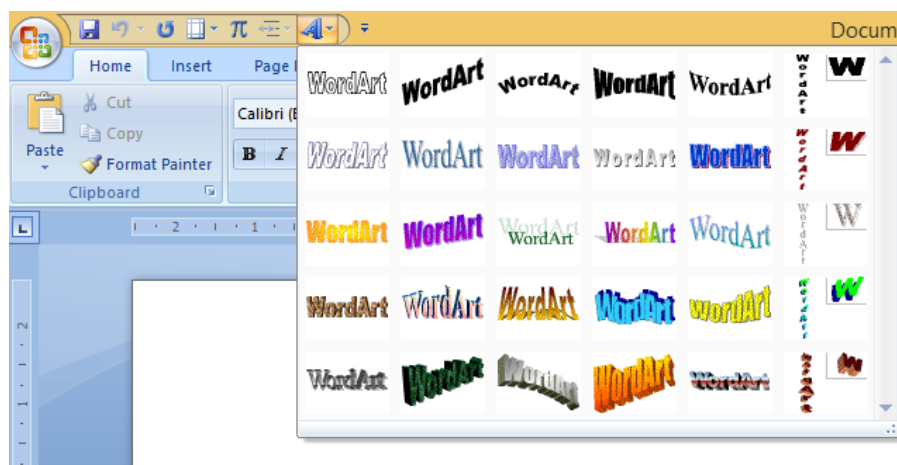
Figure 4.22 WordArt

14. Smart art (Figure 4.) option in the insert tab is used to create flowcharts and other block diagrams.
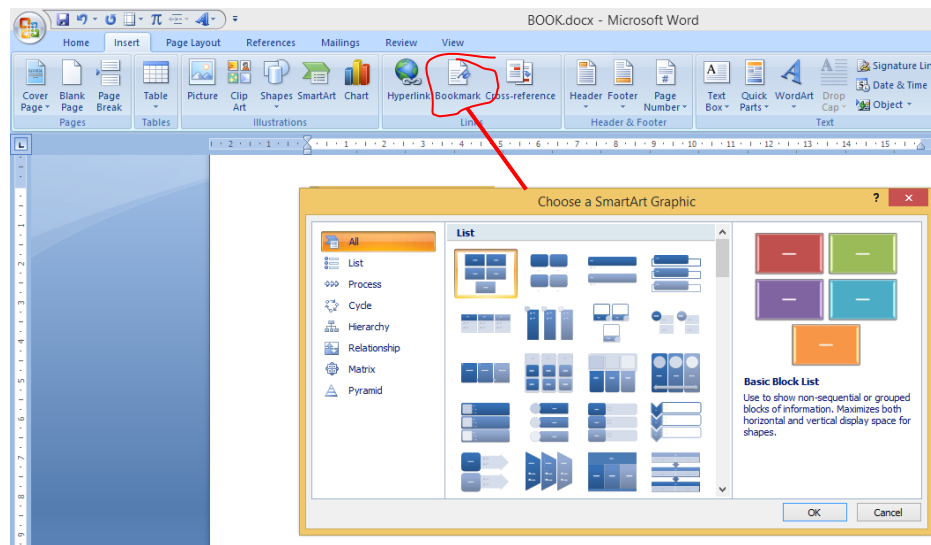
Figure 4.23 Inserting SmartArt

15. The review tab contains various options including track change settings, accept/reject changes, marking options which enables the reviewer to revise an article or report without the need for pen and paper. In addition, word also provides a summary of revisions which describes the quantum of revisions made by the reviewer interms of no. of pages, no. of words, no. of insertions/deletions, average edits per page, etc (Figure 4.).
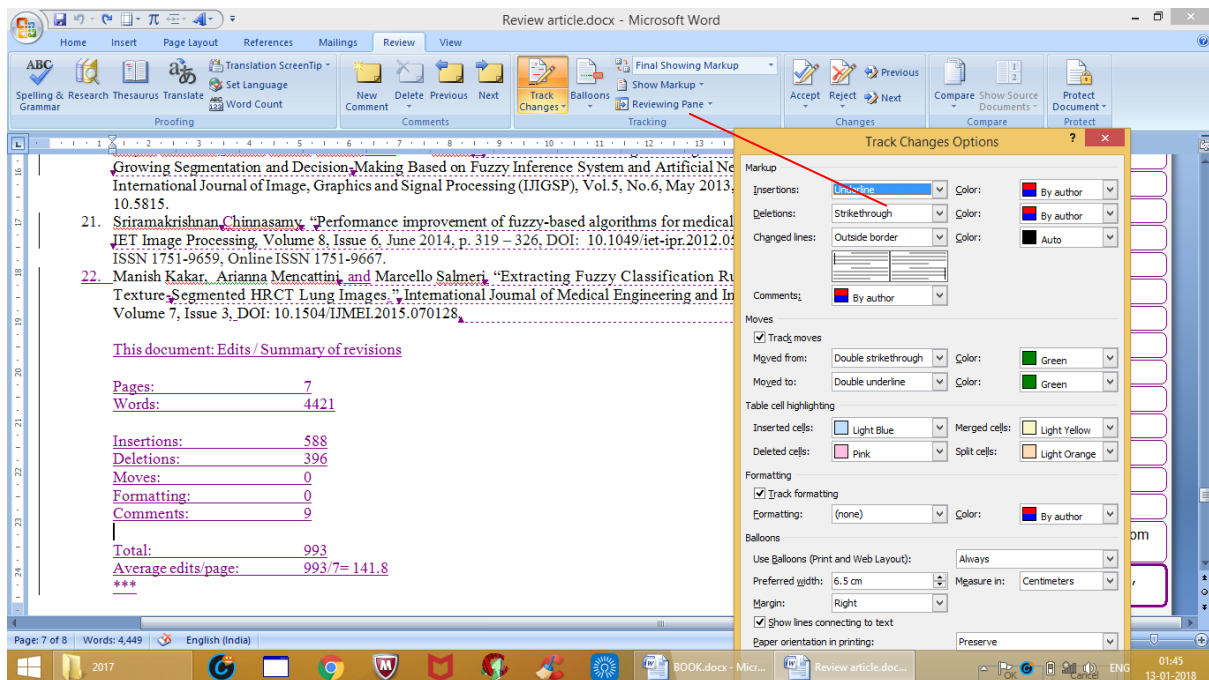
Figure 4.24 Microsoft Word – The Review Menu

Attention….

Save your document every 5 to 10 minutes! There is an alternate way to save it from the keyboard by holding down the CTRL key and the S key.

Activity 2: Create a Cover Letter and Resume using Microsoft Word

Prepare a word document containing a cover letter for job application in your area of interest and your own resume. Sample cover letter and resume are given below:

From

Type your Name,
No. 120/5, XX Street,
Palayamkottai,
Tirunelveli – 12.

To

The Correspondent,
XXX Matric. Hr. Sec. School,
Near High Court,
Palayamkottai,
Tirunelveli – 12.

Respected Sir,

Sub: Application for the post of Computer Science Teacher.

Ref: Your advertisement in The Hindu dated 5th May 20XX.

With reference to your advertisement cited above, I would like to apply for the post of Computer Science Teacher in your esteemed institution. The enclosed Curriculum Vitae enlist my educational qualifications and experience.

I assure you that I will discharge my duties to the best of my ability if I am given an opportunity.

Thanking You,

05.06.20XX   Yours Faithfully, Palayamkottai

(Arockia Jansi Rani P)

Curriculum Vitae

Insert your photo here

Type Your Name here

No. 120/5, XX Street, Palayamkottai, Tirunelveli - 12

Mobile No**:** 94xxxxxxxx   Email-ID: iam@msuniv.ac.in

Professional Experience

❖ Organization   : Manonmaniam Sundaranar University,Tirunelveli

   Designation   : Lecturer

   Period   : June 2015 to till date

Academic Qualification

Degree of Examination	Name of the School/College/ University	Year of		Subjects taken	Class or Division Average Marks of Grade
		Entry	Leaving		
SSLC	Type your School's Name, City Name	xxxx	yyyy	Tamil,English, Mathematics, Science, History, Geography	80.60%
HSSC	Type your School's Name, City Name	xxxx	yyyy	Tamil,English, Mathematics, Physics,Chemistry & Biology	87.42%
B.E.,	Type your College's Name, City Name	xxxx	yyyy	Computer Science and Engineering	60% with First class
M.E.,	Type your College's Name, City Name	xxxx	yyyy	Computer Science and Engineering	75%, First Class with Distinction

Awards / Prizes Received

- National Conference on Advances in Electronic Communication, ADELCO 2004 at National Engineering College, Kovilpatti

- T.A.Shajila and P. Arockia Jansi Rani, "Elliptic Curve Cryptography in VLSI Implementation of Digital Signatures", National Conference on Advances in Electronic Communication, National Engineering College, Kovilpatti, 2012

Symposium/Seminar/Workshops Attended

- Participated in the UGC-SAP sponsored Two day Seminar for the teaching Faculty members on Digital Image Processing using MATLAB, organized by the Department of Computer Science and Engineering on 2nd and 3rd February, 2012.

Resource Persons   : Dr. R.A. Alagu Raja and Ms. B. Sathya Bama,

Assistant Professor, Remote Sensing and GIS LAB, TCE

Technical Skill Set

- ❖ **Operating Systems**   **:** Windows, Android

- ❖ **Programming languages**   **:** Mat Lab, C, C++, & VC++

- ❖ **Productivity Tool**   **:** MS-OFFICE 2013

- ❖ **Networking**   **:** TCP/IP, FTP

- ❖ **Professional Training**   **:** Printed Circuit Board Making

Project Profile

B.E. Project:

    Title   : Wireless Communication using MODEM.

    Role   **:** Analysis, Design, Report writing, PCB Designing,

        Aligning & Soldering, Testing.

    Team Size   **:** Four

    Description   : This project envisages Wireless Communication between a computer and a remote printer. For transmitting a character, a specific baud rate is chosen. This project can be extended for transmitting data from several computers to a single printer.

PERSONAL DETAILS

Date of Birth & Age	: DD/MM/YYYY / xx years
Gender	: Female
Father's Name & Occupation	: Mr. xxxxx, Designation
Mother's Name & Occupation	: Mrs. xxxxxxx, Designation
Brothers/Sisters	: 1 Brother
Languages Known	: Tamil and English
Marital Status	: Married
Nationality	: Indian

Declaration:

I hereby declare that the information given above is true to the best of my knowledge.

Signature,

Put your Signature

(Type Your Name)

Activity 3: Create a Cover Letter and Resume using 'Microsoft office word template'

4.2.2 Microsoft Excel: MS-Excel is a Windows based application package. In addition to entering, editing and storing of data, it is quite useful in manipulating data. Arithmetic operations such as addition, subtraction, multiplication and division can be done with Excel. Sorting data based on a criterion (like ascending, descending etc.) and solving simple financial, mathematical and statistical problems are also possible.

Features of Microsoft Excel

Page Setup

Select File→Page Setup from the menu bar to format the page, set margins, and add headers and footers. The size of the worksheet on the page can also be formatted using Scaling. Select Fit to 1 page(s) wide to let the worksheet to print only one page wide so that all the columns appear on the same page. Change the top, bottom, left, and right margins under the Margins tab. Enter values in the header and footer fields to indicate how far the text should appear from the edge of the page. Check the boxes for centring horizontally or vertically on the page.

As you have been exposed to MS Access and MS Word, you must be familiar with the standard home tab, page layout tab, insert tab and the save settings; MS excel does have similar settings. In excel each cell is identified by the column number – row number pair, for eg.C5 corresponds to the cell with column id C and row id 5. This kind of cell representation is useful in relative referencing.

Relative reference

When a formula is copied into other cells, the row numbers for the cells change according to the row into which the formula has been copied.

Eg. **F5**: = C12 if F5 is copied into cells H6 and H7 then, H6=C13;   H7=C14

Absolute reference

The formula remains the same even if it is copied into other cells.

Eg. G6: =$C$12 if G6 is copied into cells H8 and H9 then, H8=G6; H9=G6

(i.e.) Relative reference points to the contents of a cell whereas Absolute reference points to a specific cell.
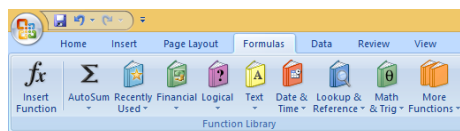
Figure 4.25 Microsoft Excel – Formula Menu

To understand the main functions of excel, let us create a student table and try to manipulate it using the excel software. In this section, let discuss the use of the formula bar and formulae which are available in the formula tab shown in the Figure 4..

1. Launch Microsoft Excel

2. Create a table with 7 fields and enter the data as shown in the figure. To do this, just enter the name of each field in each column in the excel sheet. The column/row size can be adjusted according to the length/width of the contents (Figure 4.).

   Note: buil-in formula can be inserted from the Formula tab; User defined formula can be entered in the formula bar with '=' symbol.

3. Enter the information below in the cells indicated.

   B12: Weightage;   C12: 0.3;   D12: 0.3;   E12: 0.3;   F12: 0.1

4. Enter the information below in the cell indicated.

   B13: C_Average;   B14: Sumfn;   B15: C_Averagefn

5. Enter the formulae below in the cells indicated. These formulae demonstrate three methods for calculating averages for a column of data.

   C13=(c5+c6+c7+c8)/4 C14=sum(c5:c8)/4 C15=average(c5:c8)

   Note: C13=C14=C15

        C13 (user defined formula); C14 (Built-in function to compute Sum); C15 (Built-in function to compute Average);

6. Charts for comparison can be generated as follows:

        Select a group of cells to be compared; Choose a chart option from the insert tab; Chart as shown in the Figure 4. is created.
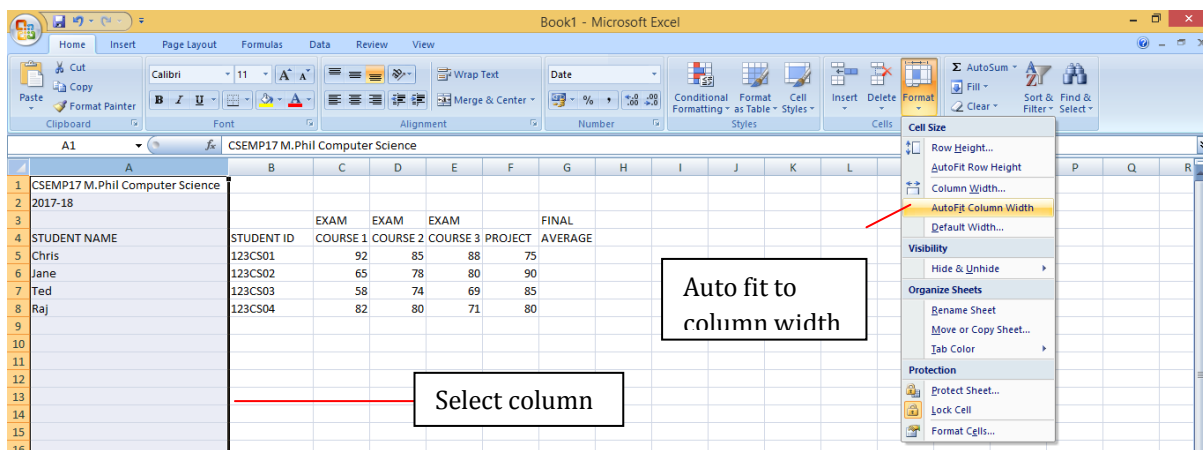
Figure 4.26 An Example Table created using Excel
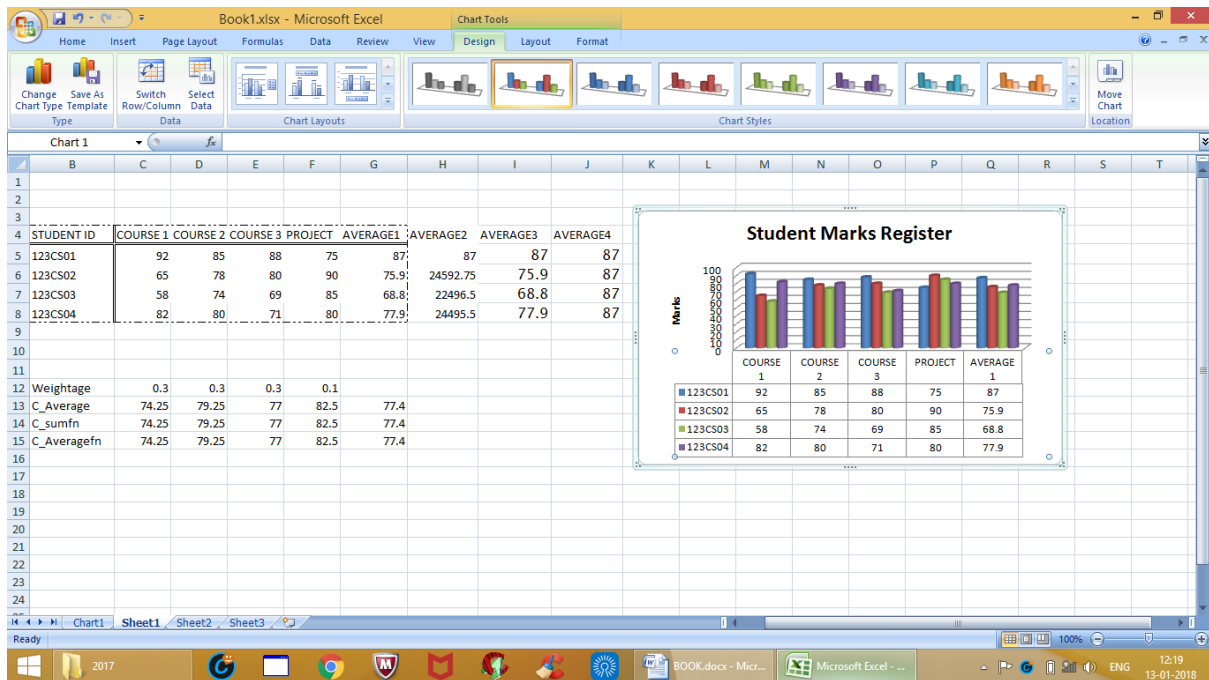
Figure 4.27 Creating Charts using Excel

7. Relative/ Absolute Referencing

a) Enter the formula below into cell G5 and copy it into cells G6 to G8. Notice that when this formula is copied into other cells, the row numbers for the cells change according to the row into which the formula has been copied.

G5: = 0.3*c5+0.3*d5+0.3*e5+0.1*f5

   This demonstrates the use of a "relative reference" that points to the contents of a cell.

b) Enter the formula below into cell H5 and then copy it into cells H6 to H8.

H5: =C12*C5+D12*D5+E12*E5+F12*F5

Note: $G5 \neq H5$

c) Enter the formula below into cell I5 and then copy it into cells I6 to I8.

I5: =$C$12*C5+$D$12*D5+$E$12*E5+$F$12*F5

Note: $G5 = I5 \neq H5$

d) Enter the formula below into cell J5 and then copy it into cells J6 to J8.

J5: =$C$12*$C$5+$D$12*$D$5+$E$12*$E$5+$F$12*$F$5

Note: $G5 = I5 \neq H5 \neq J5$

e) This demonstrates the role of an "absolute reference" that points to a specific cell. Notice that the absolute reference (for eg. $C$12) remains the same(J5) whereas the relative reference (for eg. C12) changes according to the location into which the formula is copied (H5)(Figure 4.).
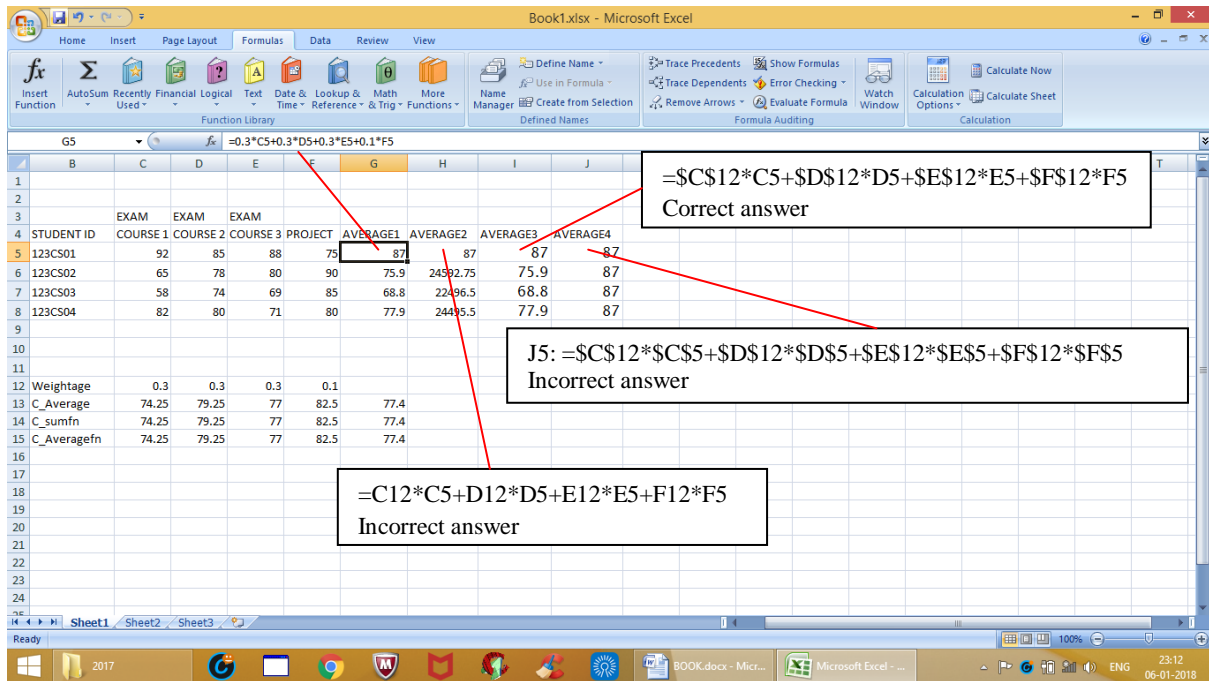
Figure 4.28 Microsoft Excel-using built-in and user-defined formulae

4.2.3 Microsoft PowerPoint:
PowerPoint is a presentation software that enables the users to present their thoughts using interactive and multimedia content. Basically, presentation is a collection of data and information that is to be delivered to a specific audience. Similarly, PowerPoint presentation is a collection of digital multimedia data.

Microsoft Word: To create and edit official /professional/personal documents.

Microsoft Excel: To perform Calculation and analyze data

Microsoft PowerPoint: To present the document summary, calculations carried out, resultant data analysis and reports in slides shows.

Features of Microsoft PowerPoint

We have discussed Microsoft Word and Excel earlier. In this section, let us discuss the method of preparing a presentation using Microsoft PowerPoint.

1. Open Microsoft Office PowerPoint. The presentation with default title slide layout is created.

2. Type a title in the title box and the author's name in the subtitle box; save this file.

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3. Insert a new slide using the insert option from the Home menu and Choose appropriate slide layout using the layout option (Figure 4.)

4. Appropriate design layout can be chosen from the Design menu (Figure 4.)

5. Two types of format menu are available: one for text formatting and the other for picture editing. The text format menu (Figure 4.) contains insert shape, shape styles, wordArt Styles, arrangement of textbox options. The picture format menu (Figure 4.) contains picture colour – contrast adjustments, picture styles and arrangement of picture options.
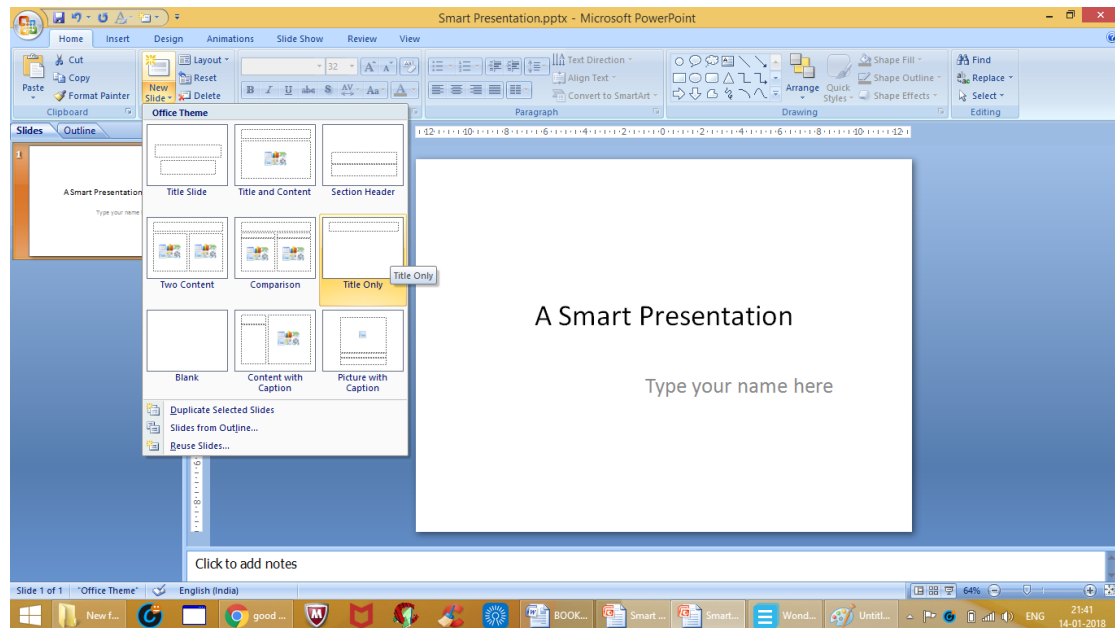
Figure 4.29 Microsoft PowerPoint – Title Slide and Layout
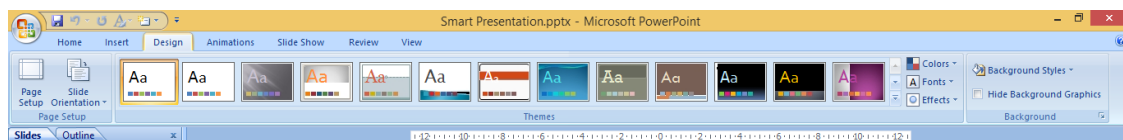
Figure 4.30 The Design Menu

6. Animation menu contains various animation effects; to add animation effect, select an option from the 'transition to this slide' list; the transition speed, sound can also be set from the animation tab; The 'Advance Slide' option is used to set the way of advancing each slide in the slide show (Figure4.).
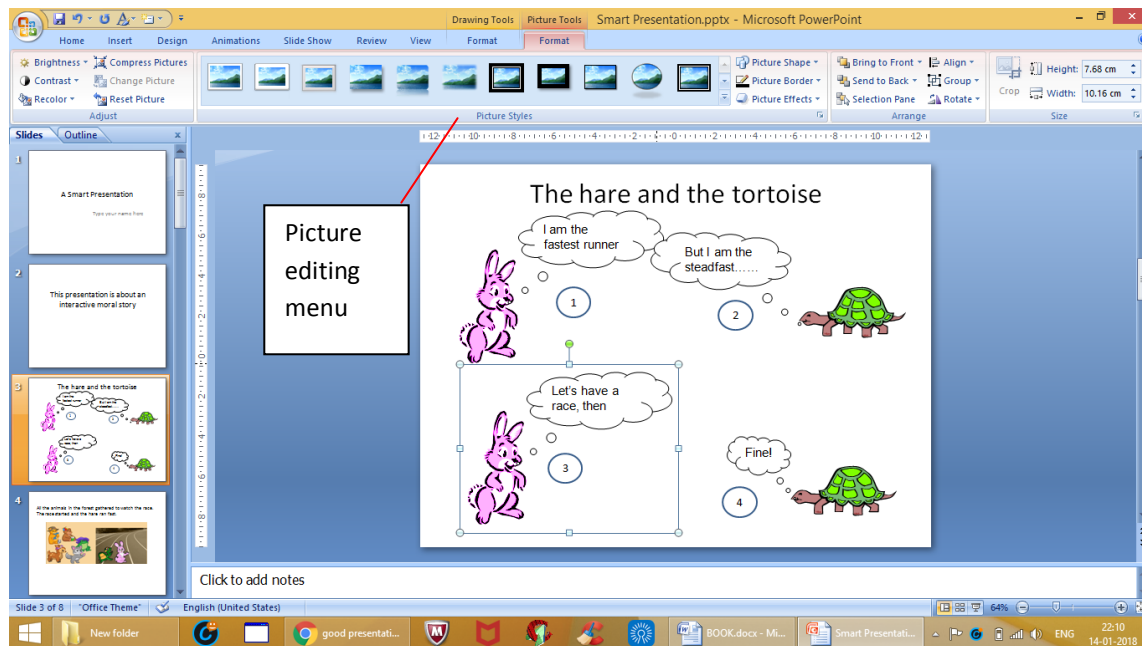
Figure 4.31 Picture Formatting Menu
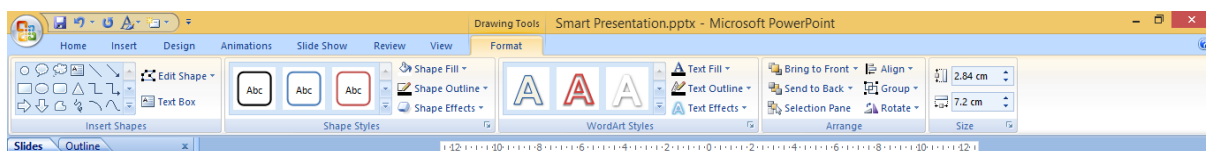
Figure 4.32 Text Formatting Menu
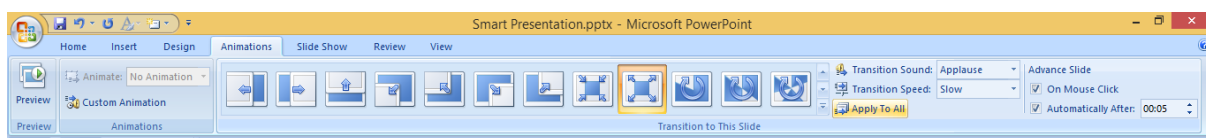
Figure4.33 Inserting Animation

7. The insert tab contains options to shapes, chart, pictures, etc. It is also possible to insert media clips like movie or sound into the slide. For example, to insert audio clipping, click the insert tab and select the sound option from the media clips list. Click 'record sound' in the sound option for voice recording. An action button appears in the slide. Click that button to playback the recorded audio when the presentation is run in the slideshow mode (Figure 4.).

8. Hyperlinks help us to navigate to another slide in the same document or to some other document (either in your hard disk or in the web). Hyperlink can be set to either text from the slide (Figure 4.) or an action button in the insert shapes option (Figure4.). To insert a hyperlink, select the text or the action button to which a hyperlink is to be set, click the 'Hyperlink' option from the Insert menu and choose an option from 'link to' option in the popup window (say, for eg., 'existing file'). Select the choice from the 'look in' option.
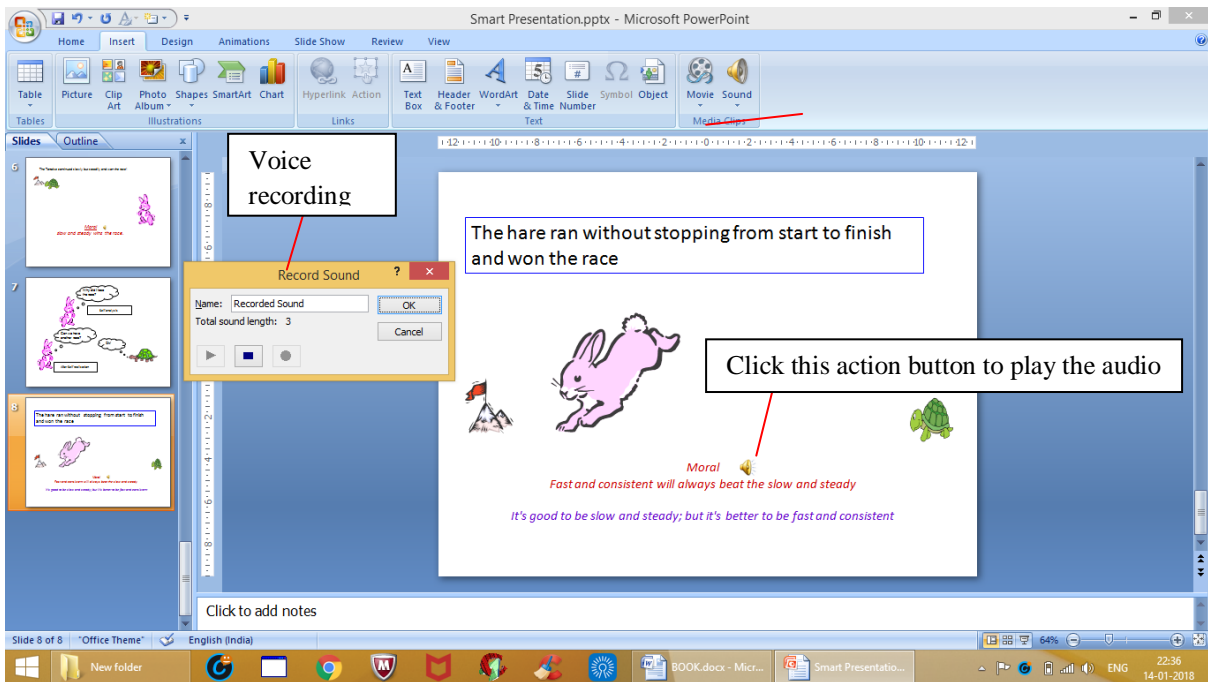
Figure 4.34 PowerPoint – Inserting Audio

9. After successful preparation of the presentation, slideshow can be run either by pressing the F5 button in the keyboard or by clicking the slideshow button in the slide. In the slideshow mode, the computer screen can also be used as white board as shown in the Figure 4..
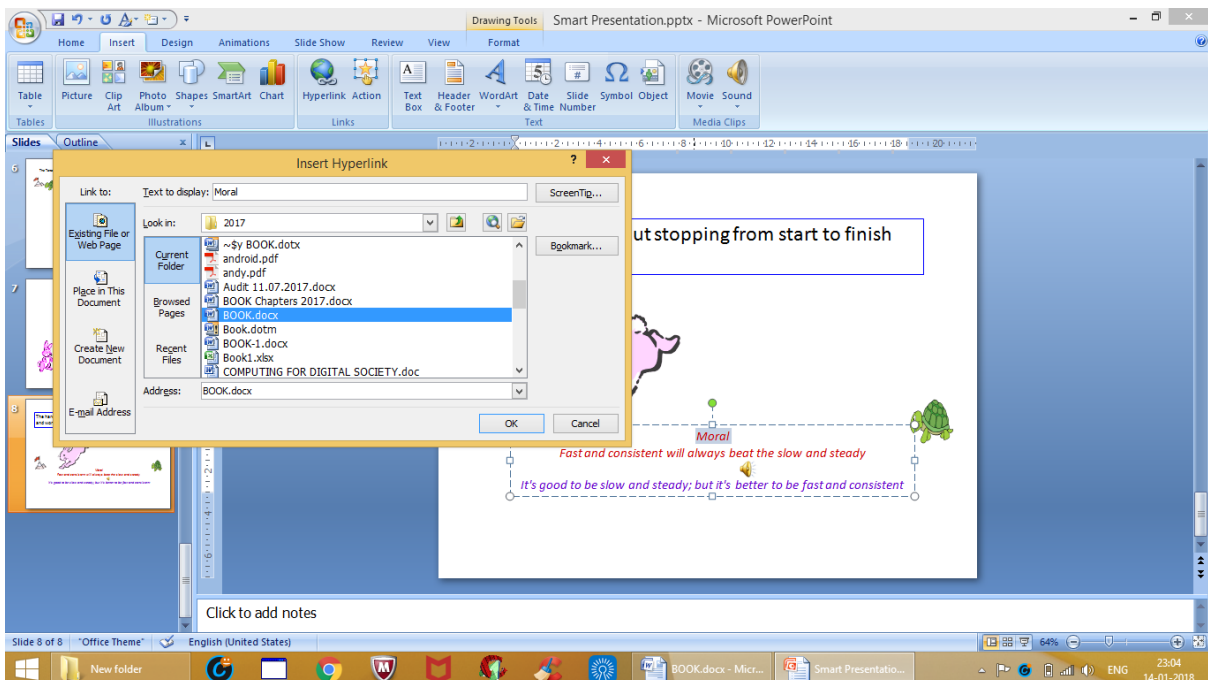
Figure 4.35 Inserting Hyperlinks through the insert menu
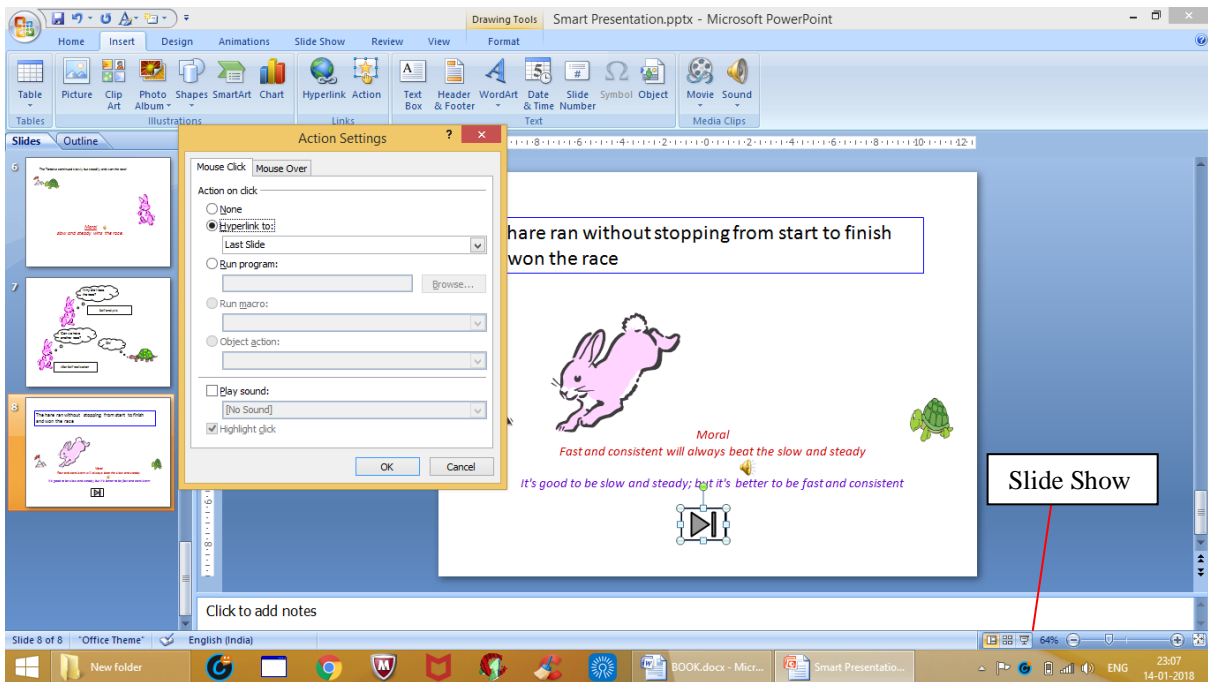
Figure4.36 Setting Hyperlinks using Action Buttons in the Shapes option
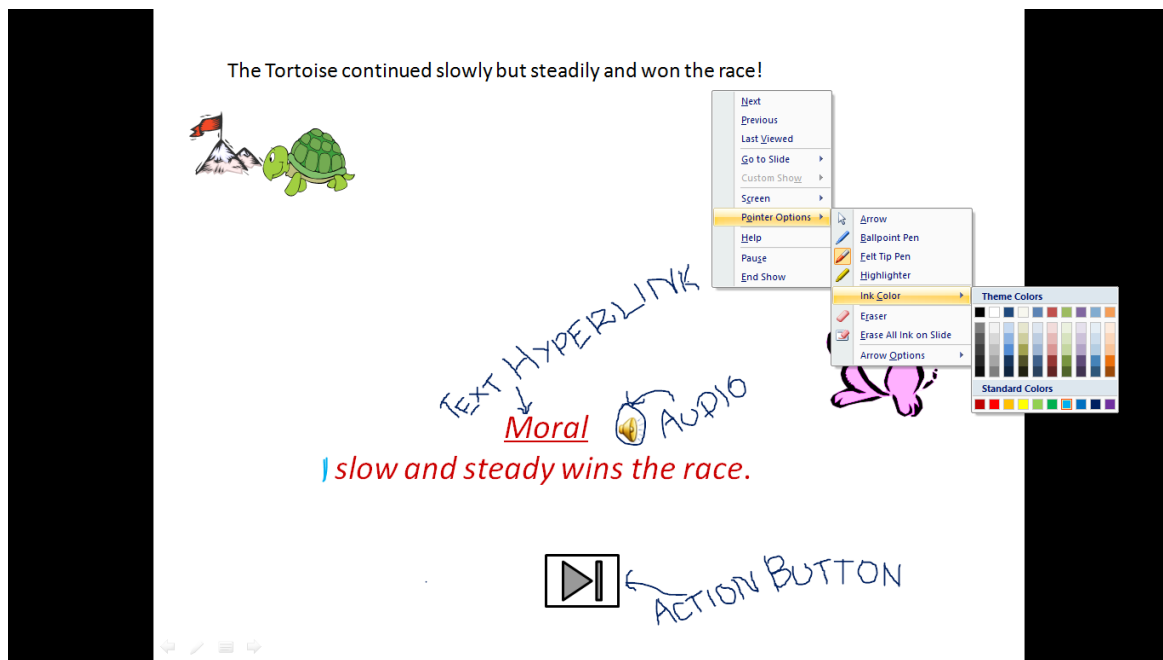
Figure 4.37 PowerPoint – SlideShow Settings

Activity 4: Create a PowerPoint Presentation

A sample presentation (Figure4.) along with seven pictures is given below. Use those pictures and prepare a PowerPoint presentation titled 'A Smart presentation' by incorporating various features of the Microsoft PowerPoint software. As part of this activity record your own voice and insert it in the slides as shown, add animation and insert hyperlink. Use the cloud callout box (figure 4.38)from Microsoft Word.

Figure4.38 Cloud Callout box

The objective of this activity is to be familiar with certain PowerPoint features and also to learn the art of preparing PowerPoint slides containing only powerful points! At the end of this activity you will understand the method of choosing slide layout, inserting shapes and text boxes, inserting media clips (sound), inserting pictures, etc.

Figure4.39 Sample PowerPoint Presentation Script

5 - Computer Communication

Communication refers to the process of sharing information. Computers or other computing devices can be used for sharing the information. While doing so, the information is converted into binary data and transmitted over the wired or wireless medium. This kind of communication is known as Data Communication and the computers along with the connectivity are known as Computer Network.
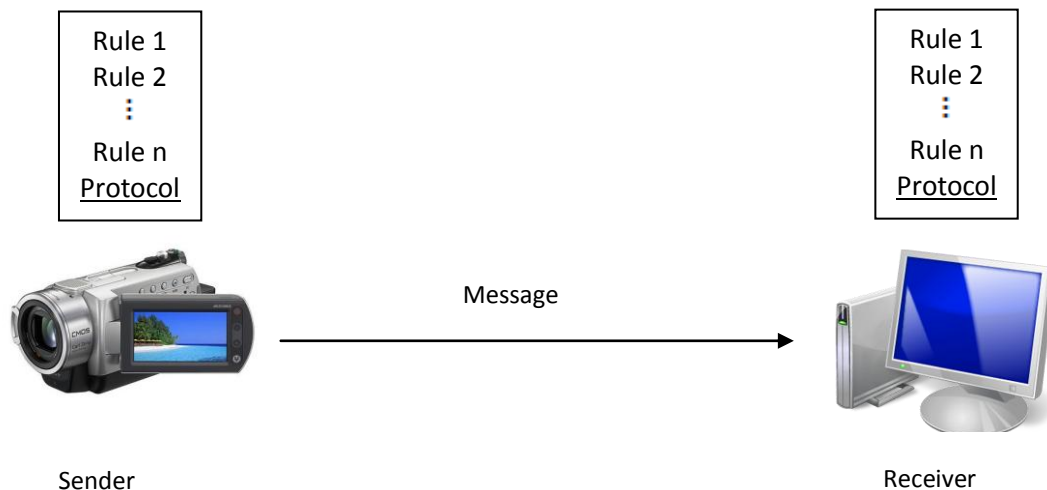
Figure 5.1 Communication System

5.1   Components of a Communication System

The communications system comprises of 5 components viz. sender, receiver, message, transmission medium and protocol as illustrated in Figure 5.1.

Sender:

It may be a computing device such as computer, mobile phone, video camera, or any other computing device that originates the message for communicating with the recipient.

Receiver:

The receiver may be another computing device to which the message is intended to be sent.

Message:

It is the information (data) that is to be communicated to the receiver. General forms of message may be text, numbers, pictures, audio, and video.

Transmission medium:

The transmission medium refers to the physical connection, used for carrying the message from sender to receiver. Some examples of transmission media may include shielded/ unshielded twisted-pair cable, coaxial cable, optical fiber cable, radio waves, etc.

Protocol:

A protocol is a set of rules that manages data communications. In other words, it represents an agreement between the communicating devices. Communication among computing devices without a protocol is similar to a person speaking French to a person who can only understand Tamil.

5.2   Types of Networks:

There are various kinds of computer networks, widely used by all. They are:

- Local Area Network (LAN)
- Wide Area Network (WAN)
- Metropolitan Area Network (MAN)
- Wireless Local Area Network (WLAN)
- Storage Area Network (SAN)
- Controller Area Network (CAN)
- Personal Area Network (PAN)
- Global Area Network (GAN)
- Internet Area Network (IAN)

Each node in the network has a specific internet protocol (IP) address for identifying the nodes and the IP address comprises of network address and node address. Basic networks which include Local Area Network (LAN), Metropolitan Area Network (MAN) and Wide Area Network (WAN) are discussed in this chapter.

5.2.1 Local Area Network: LAN links computing devices together within a limited geographical area as shown in Figure 5.2 LAN allows users to communicate messages, transfer files, and share resources, at home, school, office or college. LANs can span over a limited range i.e. of 1 km in radius. The smallest LAN can consist of 2 computers. LANs are usually owned, controlled, and managed by a single person or any organization. Many devices such as Ethernet switches, hubs, repeaters, and bridges are used in LAN.

File Server

Print Server
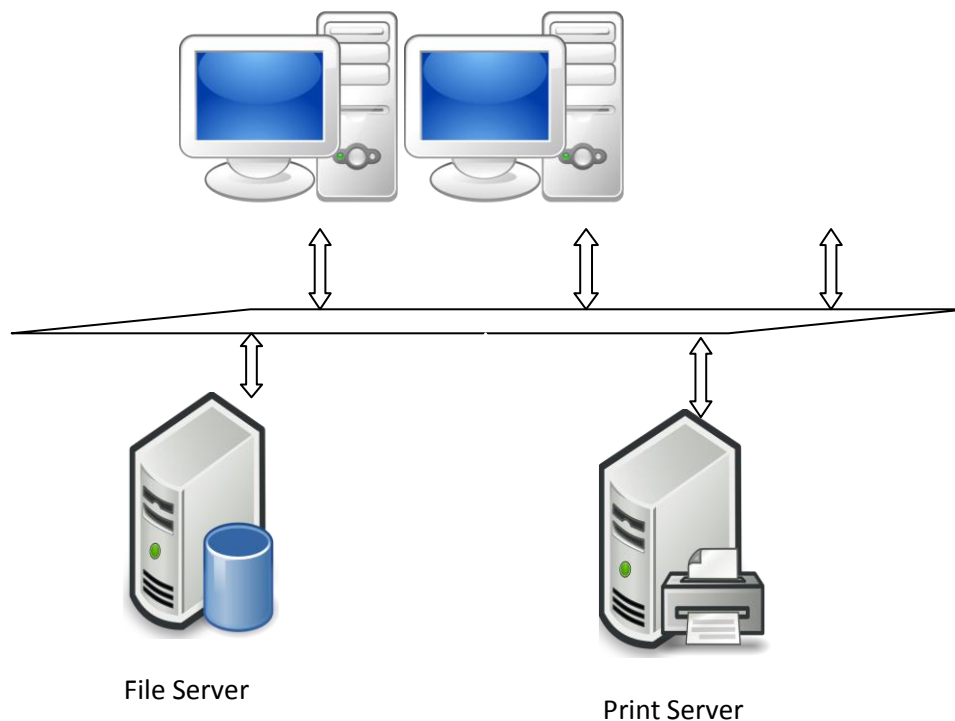
Figure 5.2 Local Area Network
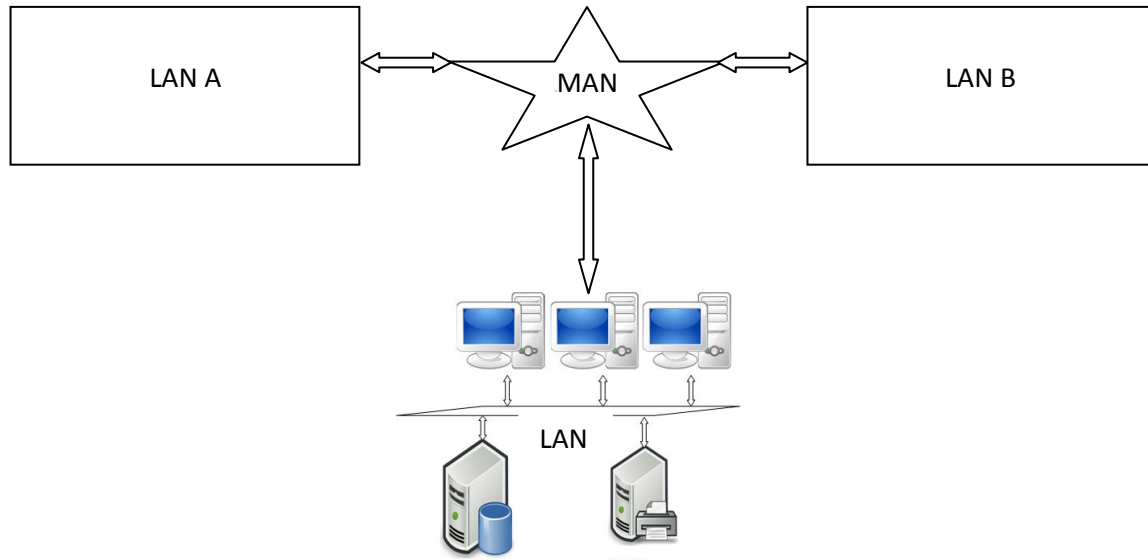
Figure 5.3 Metropolitan Area Network

5.2.2 Metropolitan Area Network:
MAN is used to connect two or more LANs in a common geographic area, say, a city or a group of buildings. It can be considered as a larger version of a LAN but smaller than the area covered by a WAN. It can span over a range of 5 to 50 km. MANs usually owned by an association of users or by a network service provider. Examples of metropolitan area networks of various sizes can be found in the metropolitan areas of Bengaluru, London, England; and Switzerland. The best-known example of a MAN is the cable television network available in many cities. Figure 5.3 illustrates a typical MAN that consists of 3 LANs.
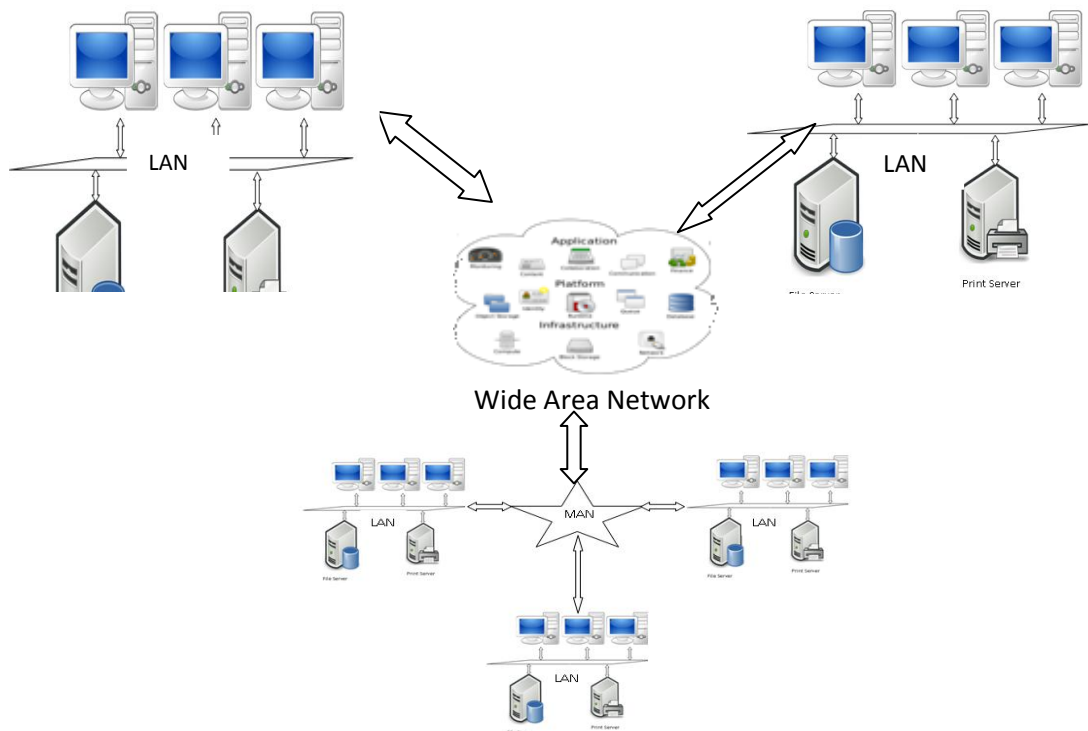
Figure 5.4 Wide Area Network

5.2.3 Wide Area Network: A WAN connects several networks, including LANs and MANs. This ensures that computers and users in one location can communicate with computers and users of other locations.WAN is used to connect reasonably large geographical area such as a state, a country, a continent, or the Internet. WAN allows users to access computers or file servers that are available outside their region. Internet browsing is also possible using WAN. It can span over a range of huge area of about 100,000 km (Eg. Planet – Internet). WAN management is distributed and it cannot be handled at individual level. Devices such as routers, communication servers, repeaters and modems are used in WAN. A WAN is illustrated in Figure 5.4.

5.2.4 Wireless and Wired Network:

Figure 5.5 Wirelesses and Wired Communication

Wired Network

Wired network refers to the computer network in which the computing devices are linked together using specialised cables, such as ethernet cables for data transfer. Fiber-optic Networks, Telephone networks and **cable television** are examples of wired Networks.

Wireless network

It is a **computer network** that uses wireless medium between the computing devices. Examples of wireless networks include cellular phone networks, satellite communication networks, wireless local area networks (WLANs), and wireless sensor networks. The wired and wireless communication is illustrated in Figure 5.5.

Wi-Fi Network

Wi-Fi is a kind of WLAN that use the IEEE 802.11 communications standard and it is a trademark of the Wi-Fi Alliance, an international association of companies involved with wireless LAN technologies and products. It is a technology that uses radio waves to provide network connectivity. Wi-fi Network can be used to link computers, smart phones, or any other computing devices to the internet and to the wired networks.

It is easy to establish Wi-Fi network service at homes, businesses, as well as in public places either free-of-cost or on commercial basis. Corporate sectors and business places, such as airports, hotels, and restaurants, often provide free-use hotspots to attract customers where hotspot is a physical location where people can avail internet access using Wi Fi technology. .

Router:

A router is a computer networking device that acts as mediating device and transfers data packets between two or more computer networks. These networks may use different technologies and communication formats. The router possesses a routing table which describes the route to be followed while transferring the packets from the source to the destination. In this case, the router receives the data packet, reads the network address, determines the destination and directs the packet to the next network till it reaches the destination.

Switch:

A network switch is another **computer networking device** that connects devices together on a **computer network** to receive, process, and forward data to the destination device.

Internet:

The internet is a network of networks that allows the users to send and receive information. The internet consists of heterogeneous network and provides several services such as World Wide Web (WWW), File Transfers, secured transactions, etc. Today several applications run on internet. Some of the common uses of internet to the society are:
- ✓ Sending and receiving of messages
- ✓ Uploading and downloading of files
- ✓ To play games, listen to music, search for pages and watch film.
- ✓ To carry out money transactions
- ✓ Effective e-governance
- ✓ Online application process, etc

5.3   World Wide Web (WWW)

WWW is one of the services provided by the internet. WWW contains huge amount of information that are shared and stored at several locations. These information are in the form of Hyper Text Markup Language (HTML) pages and can be made available to the users using Hyper Text Transfer Protocol (HTTP). The HTML pages are also called as web pages. Web browser is a program on the computer that allows you to browse the web pages. A collection of web pages are called as website. A computer that hosts a website on the Internet is called web server. Users can log on to the web server using the IP address of the web server or they can use Uniform Resource Locator (URL).

Uniform Resource Locator (URL):

A URL as shown in figure 5.6 allows the browser to find a specific webpage or file across the internet just similar to a postal address which enables mail to reach its destination. The term 'Uniform' refers to the fact that the address for every web page follows the same rules – i.e. they are uniform. The term 'Resource' refers to the website, a document or a video. The term 'Locator' refers to the components of the web address put together to indicate its place on the internet.

Search engine:

A website that helps us to find other web pages that contains our search criterions are known as search engine. Example: yahoo, google, bingo, etc.
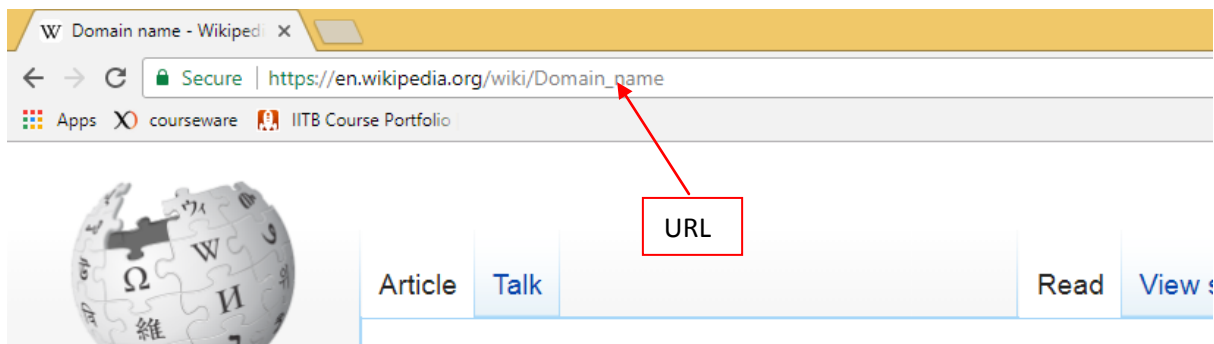
Figure 5.6 URL Example

Electronic Mail (email or e-mail):

It is a method of exchanging messages between people using the computing devices. Email operates over the Internet. Today, email systems are working on store-and-forward model. Email servers accept, forward, deliver, and store messages. Neither the users nor their computers are required to be online simultaneously. Electronic mail system comprises of in-box, sent folder, draft folder, spam folder, etc. The screenshot shown in figure 5.7 is the "Inbox" page of an email system, where users can see new emails and take actions, such as reading, deleting, saving, or responding to these messages
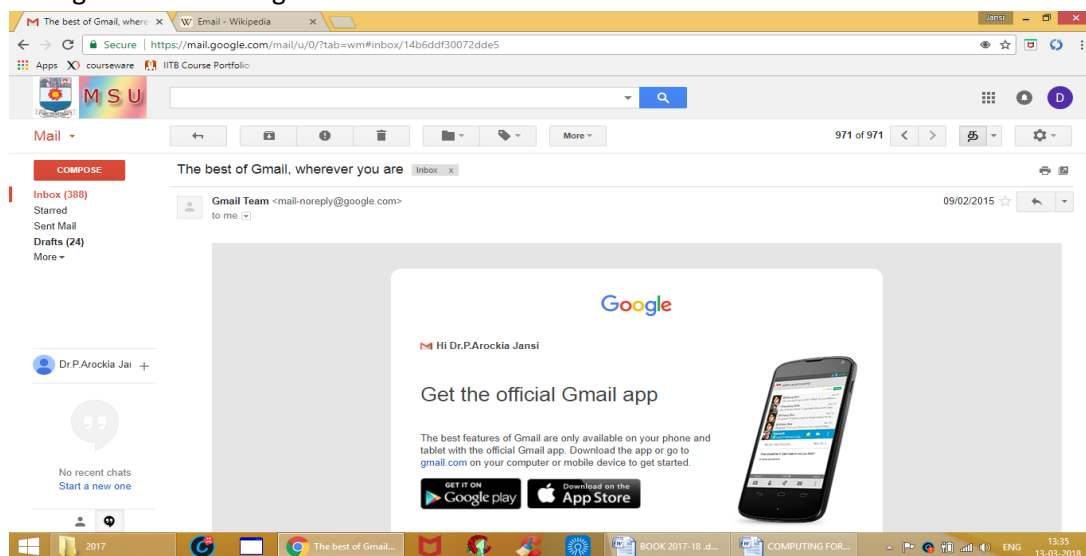
Figure 5.7 Inbox page of an e-mail system

Cookies:

The details regarding the list of sites, visited by the user is stored in files called cookies. They make user's online experience easier by saving the browsing information. With cookies, sites can keep us signed in, remember our site preferences, and give us locally relevant content.

There are two types of cookies:

- **First-party cookies:** These are created by the site visited by the user. The site is shown in the address bar.

- **Third-party cookies:** These are created by other sites. These sites own some of the content, like ads or images that you see on the webpage, visited by the user.

Steps to see cookies in Chrome browser

i. From the Chrome menu in the top right corner of the browser, select Settings.

ii. At the bottom of the page, click Show advanced settings....

iii. Under Privacy, select Content settings....

   o To manage cookie settings, check or uncheck the options under "Cookies".

   o To view or remove individual cookies, click "All cookies and site data" and hover the mouse over the entry. Select the X that appears next to the cookie to remove it.

   o To delete all cookies, click All cookies and site data and select Remove all

Sample list of cookies in a computer (search result based on keyword "iitb" are captured and shown in figure 5.8
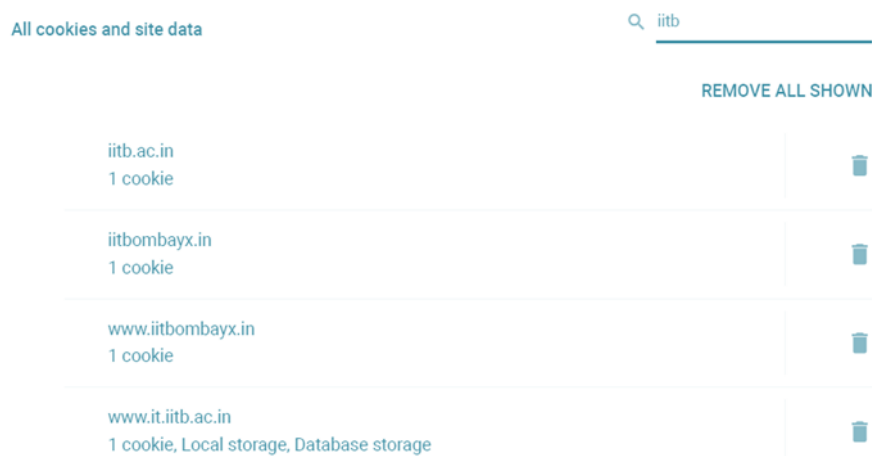
Figure 5.8 Cookies Example Screenshot

SMS (Short Message Service):

It is a text messaging service that uses communication protocols to enable mobile devices to exchange short text messages. With an SMS, a message of up to 160 characters can be sent to another device. Longer messages will automatically be split up into several parts. Most cell phones support this type of text messaging.

Multimedia Messaging Service (MMS):

It is a standard way to send multimedia messages. Multimedia message includes pictures, video, or audio Content. MMS is most commonly used to send a photo to another phone. It can

deliver a variety of media, including up to forty seconds of video, one image, a slideshow of multiple images, or audio.

5.4   Client-Server Computing
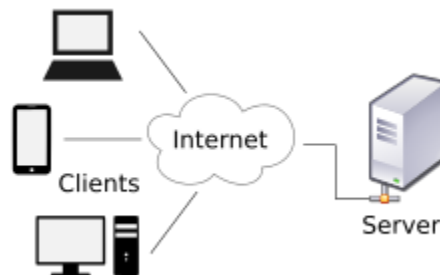
In a Client-Server Computing environment, a client is any process or a computer that requires specific services from a server which may be some other process or another computer. A server is a process that provides requested services for clients. Client and server processes can reside in the same computer or in different computers connected by a network.

Servers can control access to a network, send/receive e-mail, manage print jobs, or host a website.

Cloud Computing:

The term cloud refers to a network or internet. Cloud computing refers to the process of storing and accessing data over the Internet instead of the user computer's hard disk.

An **example** of a **Cloud Computing** provider is Google's Gmail. Gmail users can access files and applications hosted by Google via the internet from any device. Users can also publish documents so that other people can read them or even make edits. So, Google Docs is also an **example** of **cloud** computing. Web e-mail providers like Gmail, Hotmail and Yahoo! Mail store e-mail messages on their own servers.

Applications such as e-mail, web conferencing, customer relationship management, run in cloud.

Public Cloud:

The users are not responsible for any of the management of a **public cloud** hosting solution. The users' data is stored in the service provider's data centre and the provider is responsible for the management and maintenance of the data centre.

Examples of public clouds include **Amazon Elastic Compute Cloud** (**EC2**), IBM's **Blue Cloud**, Sun Cloud, **Google AppEngine** and **Windows Azure Services Platform**.

Mobile Application:

A **mobile app** is a computer program designed to run on a **mobile device** such as a smart phone/tablet or watch rather than desktop or laptop computers. A mobile application may also be known as an app, Web app, online app, iPhone app or smartphone app.

Commonly available app stores include **Google Play** for **Android, App Store** for **iOS**, and Microsoft Store for Windows 10, Windows 10 Mobile, and Xbox One.

Facebook, YouTube, Google Maps, Mobile banking, **Mobile ticketing,** Mobile vouchers & coupons, Location-based services, Mobile Browsing are few examples of Mobile Apps.

6- Electronic Governance

6.1   Introduction

Governance of a country or a business organization can be defined as the process of establishing, implementing and monitoring the well defined **policies, processes and procedures** in order **to optimize its objectives** by keeping all its stake holders satisfied. Good governance has eight major characteristics. It includes participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive services. Further good governance must follow the rules. Governance in India like countries involves several challenges due to the high population and vast areas. As a result the dissemination of policies, plans, and the welfare schemes of the central and state governments to the common public becomes challenging and the implementation becomes difficult.

6.2   E-Governance Initiatives in India

The advent of new technologies such as internet, e-commerce, cloud computing, big data analytics, etc., pave a way to overcome the above challenges. The Government of India (GoI) try to exploit the technologies to the maximum extent to make the governance effective.

The e-governance initiative in India was started in the year 1970, when the GoI established the **Department of Electronics** in 1970 followed by the establishment of the **National Informatics Centre** (NIC) in 1977. The advent of personal computers further accelerated the e-governace process by the effective utilization of storage, retrieval and processing capacities of the modern computers. In the early 90s, the computerization began in the government offices with the use of word processors. In late 90s, the effective use of **Data Base Management System** (DBMS) for processing official information becomes a reality.

Advances in communications technology further accelerated the versatility and reach of computers. As a result, many government departments started using ICT for a number of applications such as **Management Information System (MIS), Executive Support System (ESS)**, etc. MIS facilitates the managers by instantly providing their departmental information using computers and the ESS on the other hand supports the senior executives to take strategic decisions related to the organizational goals. In 1987, NICNET, a national satellite based computer network was launched. Following this, the District Information System programme of the National Informatics Centre (DISNIC) was established to computerize all district offices in the country.

6.2.1 E-Governance through Common Service Centre: E-governance in India has reached the 'transactional' stage and started yielding various services to citizens, business and government organizations. These services are dispensed by central government agencies and different state government departments. The **National e-Governance Plan** (NeGP) was initiated in 2006, for making all Government services accessible to the common man in his locality, through **Common Service Centres** (CSC). CSCs are the access points for delivery of essential public utility services, social welfare schemes, healthcare, financial, education and agriculture services, apart from

host of Government to Citizen (G2C) services. In Tamilnadu the CSC is named as People's Computer Centre. They offer services in Tamil language to meet the requirements of the rural people.

Figure 6.1 Services of Common Service Centre

The major focus of e-governance is to support the ongoing e-governance movement in India by providing a single point information access for the following services:

- Availing online citizen services
- Disseminating state specific e-governance initiatives
- Creating awareness about online legal services
- Providing mobile governance
- Creating awareness about the Right To Information (RTI)

The other services offered by CSC are illustrated in figure 6.1.

6.2.2 CSC 2.0 Scheme:
Based on the assessment of CSC scheme, the Government launched the CSC 2.0 scheme in 2015 to expand the outreach of CSCs to all Gram Panchayats across the country. Under CSC 2.0 scheme, at least one CSC will be set up in each of the 2.5 lakh Gram Panchayats across the country by 2019. CSCs functioning under the existing scheme will also be strengthened and integrated with additional 1.5 lakh CSCs across the country. CSC 2.0 scheme would consolidate service delivery through a universal technology platform, thereby making e-services, particularly G2C services accessible to citizens anywhere in the country.

6.3   E-Governance through:

During the late 1980s and early 1990s, initial attempts towards e-Governance were made with a focus on networking government departments and developing in-house government applications in the areas of defence, economic monitoring, planning and the deployment of IT to manage data-intensive functions related to elections, census, tax administration etc. These applications focused on automation of internal government functions rather than on improving service delivery to citizens.

6.3.1 National e-Governance Plan: The National e-Governance Plan (NeGP) has been formulated by the Department of Information Technology (DIT) and Department of Administrative Reforms & Public Grievances (DAR&PG) to connect e-Governance systems throughout the country and create a nation-wide network for electronic delivery of government services. NeGP comprises of 3 tiers viz. CSC, backbone data network and Mission Mode Projects (MMP). The NeGP infrastructure is reliant upon the development of State Wide Area Networks(SWAN) to be connected to form a nation-wide network, State Data Centres (SDC) to consolidate services, applications and infrastructure, and common service Centres (CSC) for end user access. Initially the NeGP comprised of 27 MMPs, which were classified as state, central and integrated projects and it has been modified recently to accommodate more services.

The state government is responsible for implementing the following state level MMPs under the overall guidance of respective line ministries:

1. **Agriculture:** This MMP aims to provide sophisticated interface to the farmers for making informed decisions. The information will be delivered using multiple delivery channels such as the internet, government offices, touch screens, Krishi Vigyan Kendras, electronic media, Kisan Call Centres, Agri-Clinics, Common Service Centres and mobile phones (broadcast, Interactive Voice Response System, interactive messaging using Unstructured Supplementary Service Data and Voice Recognition), which will enable easy access to information for the farmer.

2. **Commercial Taxes:** The administration of the commercial taxes like VAT, CST etc. Involves handling of a large number of dealers, who act on behalf of the State Departments to collect tax from consumers and deposit it in the State treasury. This MMP will lead to reduced official-dealer interface, reduced response time, faster service delivery, reduced transaction cost, increased transparency and increased accountability.

3. **e–District:** This project aims at providing support to the district administration by undertaking backend computerization to enable electronic delivery of high volume citizen centric government services using State Wide Area Networks (SWAN), State Data Centres (SDC) and Common Service Centres (CSCs) to the common people.

4. **Employment Exchange:** This MMP will help in providing speedy and easy access to employment related services and information to job seekers and employers (both organized & unorganized sector) and enable the Employment exchanges to play the pivotal role in the modern Indian economy and flexible business environment.

5. **Land Records:** National Land Records Modernization Programme (NLRMP)- It comprises of two schemes viz. Computerization of Land Records (CLR) and Strengthening of Revenue Administration and Updating of Land Records (SRA&ULR). This MMP aims to provide free accessibility to the land records thereby reducing interface with the Government functionaries to the Indian citizens.

6. **Municipalities:** e-Governance in municipalities comes under the National e-Governance Plan (NeGP) and the Jawaharlal Nehru National Urban Renewal Mission (JNURM). The main objective is to improve the operational efficiencies within Urban Local Bodies (ULBs). It will assist the municipal bodies across India to improve service delivery mechanism, achieve better information management & transparency and ensure utmost citizen's involvement in participative governance.

7. **e-Panchayats:** This MMP will enable the Panchayats to deliver its mandated services to the Citizens through ICT, effectively with transparency. It will also enable the panchayats to take better decision by better data management and expenditure monitoring.

8. **Police:** Crime and Criminal Tracking Network &Systems (CCTNS)- It aims to provide a comprehensive system for efficient policing at all levels using e-Governance and IT-enabled state-of-the-art tracking system.

9. **Road Transport:** It provides software viz. Sarathi and Vahan for the standardisation of Road Transport offices. The Transport MMP also intends to setup National and State Registers for providing the real time services to the citizens to enable the citizens to get the work done from their home.

10. **Treasuries Computerization:** It aims to achieve greater efficiencies, reducing costs, eliminating redundancies and facilitating the adoption of modern public expenditure management practices. This project will promote real-time reconciliation of accounts, strengthen Management Information Systems (MIS), and improve accuracy and timeliness in accounts preparation.

The line ministries/ Departments of Central government are responsible for implementing the central level MMPs include the services as given below:

1. **Banking:** It covers the services like Electronic Central Registry, One India One Account and Electronic Mass Payment System.

2. **Central Excise & Customs:** It aims to re-engineer the business processes and turn the existing tax administration in to a modern, efficient and transparent system.

3. **Income Tax (IT):** It provides a comprehensive service that enable citizens to transact all businesses with the Income Tax department on an anywhere, anytime basis.

4. **Insurance:** It aims to develop an integrated information technology solution for better service delivery mechanism of public sector insurance company.

5. **Ministry of Corporate Affairs (MCA) 21:** To provide a secure portal that offers availability of all registries related services including filing of documents, registration of companies and public access to corporate information.

6. **Passport:** It aims to provide passport and consular services to Indian citizens and visa services to foreign nationals.

7. **Immigration, Visa and Foreigners Registration& Tracking (IVFRT):** It aims to provide services related to immigration check and to implement a secure and integrated service delivery framework that facilitates legitimate travellers while strengthening security.

8. **Pension:** It is aimed at making the pension/ retirement related information, services and grievances handling mechanism accessible online to the needy pensioners through interactive and non-interactive components.

9. **e-Office:** It aims to modernize the central government offices through introduction of information and communication technology.

10. **UID - Unique Identity Number (Aadhaar):** It aims to create verifiable and credible databases of individuals that would enable efficient and effective delivery of benefits to eligible individuals.

The following integrated MMPs are implemented by both the Central and state governments:

1. **CSC:** It aims to deliver all government, social and private sector services in the areas of agriculture, health, education, entertainment, banking, utility payments, etc.

2. **e-Biz:** This MMP intends to transform the business environment by providing efficient, convenient, transparent and integrated electronic services to investors, industries and business throughout the business life cycle.

3. **e-Courts:** As the 3 Crores pending cases affects the development of India, this MMP intends to use the ICT for the e-filing facility in the Supreme Court & High Courts.

4. **e-Procurement:** In India, government procurement accounts for around 5-15% of the national GDP. This MMP will cover all aspects of procurement right from indent to tender preparation, bidding, bid evaluation and award of contract.

5. **EDI For eTrade:** This MMP intends to simplify procedures, introduce electronic delivery of services by regulatory and facilitating organizations, provide 24x7 accesses to users, increase transparency, reduce transaction cost and time, and introduce international standards and practices in the area of foreign trade.

6. **National e-governance Service Delivery Gateway:** The goals of the eGovernance plan are to increase the efficiency of service delivery, empower citizens by providing information, and create an environment of transparency. The eGovernance plan aims to make the government more accessible to citizens and businesses alike and foster a more

open atmosphere. The total cost of all MMPs is estimated to be Rs. 32488 Crores approximately.

7. **India Portal:** This MMP provides a single window unified interface for over 5000 websites thereby reducing inconvenience to the citizens. This portal acts as a logical front end to the e-governance initiatives under various central/state/UT government schemes and programmes.

6.4   Digital India

Digital India is a programme initiated by the Government of India and coordinated by the Department of Electronics and Information Technology. The aim of the programme is to transform India into a digitally empowered society and knowledge economy. Overall Costs of Digital India initiative is approximated as Rs. 1.13 lakh crore. The primary objectives of the programme are:

1. Infrastructure as Utility to every Indian Citizen
2. Governance and Services on Demand
3. Digital Empowerment of Citizen

Digital Infrastructure as a Utility to Every Citizen	Governance & Services on Demand	Digital Empowerment of Citizens
➢ Availability of high speed internet as a core utility for delivery of services to citizens ➢ Cradle to grave digital identity that is unique, lifelong, online and authenticable to every citizen ➢ Mobile phone & bank account enabling citizen participation in digital & financial space ➢ Easy access to a Common Service Centre ➢ Shareable private space on a public cloud ➢ Safe and Secure Cyber-space	➢ Seamlessly integrated services across departments or jurisdictions ➢ Availability of services in real time from online & mobile platforms ➢ All citizens entitlements to be portable and available on the cloud ➢ Digitally transformed services for improving ease of doing business ➢ Making financial transactions electronics & cashless ➢ Leveraging Geospatial Information Systems (GIS) for decision support systems & development	➢ Universal digital literacy ➢ Universally accessible digital resources ➢ Availability of digital resources / services in Indian languages ➢ Collaborative digital platforms for participative governance ➢ Citizens not required to physically submit Government Documents / Certificates

Figure 6.2 Objectives of Digital India

The figure 6.2 illustrates the above objectives and usefulness of Digital India scheme.

Digital India comprises of various initiatives under the single for bringing effective e - governance to citizens. Important projects under the digital India scheme are:

- Information Highways for broadband services
- Easy access to mobile connectivity
- IT Training for Jobs
- Manufacturing of electronics equipments
- Public access to internet

- E-Governance
- E-Kranti
- Global Information
- Early Harvest Program
- MyGov.in

Some of the expected outcomes of Digital India project are:
- Creation of employment opportunities for 17 million people directly or indirectly
- IT training to 100 million students in smaller towns and villages
- India will emerge to be a leader in the effective use of ICT.
- It will assure broadband connectivity in all panchayats, schools, libraries and other public places.
- Financial Inclusion through Mobile and internet banking
- Revenue Increase in Telecom sectors.
- Reduction in import

6.4.1 Agencies Enabling Digital India:
There are more than 30 agencies, involved in enabling the Digital India project. Most of the agencies are also involved in implementing the MMPs of the NeGP. Some of the important agencies along with their descriptions are listed below:

1. **Controller of Certifying Authorities (CCA):** Its aim is to promote the growth of e-commerce and eGovernance through a wide use of digital signatures. It regulates the working of certifying authorities and also ensures the compliance of IT act. Its head quarter is located at New Delhi.

2. **Centre for Development of Advanced Computing (C-Dac):** Centre for Development of Advanced Computing (C-DAC) is the premier organization of the Ministry of Electronics and Information Technology (MeitY) for carrying out research and development in IT, Electronics and associated areas. The head quarter of CDAC is located at Pune.

3. **Centre for Railway Information Systems (CRIS):** It comes under the Ministry of Railways and it develops and manage the IT Applications of Indian Railways and other organizations too. The head quarter of CRIS is located at New Delhi.

4. **Department of Agriculture Cooperation and Farmers Welfare (DAC & FW):** It coordinates with state level agencies for implementing central sector schemes in the respective fields. The Head quarter of DAC&FW is located at New Delhi.

5. **Small Farmers Agribusiness Consortium (SFAC):** SFAC is an exclusive society focused on increasing incomes of small and marginal farmers through aggregation and development of agri business. The Head Quarter is located at New Delhi.

6. **Department of empowerment of persons with disabilities (depwd):** it comes under the ministry of social justice and empowerment and located at new delhi. It facilitates empowerment of the persons with disabilities of the country.

7. **Department of Finance Services:** It covers all the activities of Banks, Financial Institutions, Insurance Companies and the National Pension System. It is located at New Delhi.

8. **Department of Science & Technology (DST):** It promotes emerging areas of Science & Technology, and it play the role of a nodal department for organising, coordinating and promoting S&T activities in the country. It is head quartered in New Delhi.

9. **Directorate General Of Supplies and Goods (DGS&D):** The main activity of DGS&D is to fix the rate contracts for common user items required by government organisation through an e-procurement portal.

10. **Indian Council for Agricultural Research (iCAR):** ICAR is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country.

The other agencies involved in the Digital India project are:
- Education & Research in Computer Networking (ERNET)
- Indian Computer Emergency Response Team (ICERT)
- Common Service Centres (CSC)
- Ministry of Corporate Affairs (MCA)
- Ministry of Electronics and Information Technology (MEITY)
- Ministry of Labour & Employment
- Ministry of External Affairs
- National Assest Directory
- National Council of Education Research and Training (NCERT)
- National Health Mission (NHM)
- National Informatics Centre (NIC)
- National Institute of Electronics & Information Technology (NIELET)
- National Institute of Health and Family Welfare
- National Internet Exchange of India (NIXI)
- National Skill Development Corporation (NSDC)
- NASSCOM
- National Payments Corporation of India
- National Securities Depository Limited (NSDL)
- National E-Governance Division (NEGD)
- National University of Educational Planning and Administration (NUEPA)
- UIDAI
- National Centre of Geo_Informatics (NCOG)

6.4.2 Digital India Services:
There are many services offered by the Digital India Platform. Some of the important services that are available for the common people are listed below:

1. *Un-Reserved Ticket through Mobile Application (UTS APP):* Indian Railways has launched the above android mobile Unreserved Ticketing System application for

enabling the passengers to get the unreserved paperless ticket as well as the issue/renewal of season ticket.

2. *Unified Mobile Application for New-Age Governance (UMANG):* It is aimed for developing a common, unified platform and mobile app to facilitate a single point of access to all government services.

3. *UDAAN:* The programme is designed to encourage corporate to travel to Jammu & Kashmir meet with the youth and hire aspiring youth in J&K who wish to explore the opportunity to work with corporate.

4. *Study Webs of Active – Learning for Young Aspiring Minds (SWAYAM):* It uses an indigenous developed IT platform for hosting all the courses, taught in classrooms from 9th Class till post graduation to be accessed by anyone, anywhere at any time.

5. *Swatch Bhaarat:* It aims to promote the cleanliness activities across the nation.

6. *Startup India:* Startup India is an initiative of the Government of India, intended to build a strong eco-system for nurturing innovation and Startup in the country that will drive sustainable economic growth and generate large scale employment opportunities.

7. *Public Financial Management System (PFMS):* It aims to link the financial networks of Central, State Governments and the agencies of State Governments.

8. *National Scholarship Portal (NSP):* NSP is a one-stop solution for end-to-end scholarship process right from the submission of student application, verification, sanction and disbursal to end beneficiary for all the scholarships provided by the Government of India.

The other services offered by the Digital India are:

- **Sugamaya Pustakalya -** online platform that makes accessible content available to print-disabled people

- **Soil Health Card –** To promote Integrated Nutrient Management through the judicial use of fertilizers

- **SMS-based Mid-Day Meal Monitoring Scheme**

- **Shala Siddhi:** A comprehensive instrument for School evaluation leading to school improvement.

- **Shaala Darpan:** An e-Governance platform for all Kendriya Vidyalayas in the country.

- **SARANSH:** Tool for comprehensive self review and analysis for CBSE affiliated schools.

- **Pusa Krishi:** It helps the farmers to find easy solutions to problems in their farm fields and get information about weather and accordingly take measures to save crops.

- **Project Monitoring Website for E-Courts:** The website was planned to develop, deliver, install and implement automated decision-making and decision support system in 700 courts.

- **Project Management System (PMIS):**PMIS is an integrated information system that offers decision oriented information on cost, time and performance parameters of a project

- **Passport Seva Project (PSP):** It enables simple, efficient and transparent processes for delivery of passport and related services.

- **Parivahan Portal:** To improve the quality of service delivery to the citizen and the quality of work environment of the RTOs.

- **Online Labs (OLABS):** It provides students with the ease and convenience of conducting experiments over the internet.

- **NIRBHAYA App:** It is android emergency application, which can send a distress call or emergency message to a specified contact or group in an emergency situation faced by a woman or any other individual in general

- **NIKSHAY:** To monitor Revised National Tuberculosis Programme (RNTCP) effectively, a web enabled and case based monitoring application has been developed by National Informatics Centre (NIC)

6.4.3 Electronic Payment and Receipt (EPR):

EPR is a payment or transfer made using electronic medium either by the department to external/internal entity or external/internal entity to department. Ministry of Electronic and Information Technology (MeitY) envisages a common e-Governance infrastructure that will offer end-to-end transactional experience for a citizen, businesses as well as internal government functions, which includes accessing various services through internet with payment gateway interface for online payments. Since 2008-09, Central Government Departments are already using Public Finance Management Systems (PFMS) for plan/ non-plan schemes. With 139 Centrally Sponsored Schemes (CSS) and more than 800 Central Sector Schemes (CS), along with State Plans and Additional Central Assistance (ACA), the PFMS is managing funds in excess of Rs.3,00,000 crore annually.

6.4.4 The Government policy statement on EPR states as follows:

Jan Dhan Yojana, the **A**adhaar initiative of UIDAI and **M**obile number (JAM), this Trinity of reforms is one of the biggest pieces of reform ever attempted in India for direct subsidy transfer to poor citizens of India. With financial inclusion as one of the key priorities of Government, using JAM, it is necessary for Government Departments to adopt modes of electronic payments & receipts for its internal and external transactions. The EPR framework is formulated with the aim of enabling 100 percent electronic payment for all the external or internal transactions of the Departments. The framework provides the guidelines for facilitating the Departments to expeditiously enable electronic payments and receipts leveraging all the payment channels.

6.4.5 Overview of Payments and Receipts in Government Departments:
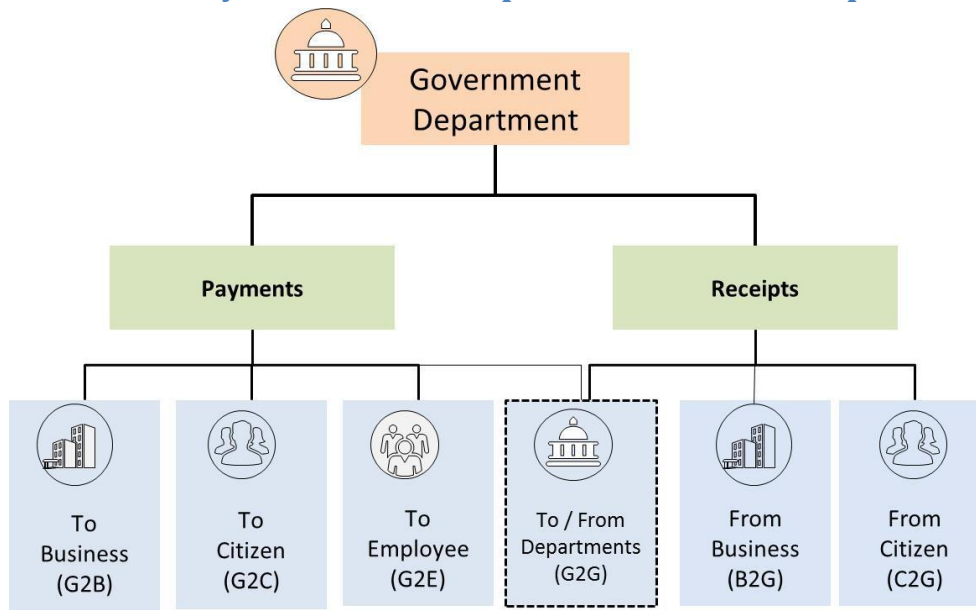
Figure 6.3 Overview of EPR in Government Departments

The payments and receipts in the government departments are done in following six ways:

1. Government to Business (G2B)
2. Government to Citizen (G2C)
3. Government to Employee (G2E)
4. Government to Government (G2G)
5. Business to Government (B2G)
6. Citizen to Government (C2G)

In general the payments are collected by the departments in the following modes:

C2G & B2G Payments

Payments to government department are paid through Cash, Paper based payments, Cheque to the department, Demand draft in favour of Departments, Chillan to the department, Electronic payments through Online mode such as National Electronic Funds Transfer (NEFT), Real Time Gross Settlements (RTGS) (especially for B2G services), Net Banking, Point of Sale (PoS) Terminal Based through Debit and Credit Cards, Mobile App Based (NEFT/RTGS/Net banking), IMPS/PPIs and also through department specific web portal.

G2C Payments

Government to Citizen Payments paid through Cash, Paper Based (Cheque), Direct Benefit Transfer to Citizen through NEFT/RTGS, Aadhaar Enabled Payments (AEPS), PFMS, eLekha and COMPACT.

G2B Payments

Government to Business payments are paid through cheque, cash, NEFT and RTGS.

G2E Payments

Central Departments make salary, General Provident Fund and pension payments to employees through electronic means primarily; e-Lekha and COMPACT developed by Controller General of Account (CGA). State Departments too started using the automated software systems for making payment.

G2C Payments

Central Government Departments use Public Finance and Management (PFMS) for making payments against plan and non-planned schemes.

6.4.6 Digital Locker:
It is a Digital India initiative and it covers the two aspects of digital India viz. Sharable Private space and storage of digital documents in public cloud. The main objective of Digilocker is to achieve the paperless governance using a cloud based platform for issuance and verification of documents & certificates digitally.
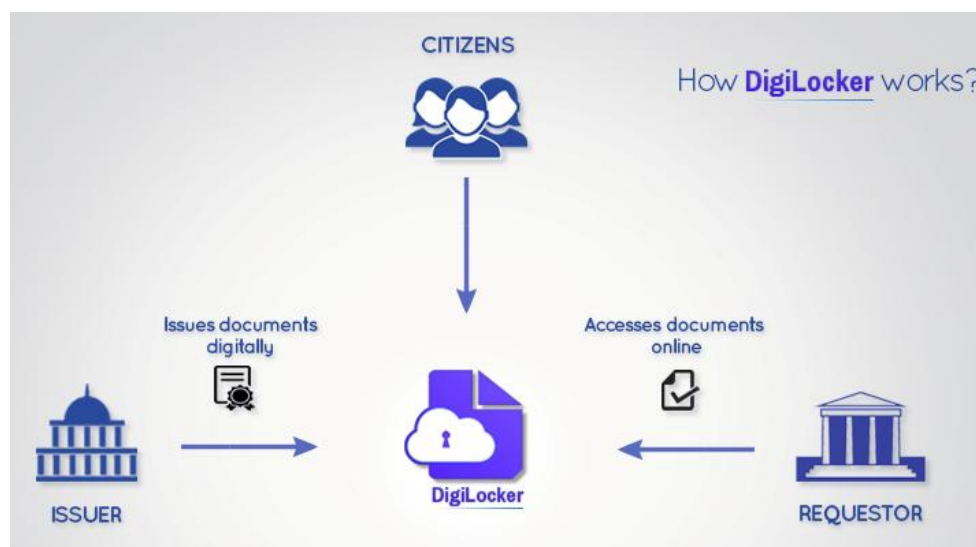
Figure 6.4 Working Principle of Digital Locker

The components of Digital lockers are Citizens, Issuer, Requestor, and Di. Issuers are the authorities who have the right to issue the certificates. Requesters are those who are interested in verifying the documents of the Citizens. To work with the Digital Locker one has to register their names with the Digital Locker portal (https://digitallocker.gov.in) by logging on to it. To sign in the portal the user has to enter aadhaar number and then to feed the One Time Password or Finger print. Presently, Indian citizens will get a maximum of 10MB storage space, which can later be increased to 1GB. The detailed step by step guide to upload the document is given here.

Step 1

To sign-up for your DigiLocker, one needs **Aadhaar** number and a mobile number that is linked to that Aadhaar number. Users can also link the account to their Google, Facebook accounts. Once you have registered, you can start uploading documents in the My certificates section.

Step 2

Select a document type. You'll have options such as SSC Certificate, HSC Certificate, PAN card, Voter ID card, etc. in a drop down list.

Step 3

You are allowed to provide a name for the document.

Step 4

Fill in some details related to the document being uploaded.

Step 5

Choose the file from your local machine. It should not be more than 1MB in size and only in PDF, JPG, JPEG, PNG, BMP or GIF format.

Step 6

Provide a short description of the document in 50 characters.

Step 7

Click 'upload' button. The document should now appear under the 'Uploadd Documents' sub-section.

6.4.7 Benefits of Digital Locker:

i. Citizens can access their digital documents anytime, anywhere and share it online.

ii. It leads to paperless governance.

iii. It is easy to validate the authenticity of documents as they are issued directly by the registered issuers.

iv. Self uploaded documents can be eSigned which is similar to the process of self-attestation.eSign service is an easy, efficient and secure way of digitally signing electronic documents. With this service, any Aadhaar holder can digitally sign an electronic document without having to obtain a physical digital signature dongle. One can use eSign service to digitally sign the self-uploaded documents in DigiLocker as a method of self attestation.

6.4.8 e-District Services: Districts are the actual front-end of government where most G2C interaction takes place. The eDistrict project is aimed to improve this experience and enhance the efficiencies of the various Departments at the district-level to enable seamless service delivery to the citizen. Front-ends under the scheme, in the form of citizen facilitation Centres, are envisoned to be built at District, Tehsil, Sub-division and Block levels. Village-level front-ends would be established through Common Services Centres (CSCs) for delivery of services.

Indicative services planned to be delivered through this MMP include:

1. **Certificates:** Creation and distribution of certificates for iIncome, domicile, caste, Birth, Death

2. **Licences:** Arms Licenses, mining licence, etc.

3. **Public Distribution System (PDS):** Issue of Ration Card and related matters.

4. **Social Welfare Schemes:** Disbursement of several kinds of pensions.

5. **Complaints:** Related to unfair prices, absentee teachers, non-availability of doctor, etc.

6. **RTI:** Online filing and receipt of information relating to the Right to Information Act

7. **Linking with other e government projects:** Registration, Land Records, and Driving Licences, etc.

8. **Information Dissemination:** About government schemes, entitlements, etc.

9. **Assessment of taxes:** Property tax, and other government taxes.

10. **Utility Payment:** Payments relating to electricity, water bills property taxes etc.

6.4.9 Digital AIIMS:

The Digital AIIMS project is a part of the Digital India Initiative implemented at **All India Institute of Medical Science (AIIMS)**. It is aimed to implement digital technology for better healthcare in India. The online registration software for AIIMS and three other hospitals of Delhi was launched on July 4, 2015 as part of Digital India initiatives. The Digital AIIMS project is useful to 45 lakh beneficiaries and it has reduced patient wait times by six hours per visit. Also, the effective utilization of clinician's OPD timings is increased by the transparent and streamlined patient records. Under this scheme, Nursing Informatics Specialist cadre was created to coordinate between the departments and the computer facility to ensure transparency in patient management practices. The patient's appointment data are available on the Aadhar-enabled digital platform for easier management. The cadre of Data Entry Operators has enabled speed in registration at the OPD Counters. There are fast track registration counters for those patients who have made online registrations. The Patient Care Coordinators enable the patients to reach the clinician's OPD consultation rooms and allow follow up appointments. The Exit OPD counters have been created to ensure that the next visit date of the Patient is available to him along with investigation dates.

6.4.10 India BPO Promotion Scheme (IBPS):

In the recent past the IT and BPO/IT Enabled services provides enormous employment opportunities to youth of the nation and also contributes significantly for the growth of the GDP. IBPS is a part of Digital India Programme for enhancing the BPO/ITES operations across the country. This would help in capacity building in smaller cities in terms of infrastructure & manpower and would become basis for next wave of IT/ITES led growth. This scheme has potential to create employment opportunities of around 1.5 lakh direct jobs considering three shift operations. It may also create good number of indirect jobs.

Salient Features

1. Financial Support: Up to 50% of expenditure incurred on BPO/ITES operations towards capital expenditure (CAPEX) and/or operational expenditure (OPEX) on admissible items, subject to an upper ceiling of Rs.1 Lakh / Seat.
2. Special incentives toward employment of women & specially enabled persons.
3. Incentive for generating employment beyond target & wider dispersal within state including rural areas.

4. Encouragement for local entrepreneurs.
5. Special consideration for Hilly states of HP, J&K and UK.

6.4.11 Geographical Information System (GIS):

GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information (that is data identified according to their locations). In simple way GIS can be define as an image that is referenced to the earth or has x and y coordinate and its attribute values are stored in the table. These x and y coordinates are based on different projection system and there are various types of projection system. Most of the time GIS is used to create maps and to print. To perform the basic task in GIS, layers are combined, edited and designed.

Advantage of GIS:

- Better decision made by government people
- Improve decision making with the help of layered information
- Citizen engagement due to better system
- Help to identify communities that is under risk or lacking infrastructure
- Helps in identifying criminology matters
- Better management of natural resources
- Better communication during emergency situation
- Cost savings due to better decision
- Finding different kinds of trends within the community
- Planning the demographic changes

6.4.12 Mobile Sewa App Store (m-Appstore):

A mobile application is a software application designed to run on smart phones, tablet computers and other mobile devices. M-apps are fast becoming the preferred mode of accessing a particular solution or service, especially amongst young citizens of the country. m-Appstore is a part of mobile governance initiative of Digital India and developed by CDAC. It has been created with an aim to facilitate development and deployment of suitable applications for delivery of public services through mobile devices. The store is based upon service oriented architecture and cloud based technologies using open standards as far as practicable. It integrates Mobile apps with SMS, Interactive Voice Response System (IVRS), Uunstructured Supplementary Service Data (USSD), etc.

6.4.13 GARV Grameen Vidyutikaran:

The Government of India launched 'Rajiv Gandhi Grameen Vidyutikaran Yojana(RGGVY) – Programme for creation of Rural Electricity Infrastructure & Household Electrification, in April 2005 for providing access to electricity to rural households. There is a mobile app that has been designed under the Digital India for the effective implementation of the above scheme. Recently, the government has launched GARV- II app to **track Rural Household Electrification.** This is the next step in Government of India's aim to provide access to electricity to all households in the country. GARV-II allows **peoples participation** for rural electrification work. It opens rural electrification work to **public scrutiny** and input about rural electrification programme. It also has a **citizen engagement window 'SAMVAD'** to enhance participation.

6.5   Integrated Nutrient Management

Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner.

Concepts:

1. Regulated nutrient supply for optimum crop growth and higher productivity.

2. Improvement and maintenance of soil fertility.

3. Zero adverse impact on agro – ecosystem quality by balanced fertilization of organic manures, inorganic fertilizers and bio- inoculant

Determinants:

1. Nutrient requirement of cropping system as a whole.

2. Soil fertility status and special management needs to overcome soil problems, if any

3. Local availability of nutrients resources (organic, inorganic and biological sources)

4. Economic conditions of farmers and profitability of proposed INM option.

5. Social acceptability.

6. Ecological considerations.

7. Impact on the environment

Advantages:

1. Enhances the availability of applied as well as native soil nutrients

2. Synchronizes the nutrient demand of the crop with nutrient supply from native and applied sources.

3. Provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance.

4. Improves and sustains the physical, chemical and biological functioning of soil.

5. Minimizes the deterioration of soil, water and ecosystem by promoting carbon sequestration, reducing nutrient losses to ground and surface water bodies and to atmosphere

7- E- Learning and MOOC

Learning is the process of acquiring knowledge and expertise through studies experience or being taught. In other words, learning is relatively a permanent change in behavioral tendencies and is the result of reinforced practice. In the traditional system the students learn from the teachers in an academically conducive atmosphere. The teachers apply several teaching methodologies to make the students learn. The advent of modern Information Communication Technology tools facilitates both the learners and teachers by keeping them to be away from physical contact. As a result, the imparting of education to the mass becomes possible. MOOC stands for Massive Open Online Courses which uses the internet and web resources for better delivery of contents.

7.1 E – Learning

It can be defined as a process in which the Internet technologies are used to deliver educational curriculum outside of a traditional class room to enhance knowledge and performance. In most cases, it refers to a course, program or degree delivered completely online where one can communicate with his teachers, professors or other students. At sometimes the lectures are delivered live and at some other times pre-recorded lectures are made available. There is always a teacher communicating with learners and grading their participation, assignments and tests. E-Learning has become popular method of training and education for many citizens in India.

The e-learning will be beneficial and successful for those who have self discipline and self control as they learn with their choice on schedule, pace and place. E- Learning reduces the per capita cost on education as the learners need not to spend on travel, hard copy materials and other educational resources. As the content delivery is consistent and replicable the learners can make use of them for their better understanding. E-learning has been widely used in the corporate sector, especially when training programs are conducted by experts for employees across the globe.

Learning Management System (LMS) is a part of e-learning and it allows you to access online training in the same way you might log on to email system (like Hotmail or Google mail). Users can monitor how far they have progressed through each module by logging on to the LMS using their user id. By using an LMS teachers can easily keep track of how much training a person has completed. Since everything is stored online, it is fast and easy to access learners' records without having to keep piles of paperwork.

7.2 MOOC

Indian Higher Education System can be classified into three sectors viz. Formal, Non-formal and informal sectors where as the formal education deals with the traditional teaching – learning process, the non-formal education deals with the formal programmes offered through non-formal methods and informal education deals with the continuous learning where the learners are interested in gaining knowledge rather than getting certified. MOOC can play a vital role in all the three sectors.

The word MOOC was coined by David Cormier and it was started in the year 2008. In April 2012, Daphne Koller and Andrew Ng, both Stanford colleagues involved in the Stanford MOOCs, started Coursera. In May, Harvard and MIT joined together to create the EdX platform. Since then many universities have joined the xMOOCs bandwagon globally (including the IITs from India), and many new MOOC initiatives have sprung up rapidly across the world such as Udemy, P2PU, FutureLearn, OpenStudy and Canvas. IIT Delhi and BITS Pilani are offering courses using Coursera to their students. The MOOC deploys several learning strategies such as gamification, adaptive learning, etc., where as the gamification is the use of gaming techniques for non-game situations and the adaptive learning is the process of adjusting the speed of learning based on learners' profile.

Unlike regular college/ university courses, MOOCs can attract thousands of learners around the world. They can come in the form of active course sessions with participant interaction, or as archived content for self-paced study. MOOCs can be free, or there can be a charge – either on a subscription basis or a one-time charge. Most of the MOOCs offers free of cost delivery of courses and a paid "verified certificate" option. In the recent periods the process of integrating the MOOC with formal education is on the way in India. There are thousands of MOOCs available worldwide from several hundred colleges, universities and other institutions of higher learning. Some of the popular international MOOC platforms are Coursera, edX, iversity, udacity, Futurelearn, etc.

7.3   Coursera

It was founded in 2012 by Stanford University computer science professors Andrew Ng and Daphne Koller. Princeton, Stanford, the University of Michigan and the University of Pennsylvania were the first universities to offer content on the platform. The platform contains collections of courses that build skills in a specific subject as well as degrees and a workforce development product for businesses and government organizations. As of October 2017, Coursera had more than 28 million registered users and more than 2,000 courses. The duration of Coursera courses are four to ten weeks, with one to two hours of video lectures a week. These courses apply several learning methods such as quizzes, weekly exercises, peer-graded assignments, and sometimes a final project or exam. Courses are also provided on-demand, in which case users can take their time in completing the course with all of the material available at once. The learners can register their courses by logging on to the website URL:http://www.coursera.org

7.4   edX

edX is an online learning destination and MOOC provider, offering high-quality courses from the world's best universities and institutions to learners everywhere. It was founded by Harvard University and Massachusetts Institute of Technology (MIT) in 2012, and offers the courses on nonprofits basis and also as an open source. With Open edX, educators and technologists can build learning tools and contribute new features to the platform, creating innovative solutions to benefit students everywhere. There are more than 1000 courses, available in edX platform. Learners can log on to https://www.edx.org for registering their courses.

7.4.1 MOOC at India: In India, there are several MOOC platforms available for the learners to gain knowledge. Some of them are Khan Academy, NPTEL, SWAYAM, etc. Khan Academy is a non-

profit organisation which offers online practice exercises, instructional videos, and a personalized learning dashboard that empowers learners to study at their own pace in and outside of the classroom. It offers online courses on the subjects like mathematics, science, computer programming, history, art history, economics, and more. The learners can log on to https://www.khanacademy.org for registering online courses.

National Programme on Technology Enhanced Learning is a joint venture of all the Indian Institute of Technologies (IITs) and Indian Institute of Science (IISc) Bangalore. NPTEL offers online courses and certification in various topics on technical/ engineering discipline. They offer certification for selected courses for a fee of approximately Rs 1000. NPTEL has videos focused on all disciplines of Engineering so many of which you won't find in Coursera, edX, etc. The NPTEL offers the programmes with the duration ranging from 4 weeks to 12 weeks. Learners can log on to https://www.nptel.ac.in for registering their courses of interest.

SWAYAM is a programme initiated by Government of India and designed to achieve the three principles of Education Policy viz., access, equity and quality. There are eight national coordinators to integrate the various disciplines of higher education. Indian government has selected Microsoft as its technical partner for SWAYAM. They are:

1. **National Programme for Technology Enabled Learning (NPTEL)** for Technical/Engineering UG/PG Programmes.

2. **University Grants Commission (UGC**) for post-graduation degree programmes.

3. **Consortium of Educational Communication (CEC)** for non-technology under-graduate education

4. **National Council for Educational Research and Training (NCERT)** for School Educational Programmes from class 9th to 12th

5. **National Institute of Open Schooling (NIOS)** for school education

6. **IGNOU** for Diploma and Certificate Programme

7. **Indian Institute of Management (IIM) Banglaore**, for Management Programmes

8. **National Institute of Technical Teacher Training (NITTR), Chennai** for Teacher Training Programme.

The learners can log on to https://www.swayam.gov.in for registering the course of their choice as shown in Figure 7.1.
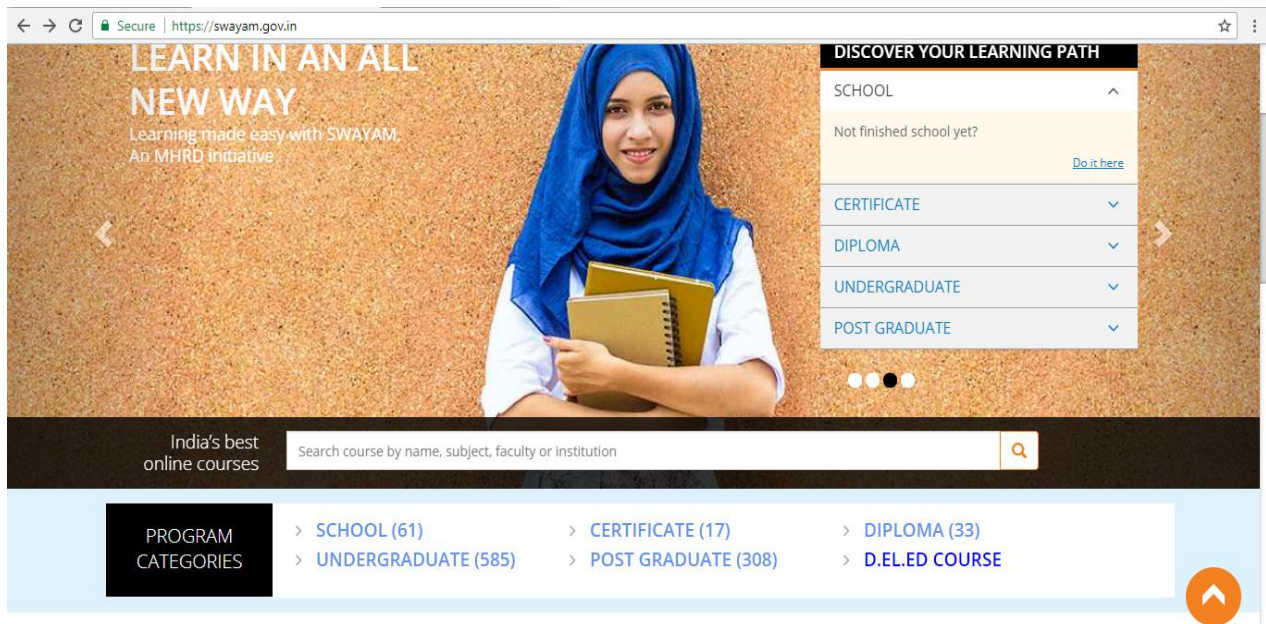
Figure 7.1 Screenshot of SWAYAM website

7.5 Digital Library

A digital library is a collection of digital documents or objects. As per the definition of Smith Abbey, a digital library is an organized and focused collection of digital objects, including text, images, video and audio, with the methods of access and retrieval and for the selection, creation, organization, maintenance and sharing of collection. As the digital contents of the library are accessed through the internet the location and time of access are no bar for accessing the contents. Multiple users can access the same resource at a time. These advantages are only possible if the digital contents are organised and indexed properly.

7.5.1 National Digital Library: Ministry of Human Resource Development (MHRD) under its National Mission on Education through Information and Communication Technology (NMEICT) has initiated the National Digital Library of India (NDL India) pilot project to develop a framework of virtual repository of learning resources with a single-window search facility. NDL India is designed to hold content of any language and provides interface support for leading Indian languages. It is being arranged to provide support for all academic levels including researchers and life-long learners, all disciplines, all popular form of access devices and differently-abled learners. It is being developed to help students to prepare for entrance and competitive examination, to enable people to learn and prepare from best practices from all over the world and to facilitate researchers to perform inter-linked exploration from multiple sources. NDL is being developed at Indian Institute of Technology Kharagpur.

Students can log on to https://www.ndl.iitkgp.ac.in for accessing the resources. The fig. 7.2 illustrates the facilities available at NDL. Students can access e-books from several service providers such as Digital Library of India (DLI), Googlebooks, Kobo, FreeBookSpot, BookPub, etc.
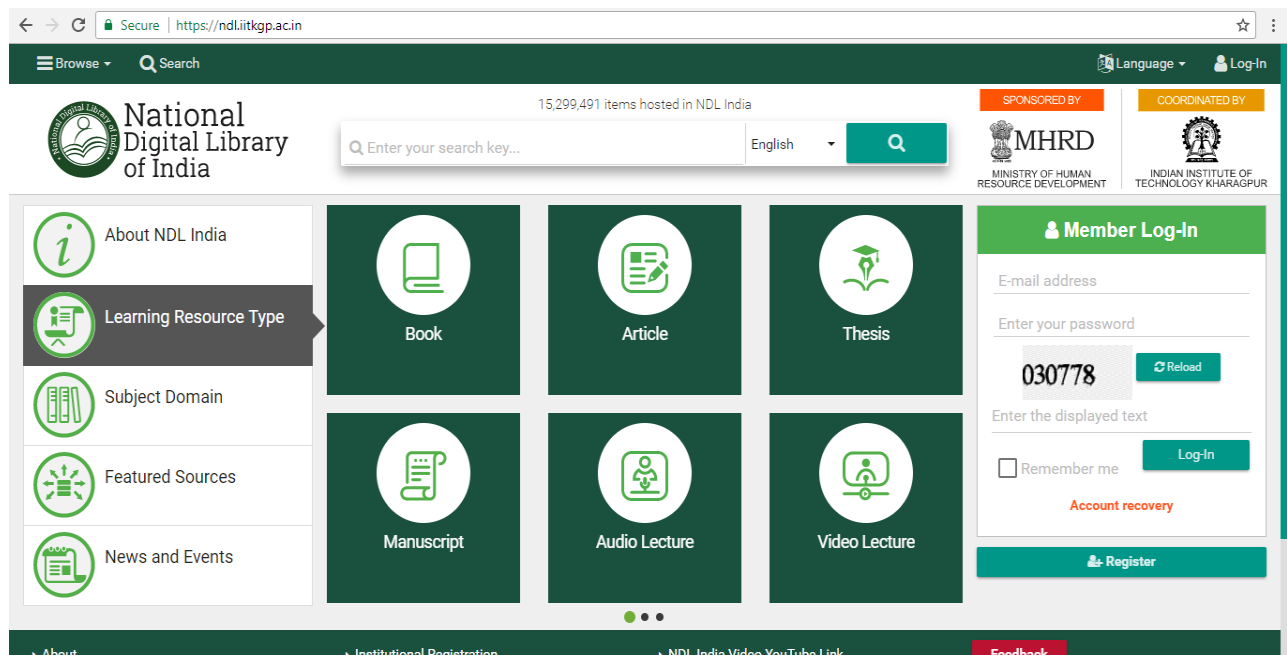
Figure 7.2 Screenshot of National Digital Library

7.5.2 E-Journals and Books: Electronic journals, also known as e-journals, are electronic version of research journals or articles which can be accessed using ICT tools or internet. In general they are available in the PDF or HTML format. A subset of these journals exists as Open Access titles which can be accessed freely. The E- Book is the electronic version of the books which can be accessed using ICT tools and internet. The specific problems that are associated with e – journals or books are as follows:

1. Organising the resources needs better planning.

2. Indexing of resources is necessary for speedy retrieval.

3. Search on several criterions are required

4. User friendly navigations are required

7.6   Cyber Security

There are various ongoing activities and programs of the Government to address the cyber security challenges which have significantly contributed to the creation of a platform that is now capable of supporting and sustaining the efforts in securing the cyber space. Due to the dynamic nature of cyberspace, there is now a need for these actions to be unified under a National Cyber Security Policy, with an integrated vision and a set of sustained & coordinated strategies for implementation.

7.6.1 Computer Virus: A computer virus is a malicious software program (malware) that copies itself by modifying other programs and inserts its own code. In a networked environment, Virus has the ability to spread from one system to other system. It operates by inserting itself to a

legitimate program or document that supports macros (piece of program used to perform a task repeatedly) in order to execute its code. A virus can harm the system software by corrupting or destroying data. Some viruses can erase the data or cause damage to the hard disk and some other can benefit financially. Viruses can be spread through email, Internet file downloads, social media scam links, and mobile applications download. As a best practice, one should not download text or email attachments that one is not expecting, or files from websites you don't trust. To protect our systems from viruses we need to install antivirus programs. There are several antivirus programs such as McAfee, Norton, Kaspersky, K7, Avast, etc, are available in the market.

7.6.2 Hacking: Hacking is a process of finding the possible ways for getting into the computer or network and stealing data. Typically hacking is divided as two parts as follows; legal and illegal hacking. An alternate name for legal is ethical hacking which means the process that finds the weakness in computer or network systems to be addressed such as a testing phase. On the other hand, illegal hacking could be defined as a practice with the motivation of stealing private data from the computer or network systems. As of now the hacking is associated with five categories as shown in figure 7.3.
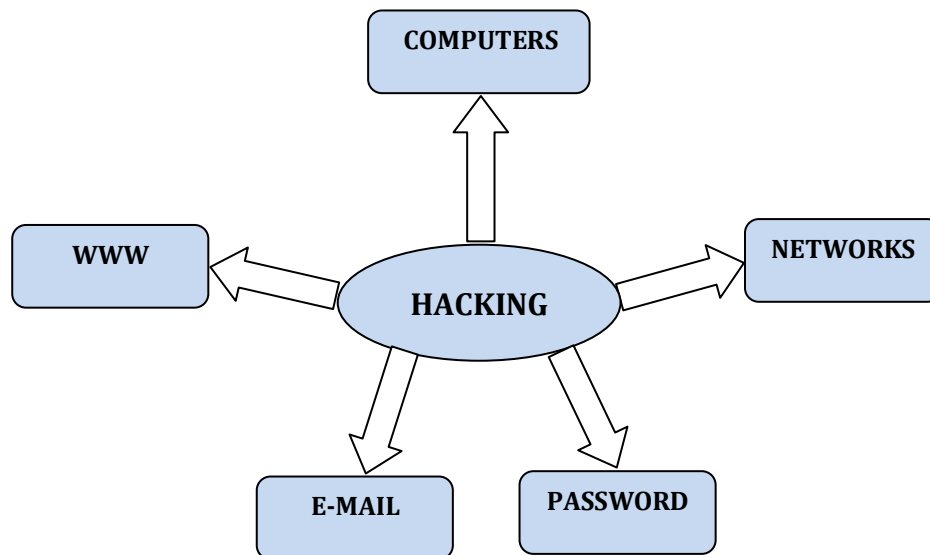
Figure 7.3 Types of Hacking

Network Hacking is the process of gathering information about a domain using tools or process like Telnet, Ping, Tracert, NS lookup, Netstat, etc.

Email Hacking is the process of accessing or manipulating an email account and mail correspondence without the knowledge of its authorised user.

Password Hacking is usually accomplished by recovering secret passwords from data that has been stored in or transmitted by a computer system.

Computer Hacking is the process of unauthorized intrusion into a computer system for stealing ID and password by applying hacking methods and getting the access to a computer system.

Website Hacking means that a stranger gains control over a web server and its associated software such as databases and other interfaces.

7.7 Big Data

The advent of the ICT tools resulted in the huge growth of data. Today the governments and industries face a problem of analysing huge volume of data in order to make wise decisions. The word "big data" denotes the large volume of several kinds of data that changes in a rapid manner. There are three Vs viz. Volume, Velocity and Variety, associated with the big data.

Volume

Today the data arrives from a variety of sources, including business transactions, social media and information from sensor or machine-to-machine data.

Velocity

In the recent period the data changes rapidly as it is captured from electronic sources such as Radio Frequency Identifier (RFID) tags, sensors and smart meters.

Variety

Data comes in all types of formats such as numeric, text, email, video, audio and financial transactions.

Table 7.1 Data Processed Per Day

Name of Organisation	Data Size
e-Bay	100 peta byte
Google	100 peta byte
Facebook	600 terra byte
NSA	29 peta byte
Twitter	100 terra byte

The data stored by the organisation ranges from peta bytes to exo bytes. The data, processed by the leading organizations per day are shown in the table 7.1 (ref. http://www.followthedata.wordpress.com)

7.7.1 Data Analytics: In the recent period, huge amount of data are generated from several sources. Ninety percent of the today's data in the world has been created in the last two years alone. This data comes from several electronic sensors, posts to social media sites, digital pictures and videos, purchase transaction records, cell phone GPS signals, etc. Data analytics refers to the process of extracting useful knowledge from the huge amount of data using the following method:

- Testing
- Analysis of variance
- Probabilistic methods
- Classification
- Association analysis

- Clustering
- Prediction
- Outlier analysis
- Natural Language Processing
- Machine learning
- Artificial Intelligence
- Multivariate analysis
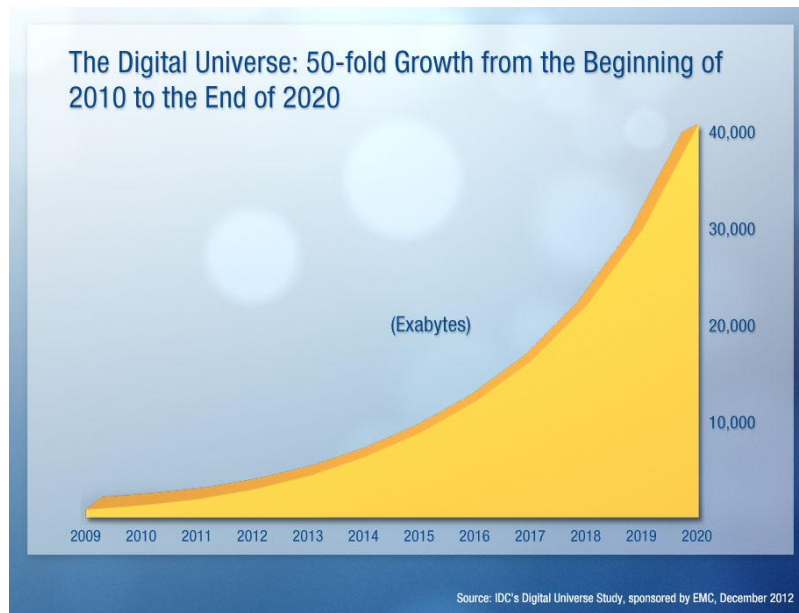
7.8 Introduction to IT Act

During the initial stage of computerisation there was no law available in India to regulate the Electronic Data Interchange (EDI). The Indian Government felt the need for such act during the late 90s and came with the Information Technology (IT) Act 2000 on 9th June 2000. IT Act provide legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication, commonly referred to as "electronic commerce". E – Commerce involves the use of paperless communication and electronic storage, to file documents with the Government agencies. The relevant amendment has been made in the Indian Penal Code, the Indian Evidence Act, 1872, the Bankers' Books Evidence Act, 1891 and the Reserve Bank of India Act, 1934 and for matters connected therewith. Some of the salient features of IT Act 2000 are as follows:

1. Legal Recognition of Electronic Record
2. Legal Recognition of Digital Signature
3. Legal Recognition of Electronic Receipt
4. Recognition of Foreign certifying authorities
5. Establishment of Cyber Appellate Tribunal
6. Penalty for fraudulent transaction

The definitions related to some of the EDI activities are given below:

- "Data" means a representation of information, knowledge, facts, concepts or instructions which are being prepared or have been prepared in a formalised manner, and is intended to

be processed, is being processed or has been processed in a computer system or computer network, and may be in any form (including computer printouts magnetic or optical storage media, punched cards, punched tapes) or stored internally in the memory of the computer;

- "Digital Signature" means authentication of any electronic record by a subscriber by means of an electronic method or procedure in accordance with the provisions of section 3;

- "Digital Signature Certificate" means a Digital Signature Certificate issued under subsection (4) of section 35 of IT Act;

- "Electronic Form" with reference to information means any information generated, sent, received or stored in media, magnetic, optical, computer memory, micro film, computer generated micro fiche or similar device;

- "Electronic Record" means data, record or data generated; image or sound stored, received or sent in an electronic form or micro film.

Some of the important aspects of the IT Act are furnished below:

Chapter XI of IT Act 2000 deals with the offences related to tampering, hacking, publishing of electronic information.

7.8.1 Publishing of information which is obscene in electronic form: Whoever publishes or transmits or causes to be published in the electronic form, any material which is lascivious or appeals to the prurient interest or if its effect is such as to tend to deprave and corrupt persons who are likely, having regard to all relevant circumstances, to read, see or hear the matter contained or embodied in it, shall be punished on first conviction with imprisonment of either description for a term which may extend to five years and with fine which may extend to one lakh rupees and in the event of a second or subsequent conviction with imprisonment of either description for a term which may extend to ten years and also with fine which may extend to two lakh rupees.

7.8.2 Penalty for misrepresentation: Whoever makes any misrepresentation to, or suppresses any material fact from, the Controller or the Certifying Authority for obtaining any licence or Digital Signature Certificate, as the case may be. Shall be punished with imprisonment for a term which may extend to two years, or with fine which may extend to one lakh rupees, or with both.

7.8.3 Publication for fraudulent purpose: Whoever knowingly creates, publishes or otherwise makes available a Digital Signature Certificate for any fraudulent or unlawful purpose shall be punished with imprisonment for a term which may extend to two years, or with fine which may extend to one lakh rupees, or with both.

7.9   Social Networks

Social networks are the systems that use the computer networks and World Wide Web (WWW) for human interactions and for building relationships. Some of the examples for the social networks are Facebook, Twitter, LinkedIn, Google+, MySpace, Ning, Tagged, MyYearbook, Meetup, Bebo, etc,. In general, a social network is defined as a network of individuals or organization via some medium in order to share thoughts, interests and activities.

7.9.1 Social Network Analysis:
Social Network Analysis (SNA) is the process of mapping social relationships in terms of nodes and connections (links). The nodes may represent the people, groups, organizations, computers, URLs, etc., within the network and connections represent relationships between the nodes. Unlike statistical analysis which focuses only on individual for justifying their inherent quality, the SNA aims to analyze the relationships among nodes. In general, SNA is a tool to examine the human relationship with respect to visual and mathematical analysis. The SNA when it comes to management is called Organizational Network Analysis [ONA]. The relationship in SNA is measured using the measures like Degree, Density, Reach, Centrality, Betweenness, etc.

7.9.2 Government Initiatives on Social Media:
The growth in the social media poses major challenges in terms of national security. Social Media refers to a set of web-based services that rely on user generated content. Recently, the government set up National Media Analytics Centre (NMAC) to monitor blogs, media channels, news outlets and social media platforms. The tracking software used by NMAC will generate tags to classify post and comments on social media into negative, positive and neutral categories, paying special attention to "belligerent" comments, and also look at the past patterns of posts.

In the year 2014, the government launched a scheme named "MyGov.in" under the Digital India Mission. It is a citizen engagement platform to promote the active participation of Indian citizens in their country's governance and to get ideas from citizens. The platform provides services such as survey polls, activities, discussions, blogs and communication with the Prime Minister.

NETRA (Network Traffic Analysis) is another scheme developed by the Center for Artificial Intelligence & Robotics (CAIR) laboratory under the Defence Research and would be installed at the ISP (Internet service provider) level at more than 1000 locations across India Each location will be called as "Node", with 300GB of storage space." 7 The basic idea behind this project is to enable real-time detection of suspicious "keywords" and "key-phrases" in social media, emails, blogs, tweets, instant messaging services, and in other types of Internet content. NETRA will essentially be a surveillance system designed specifically to monitor the nation's internet networks including voice traffic. The overall summary on the schemes of Indian Government is furnished in the table 7.2.

Table 7.2 Government Initiatives on Social Media

No.	Name of scheme	Nature of information to be monitored	Purpose of monitoring
1	NETRA (Network Traffic Analysis)	All Internet traffic including social media, emails, blogs, tweets, instant messaging services, and voice over IP	To detect suspicious activity for national security purposes
2	NMAC (National Media Analytics Centre)	Social Media content, blogs, news and media channels	Sentiment analysis of posts for security purposes and big data analysis for detection of pattern of posting. Both domestic law enforcement and national security purpose
3	Social Media Labs	Social Media platforms	To detect suspicious activity, and track mobilisation using social media for protests, and support domestic law enforcement.
4	CCTNS	Crime data, geo location data, call data records, social media data etc.	One of the stated goals of CCTNS is predictive policing using among other things, real time tracking of internet data including social media data, for domestic law enforcement.
5	MyGov.in	Crowd sourced data on the platform, social media content and blogs.	While the main purpose is to serve as a platform from citizen engagement, it has been reported that data mining and analysis techniques will be used to follow public discourse and discussion on social media platforms and blogs

7.10 Sentiment Analysis

Sentiment analysis refers to the class of computational and natural language processing study of people's opinions, appraisals, and emotions toward events, institutions or other subject matter in order to extract subjective information, such as opinions, expressed in a given piece of text. The main purpose of sentiment analysis is to classify attitudes towards various topics into positive, negative or neutral categories.

7.11 Predictive Policing

Predictive Policing is the application of Big Data analytical techniques to prevent crimes through police intervention or use of statistical predictions to solve crimes. Predictive Policing techniques typically look at various sources of data and one of the key sources has been social media data. The Crime and Criminal Network Tracking System (CCTNS) is an e-governance project under the Digital India mission which connects approximately 14000 police stations across the country and facilitate investigation, detection and prevention of crime.

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