

SYLLABUS**NON MAJOR ELECTIVE II****FUNDAMENTALS OF INFORMATION TECHNOLOGY**

Objective: To Provide the Basic Concepts in Information Technology

Unit I

Introduction to Computers - Generation of Computers - Classification of Digital Computer - Anatomy of Digital Computer.

Unit II

CPU and Memory - Secondary Storage Devices - Input Devices - Output Devices.

Unit III

Introduction to Computer Software - Programming Language – Operating Systems - Introduction to Database Management System.

Unit IV

Computer Networks - WWW and Internet - Email - Web Design

Unit V

Computers at Home, Education, Entertainment, Science, Medicine and Engineering - Introduction to Computer Security - Computer Viruses, Bombs, Worms.

Text Book:

1. Fundamentals of Information Technology, Alexis Leon And Mathews Leon, Vikas Publishing House Pvt. Ltd, 2009

Reference Book:

1. Fundamentals of Computers and Information Technology, M.N Doja, 2005

UNIT - I**INTRODUCTION TO COMPUTERS:**

A computer is a programmable machine. The two principal characteristics of a computer are:

- It responds to a specific set of instructions in a well-defined manner.
- It can execute a prerecorded list of instructions (a program).

All general-purpose computers require the following hardware components:

1. **Central Processing Unit (CPU):** The “heart” of the computer, the component that actually executes instructions.
2. **Memory:** Enables a computer to store, at least temporarily, data and programs.
3. **Input device:** Usually a keyboard or mouse, the input device is used to feed the data and the instructions to the computer.
4. **Output device:** Output devices are used to represent information from the computer. Example: Monitor and Printer.
5. **Mass storage device:** Allows a computer to permanently retain large amounts of data. Example: Disk drives and tape drives.

Types of Computers:

Computers can be classified by their size and power as follows:

- **Personal computer:** A small, single-user computer based on a microprocessor. In addition to microprocessor, a personal computer has a keyboard for entering data, a monitor for displaying information, and a storage device for saving data.
- **Workstation:** A powerful, single-user computer. A workstation is like a personal computer, but it has a more powerful microprocessor and a higher-quality monitor.
- **Minicomputer:** A multi-user computer capable of supporting 10 to hundreds of users simultaneously.
- **Mainframe:** A powerful multi-user computer capable of supporting many hundreds of users simultaneously.
- **Supercomputer:** An extremely fast computer that can perform hundreds of millions of instructions per second.

Characteristics of Computers:

All computers have certain common characteristics irrespective of their type and size.

- ✓ **Word length:** The number of bits that a computer can process at a time in parallel is called its *word length*. Commonly used word lengths are 8, 16, 32 and 64 bits. Word length is the measure of the computing power of a computer.
- ✓ **Speed:** Computers can calculate at very high speeds. A microcomputer can execute millions of instructions of instructions per second. Super computers can operate in nanoseconds.

$$1\text{ms (milli second)} = 1/10^3 \text{ seconds}$$

$$1\mu\text{s (micro second)} = 1/10^6 \text{ seconds}$$

$$1\text{ns (nano second)} = 1/10^9 \text{ seconds}$$

$$1\text{ps (pico second)} = 1/10^{12} \text{ seconds}$$

- ✓ **Storage:** Computers have their main memory and auxiliary memory systems. A computer can store a large amount of data.
 - 1 byte = 8 bits
 - 1 KB (Kilo Byte) = 1024 bytes
 - 1 MB (Mega Byte) = 1024 KB
 - 1 GB (Giga Byte) = 1024 MB
 - 1 TB (Tera Byte) = 1024 GB
- ✓ **Accuracy:** The accuracy of a computer system is very high. Errors in hardware can occur, but error detecting and correcting techniques will prevent false results.
 - If a wrong input is given, the output will be wrong – **GIGO** (Garbage In Garbage Out)
- ✓ **Versatility:** Computers are very versatile machines. They can perform activities ranging from simple calculations to performing complex CAD modeling and simulation to navigating missiles and satellites.
- ✓ **Automation:** Once a task is initiated, computers can proceed on its own till its completion.
- ✓ **Diligence:** Diligence means being constant. Human beings suffer from weakness like tiredness, lack of concentration, etc. A computer does not have any of these human weaknesses. They won't get tired or bored.

WHAT COMPUTERS CAN DO?

A computer can do many things:

- Stock market analysis.
- Publish a newsletter.
- Design a building or play games.

- Businesses use computers for a variety of purposes ranging from decision making to electronic commerce.
- Scientists and researchers use computers to develop theories, to simulate and to exchange information.
- In medicine, computers are used for everything from diagnosing illnesses to monitoring patients during surgery.
- Everyone from school children to research students use computers.
- Military uses computers in a variety of ways.
- Musicians and singers use computers to create an amazing range of instruments and sounds simply by playing a keyboard.
- Most of the household appliances have computers in them.

WHAT COMPUTERS CAN'T DO?

- **Productivity:** It takes too much time to learn how to use an application to increase productivity.
- **Reasoning:** Computers can't think.
- **Errors:** Computers don't make errors, people do. Computer does not allow spelling mistakes.

ENIAC (Electronic Numerical Integrator and Calculator) – The first large-scale computer was created for the US army.

UNIVAC (Universal Automatic Computer) – one of the first commercially available computers.

EDVAC (Electronic Discrete Variable Automatic Computer)

MIDI (Musical Instrument Digital Interface) is a system that synchronizes hardware and software that produces electronic tones.

USES OF COMPUTERS:

- Computers are helpful because they offer a wide range of functions and services that are not available anywhere else.
- There are four main uses: word processing, internet/communications, digital video/audio composition, and desktop publishing.
- Easy processing of complex tasks.
- It saves time by quick manipulation of data as compared to when done manually.
- The errors in data processing are minimized when a computer is used.
- It has helped in making communication easier by using internet.
- It stores, retrieves, and processes a large amount of data.
- It helps in multitasking of various jobs.
- Data is more secure and easier to use.

GENERATIONS OF COMPUTERS:

Based on the period of development and the features incorporated, the computers are classified into different generations – from first generation to fifth generation computers.

- ❖ **First generation computers (1945 – 1955)** were made-to-order for specific tasks. Each computer had a different binary-coded program called a machine language that told it how to operate. The computers used vacuum tubes and magnetic drums for data storage.
- ❖ **Second generation computers (1956 – 1963)** used vacuum tubes with transistors and machine language with assembly language. They also contained all the components we associate with the modern day computer: printers, tape storage, disk storage, memory, operating systems, and stored programs.

Throughout the early 1960's, there were a number of commercially successful second-generation computers used in businesses, universities and government.

- ❖ **Third generation computers (1964 – 1971)** replaced transistors with integrated circuits (IC). These computers could be used for both scientific and nonscientific applications. These computers allowed the use of an operating system that allowed machines to run many different programs at once with a central program that monitored and coordinated the computer's memory.
- ❖ **Fourth generations computers (1972 onwards)** were characterized by their small size, the processor and more processing power. This era also marked the introduction and popularity of the personal computer. The size of the computers shrank and the processing power increased. The computers became easier to operate with new operating systems that supported graphical user interfaces (GUI) operation.
- ❖ **Fifth generation computers (present and future)** aim to be able to solve highly complex problems that require reasoning, intelligence and expertise when solved by people.

CLASSIFICATION OF DIGITAL COMPUTERS:

Computer systems are classified as Microcomputers, Minicomputers, Mainframes and Supercomputers.

❖ **Microcomputers:**

- **Personal computers (PCs):** They were usually to easier to use and more affordable. These machines ran easy-to-use applications software such as word processors, spreadsheets, etc. Ex: Acer's Aspire
- **Workstations:** Workstations are expensive, powerful machines used by engineers, scientists, and other

professionals who processed a lot of data. Ex: Sun, Apollo Hewlett-Packard.

- **Portable computers:** There are three categories of portable computers:
 - a. **Laptops / Notebooks:** They are ideal for users who have to work away from their offices. The users might be an executive on the move, a student, a journalist, a salesperson, etc. Ex: IBM ThinkPad.
 - b. **Subnotebooks:** These are used for frequent flyers and life-on-the-road professionals. It gives up a full display screen and keyboard in exchange for less weight. Ex: Toshiba Protégé.
 - c. **Personal Digital Assistants (PDAs):** It is smaller than subnotebooks. They combine pen input, writing recognition, communication capabilities in a very small package. Users: executives, businessman – used for their day-to-day activities. Ex: Apple's Newton.
- ❖ **Minicomputers:** A minicomputer is a computer of size intermediate between a microcomputer and a mainframe. Typically, minicomputers have been stand-alone computers sold to small and mid-size businesses for general business applications and to large enterprises for department-level operations.
- ❖ **Mainframes:** A mainframe is a high-performance computer used for large-scale computing purposes that require greater availability and security than smaller-scale machine offer.
- ❖ **Supercomputers:** A supercomputer is a computer that performs at or near the currently highest operational rate for computers. A supercomputer is typically used for scientific and engineering

applications that must handle very large databases or do a great amount of computation.

- ❖ **Network computers:** A network computer describes low-cost personal computers for business networks that would be configured with only essential equipment and managed centrally.

ANATOMY OF A DIGITAL COMPUTER:

A computer system consists of the following four components:

- i. Hardware
- ii. Software or programs
- iii. Data which the computer converts into information
- iv. People or users

The **hardware** refers to the parts of the computer. It consists of interconnected electronics devices that control everything the computer does.

The **software** refers to sets of electronic instructions that tell the hardware what to do.

The **data** consists of letters, numbers, sounds and images.

The person who uses the computer is referred to the **user**.

Parts of a computer:

All general-purpose computers require the following hardware components:

- ✓ **Central Processing Unit (CPU) or processor** – The CPU or processor is the “brain” of the computer; it is the component that actually executes instructions.
- ✓ **Memory** –Memory enables a computer to store, at least temporarily, data and programs.
- ✓ **Input device** – An input device usually is a keyboard or a mouse. It is the conduit through which data and instructions enter a computer.

- ✓ **Output device** – The typical output devices are display screens, printer, or other such devices that lets you see what the computer has accomplished.
- ✓ **Mass storage device** – These devices allow a computer to permanently retain large amounts of data. Common mass storage devices include disk drives and tape drives.

UNIT - II

CENTRAL PROCESSING UNIT (CPU):

A computer does the following four functions: receive input, process information, produce output and store information.

The part of the computer that executes program instructions is known as the processor or central processing unit (CPU).

The CPU is the heart of the computer and this is where all the computing is done.

The CPU consists of three main components: the control unit (CU), the arithmetic logic unit (ALU) and the registers.

- **Control Unit:** The control unit tells the rest of the computer system how to carry out a program’s instructions.

It directs the movement of electronic signals between memory, which temporarily holds data, instructions and processed information and the ALU.

It also directs these control signals between the CPU and input/output devices.

All the computer’s resources are managed from the control unit.

The control unit is the logical hub of the computer.

The CPU’s instructions for carrying out commands are built into the control unit. The instructions list all the operations that the CPU can perform.

- **Arithmetic Logic Unit (ALU):** ALU performs two types of operations – arithmetic and logical.

Arithmetic operations are the fundamental mathematical operations consisting of addition, subtraction, multiplication and division.

Logical operations consist of comparisons. That is, two pieces of data are compared to see whether one is equal to, less than, or greater than the other.

Many instructions carried out in the control unit involve moving data from one place to another from memory to storage, from memory to the printer or monitor and so on.

The ALU includes a group of high speed memory locations built directly into the CPU. These memory locations are called **registers** and are used to hold data that is currently being processed.

MEMORY:

Memory – also known as the primary storage or main memory - is a part of the microcomputer that holds data for processing, instructions for processing the data and information.

There are mainly two types of memory: RAM (Random Access Memory) and ROM (Read Only Memory).

- **RAM – Random Access Memory** is a type of computer memory that can be accessed randomly. (that is, any byte of memory can be accessed without touching the preceding bytes.)

It is also referred to as **read and write** memory, that is the user can read data from memory and write into RAM.

RAM memory is **volatile**, which means that, when the power is turned off, the data is lost.

There are two types:

- **Dynamic RAM (DRAM)** – DRAM is a type of physical memory used in most personal computers. The term dynamic indicates that the memory must be frequently refreshed or it will lose its contents. (It is main memory)
- **Static RAM (SRAM)** – SRAM is a type of memory that is faster and more reliable than DRAM. It does not need to be refreshed like dynamic RAM. (It is used as a cache memory)

- **ROM – Read Only Memory** is a computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.

The different types of ROM are:

- **PROM – Programmable Read Only Memory** – A PROM memory is a memory chip on which data can be written only once.
- **EPROM – Erasable Programmable Read Only Memory** – It retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, making it possible to reprogram the memory.
- **EEPROM – Electrically Erasable Programmable Read Only Memory** – It can be erased by exposing it to an electrical charge.

INPUT DEVICES:

Input device is any machine that feeds data into a computer. Ex: keyboard, mouse and track ball.

- **Keyboard:** Keyboard is an input device consisting of a set of typewriter-like keys that enable users to enter data into a computer. The keys on computer keyboards are often classified as follows:
 - ✓ Alphanumeric keys – letters and numbers.

- ✓ Punctuation keys – comma, period, semicolon and so on.
- ✓ Special keys – function keys, control keys, arrow keys, Caps Lock key and so on.
- ✓ The standard keyboard layout is known as QWERTY.
- ✓ An enhanced keyboard has 101 keys.
- **Mouse:** Mouse is a device that controls the movement of the cursor or pointer on a display screen.
 - ✓ A mouse is a small object that can be rolled along a hard, flat surface.
 - ✓ **Types of mouse:**
 - **The mechanical mouse** has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors are used to detect the direction the ball is rolling and move the screen pointer accordingly.
 - **The opto-mechanical mouse** is the same as a mechanical mouse, but uses optical sensors to detect motion of the ball.
 - **Optical mouse** uses photodiodes and LED technology that is usually present under the mouse, to detect the movements.
 - **The Laser mouse** uses infrared laser or LED to light the surface under it.
- **Trackball:** It is a pointing device. It is same as a mouse, except the ball is positioned at the top. The device is fixed. To move the pointer the ball is rotated with palm of our hand.
- **A game controller** is an input device that provides the inputs for computer games. Game controllers fall into two categories – joysticks and game pads.
- **Scanner** is an input device that can read text or illustrations printed in paper and translate the information into a form that the computer can use.
- **Digitizer** is an input device that enables the user to enter drawings and sketches into a computer.
- **Microphones** convert a person's speech into digital form. These input devices, when combined with appropriate software, form voice recognition systems.
- **A webcam** is a camera that is in some way connected to the WWW or Internet.
- **A digital camera** is a camera that stores images digitally rather than recording them on film.
- **The barcode reader** is used to convert the printed image – the barcode – into electronic form by shining light onto the image and sensing the intensity of the light's reflection at every point.
- **A video camera** is a portable electronic recording device that is capable of recording live-motion video and audio for later replay through VCRs, TVs or computers.
- **An Optical Character Recognition (OCR)** is used to read text from paper and translate into a form that the computer can manipulate.
- **Optical Mark Recognition (OMR)** also called **mark sensing** is a technology where an OMR device senses the presence or absence of a mark, such as a pencil mark.
- **Magnetic Ink Character Recognition (MICR)** allows the computer to recognize characters printed using magnetic ink. Ex: Cheque number printed in a cheque.

OUTPUT DEVICES:

An output device is any machine that capable of representing information from computer.

❖ **Monitor:** Monitor is the most commonly used output device. There are two types of monitors that are used with personal computers – CRT monitor and flat-panel monitors.

✚ The **Cathode Ray Tube (CRT)** monitor looks like a television and works the same way.

✚ The flat-panel monitors were originally used mainly with portable computers like laptops and notebooks.

✚ **Classification of monitors – based on color:**

- **Monochrome** – Monochrome monitors actually display two colors, one for the background and one for the foreground. The colors can be black and white or green and black.
- **Gray-scale** - A grayscale monitor is capable of displaying different shades of gray, from very light gray to black.
- **Color** - Color monitors can display anywhere from 16 to over 1 million different colors. Color monitors are sometimes called RGB monitors because they accept three separate signals – red, green and blue.

✚ **Classification of monitors – based on signal:**

- **Digital monitor** – A digital monitor accepts digital signals rather than analog signals.
- **Analog monitor** – This is the traditional type of color display screen that has been used in televisions.

✚ **Characteristics of monitor:**

- **Size** – Screen sizes are measured in diagonal inches, the distance from one corner to the opposite corner diagonally. Ex: 14 inches, 16 inches.
- **Resolution** – The resolution indicates how densely the pixels are packed. **Pixel** is short for **Picture Element**. A pixel is a single point in a graphic image. Ex: 640 X 480, 1024 X 768
- **Refresh rate** - Display monitors must be refreshed many times per second. The refresh rate determines how many times per second the screen is to be refreshed (redrawn). The refresh rate is measured in Hertz (Hz) and is also called the vertical frequency or vertical refresh rate.
- **Bandwidth** – Bandwidth is the amount of data that can be transmitted in a fixed amount of time. It is usually expressed in bits or bytes per second.
- **Interlaced or non-interlaced** – Interlacing is a display technique that enables a monitor to provide more resolution inexpensively. With interlacing monitors, the electron guns draw only half the horizontal lines with each pass (all odd lines on one pass and all even lines on the second pass).
- **Dot-Pitch** - Dot pitch is a measurement that indicates the vertical distance between each pixel on a display screen.
- **Convergence** – Convergence refers to how sharply an individual color pixel on a monitor appears. Each pixel is composed of three dots – red, green and blue. The three dots should all converge at the same point.

Video Standards:

- **VGA:** Video Graphics Array
- **SVGA** – Super VGA

❖ PRINTER:

Printer is a device that prints text or illustrations on paper.

• Characteristics of Printer:

- **Quality of type** – The output produced by printers is said to be either letter quality, near letter quality, or draft quality.
- **Speed** – Measured in characters per second (CPS) or pages per minute (PPM). The speed of Daisy-wheel printers is 30cps and for the laser printer is 4 to 20 text pages per minute.
- **Impact or non-impact** – Impact printers include all printers that work by striking an ink ribbon. Non-impact printers include laser printers and ink-jet printers. The impact printers are much noisier but are useful for making multiple copies like carbon copies.
- **Graphics** – Some printers can print only text. Other printers can print both text and graphics.
- **Fonts** – Some printers are limited to one or a few fonts. Laser and ink-jet printers are capable of printing an almost unlimited variety of fonts.

• Types of Printers:

- **Daisy-wheel printer:** Daisy-wheel printer is a type of printer that produces letter-quality type. It works on the same principle as a ball-head typewriter. The daisy wheel is a disk made of plastic or metal on which characters

stand out in relief along the outer edge. To print a character, the printer rotates the disk until the desired letter is facing the paper. Then a hammer strikes the disk, forcing the character to hit an ink ribbon, leaving an impression of the character on the paper.

- **Dot-matrix printer:** Dot-matrix printers create characters by striking pins against an ink ribbon. Each pin makes a dot, and combinations of dots form characters and illustrations. They are inexpensive and relatively fast.
- **Ink-jet printer:** Ink-jet printers work by spraying ionized ink at a sheet of paper. Magnetized plates in the ink's path direct the ink onto the paper in the desired shapes. Ink-jet printers are capable of producing high quality print. They can be used as portable printers. They provide inexpensive way to print full-color documents.
- **Laser printer:** Laser printer utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of the heat and pressure.
- ❖ **Plotter:** Plotter is a device that draws pictures on paper based on commands from a computer. Plotters differ from printers in that they draw lines using a pen. As a result, they can produce continuous lines, whereas printers can only simulate lines by printing a closely spaced series of dots. They are used in engineering applications.
- ❖ **Speech synthesizers:** Speech synthesis refers to a computer's ability to produce sound that resembles human speech.

- ❖ **Sound card and speakers:** Sound card is an expansion board that enables a computer to manipulate and output sounds. Sound cards enable the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer, and manipulate sound stored on a disk.

SECONDARY STORAGE DEVICES: (Auxiliary storage devices)

Secondary storage is the memory that supplements the main storage. Secondary storage devices are also useful in transferring data or programs from one computer to another. They also function as back-up devices, which allow us to back-up the valuable information.

There are two types of secondary storage devices: sequential and random access devices.

In the case of sequential-access media, the data stored in the media can only be read in sequence.

Random access is also called direct access media because a disk drive can access any point at random without passing through intervening points.

Sequential access storage is off-line. Ex: magnetic tape

Direct access storage devices (DASD) directly connected to the CPU. Ex: Hard disk.

Advantages of Secondary Storage devices:

- **Economy:** It is more economical to store data on secondary storage devices than in primary storage.
- **Capacity:** There is much more capacity in secondary storage than in primary storage.
- **Security:** Data is usually stored in secondary storage devices so that it is safe from tampering by unauthorized people.

The secondary storage devices are:

- **Magnetic tape:** Magnetic tape is a magnetically coated strip of plastic on which data can be enclosed. It is sequential access media. It is cheaper to store large amount of data. It has read/write head and an erase head.
 - Magnetic tapes are used for backup storage.
- **Magnetic disks:** Disk technology permits direct and immediate access to data.
 - **Hard disk:** Magnetic hard disks are thin steel platters with an iron oxide coating. Electromagnetic **read/write heads** are mounted on **access arms**. The heads fly over the rotating disks and read or write data on concentric circles called **tracks**.
 - **Floppy disk:** Floppy disk is a soft magnetic disk. Floppy disks are portable. Floppy disks are slower to access than hard disks and have less storage capacity. They are less expensive.
- **Optical disk:** Optical disks are a storage medium from which data is read and to which it is written by lasers. Optical disks can store much more data up to 6 GB.
 - Types:**
 - **CD-ROM (Compact Disk – Read Only Memory)** – The data is already encoded and permanent and can be read any number of times. It cannot be modified.
 - **WORM (Write Once Read Many)** – We can write data once, and read many times.
 - **Erasable (EO – Erasable Optical)** – The disks can be erased and loaded with new data.

INTRODUCTION TO COMPUTER SOFTWARE:

Software is a set of instructions or statements that is carried out by the computer's CPU.

Computer software is also called programs. A program is a set of instructions given to the computer to perform a particular task.

Once a programmer has decided how to solve a problem, they need to write the solution in a valid programming language. The program is then translated into machine understandable format. Finally the processor executes the program.

Fetch-Decode-Execute Cycle:

- The CPU reads instruction from the memory. (Fetch)
- Then the CPU decodes the instruction to determine what action needs to take place.
- Finally the CPU carries out or executes the instruction.
- The cycle is now complete, and can start again for the next instruction.

Classification of Software:

Software is divided into two categories:

- **System software** – includes the operating system and all the utilities that enable the computer to function.
- **Application software** – includes programs that do real work for users. Ex: Word processors, spreadsheets, image processors, DBMS.

Operating system: An operation system is an interface between hardware and software. They are the most important programs that run on a computer. Ex: DOS, Windows, UNIX

Utilities: Utility is a program that performs a very specific task, usually related to managing system resources. Operating systems contain a number of utilities for managing disk drives, printers, and other devices.

Compiler and interpreter: Compiler is a program that translates source code into object code. The compiler takes the entire program for the translation.

Interpreter is also used to translate source code into object code. But it takes a single line of instructions and translates it. After the execution of that statement, the next instruction will be translated.

Word Processors: A word processor is a program that enables the user to perform word processing functions. Word processors use a computer to create, edit, and print documents. Ex: MS-Word

Spreadsheets: A spreadsheet is a table of values arranged in rows and columns. In a spreadsheet application, each value is placed in a cell. The relationships between cells are called **formulas**. This software makes it possible to enter data into a table format, manipulate them, store them, print them and create reports and graphs using them. Ex: MS-Excel.

Presentation software: To make a presentation to clients, colleagues, superiors, or your subordinates, the presentation software is used. Ex: MS-PowerPoint.

Image processors: Image processors or graphics programs enable the user to create, edit, manipulate, add special effects, view, print and save images. Ex: MS-Paint, Photoshop

DBMS – Database Management Systems: A DBMS is a collection of programs that enable the user to store, modify, and extract information from a database.

PROGRAMMING LANGUAGES:

The computer understands only the machine language. To communicate with the computer, we should develop a language that can be understood by both the computer and the human.

Types:

❖ **Machine languages:** Machine language is the lowest level of programming language. The programs were written in machine language which contains only 0s and 1s.

- **Advantage:** Execution is very fast and efficient.
- **Disadvantages:**
 - The languages are machine dependent.
 - It is difficult to understand and debug the programs.
 - Program entry is a boring and time-consuming process.

❖ **Assembly languages:** Assembly languages use abbreviations or mnemonic code to write the programs. Ex: ADD for addition, SUB for subtraction.

Assembly language programs translated into machine language program by using assemblers. Here the assembly language program is called source program and the machine language is called object program.

- **Advantages:**
 - Easier to use.
 - They operate very efficiently.
 - Easy to debug. (ie) it is easy to locate and identify the syntax errors.
- **Disadvantages:**
 - Programs are very long.
 - Programs are complex.

- Machine dependent.

❖ **High level languages:**

- A high-level language is used to write programs that are more or less independent of a particular type of computer.
- Such languages are considered high-level because they are closer to human languages.
- Ex: C, C++, Java
- **Advantages:**
 - High level languages are programmer friendly. They are easier to read, write and maintain.
 - Provides higher level of abstraction from machine language.
 - Easy to learn.
 - Easy to find and debug errors (mistakes).
 - Better programming productivity
- **Disadvantages:**
 - It takes additional translation times to translate the source to machine code.
 - Slower than low level programs.
 - Cannot communicate directly with the hardware.
 - Less memory efficient.

Compilers and Interpreters: (Language translators)

The high-level language must be translated into machine language. There are two kinds of translators – compilers and interpreters.

Compiler is a software that translates the given source code into machine language. (It takes the whole program for the translation)

An interpreter is a program that converts each program statement into machine code just before the statement is to be executed.

OPERATING SYSTEMS:

An operating system is an interface between the computer hardware and software.

It manages and coordinates the functions performed by the computer hardware, including the CPU, input/output devices, secondary storage devices, and communication and network components.

Operating systems are the most important program that runs on a computer.

The operating system software must keep track of each hardware resource determine who gets what, determine when the user will have access to the resource, allocate how much of the resource the user will be given, and terminate access at the end of the use period.

Functions of Operating Systems:

- **Job Management:** Job management manages the jobs waiting to be processed. It recognizes the jobs, identifies their priorities, determines whether the appropriate main memory and secondary storage capability they require is available, and schedules and finally runs each job at the appropriate moment.
- **Batch processing:** Data are accumulated and processed in groups. Ex: Payroll preparations.
- **On-line Processing:** In online processing data are processed instantaneously.
- **Virtual Storage:** Operating systems also manages the allocation of main memory to specific tasks. Virtual storage increases the capacity of main memory without actually increasing its size.
- **Input/Output Management:** Operating systems also manage the input to and output from a computer system.

Classification of Operating Systems:

- **Single user and multi-user OS:** Single user OS allow only one user to run programs at a time. Multi-user operating systems allow two or more users to run programs at the same time.
- **Multiprocessing:** Multiprocessing refers to a computer system's ability to support more than one process at the same time. It enables several programs to run concurrently.
- **Multitasking:** Multitasking OS allows more than one program to run concurrently. Multitasking is the ability to execute more than one task at the same time, a task being a program. There are two basic types: i. Preemptive – CPU time slice is allotted for each program. ii. Cooperative – Each program can control the CPU for as long as it needs it.
- **Multithreading:** Multithreading allows different parts (called threads) of a single program to run concurrently.
- **Real-time OS:** Real-time operating systems are systems that respond to input immediately.

GUI – Graphical User Interface – allows user to enter commands by pointing and clicking at objects that appears on the screen.

Microsoft Windows is an OS which uses a graphical user interface.

INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS:

Information is the backbone of any organization. Information is processed or refined data. Data means raw fact.

The quality of information:

- **Accuracy** – Accuracy means information is free from mistakes and errors.

- **Timeliness** – Timeliness means that getting the information to the user within the needed time frame.
- **Relevancy** – Relevancy means the use of a piece of information for a particular person. Information relevant for one person may not be relevant for another.

What is database?

Database is a collection of data about an entity. It consists of data, relationships, constraints and a schema.

A schema separates the physical aspects of data storage from the logical aspects of data representation. There are three levels of schema.

- The internal schema defines how and where data are organized in physical data storage.
- The conceptual schema defines the stored data structure in term of the database model used.
- The external schema defines a view or views of the database for particular users.

Advantages of database:

- Redundancy can be reduced.
- Inconsistency can be avoided. Duplicates data creates inconsistency. If duplication is eliminated, the inconsistency can be avoided.
- Data can be shared.
- Standards can be enforced.
- Security restrictions can be applied.
- Integrity can be maintained. Integrity means that the data in the database is accurate.
- Conflicting requirements can be balanced.

Characteristics of data in a database:

- **Shared** – Data in a database are shared among different users and applications.
- **Persistence** – Data in a database exist permanently in the sense, the data can live beyond the scope of the process that created it.
- **Validity / Integrity / Correctness** – Data should be correct with respect to the real world entity that they represent.
- **Security** – Data should be protected from unauthorized access.
- **Consistency** – Whenever more than one data element in a database represents related real-world values, the values should be consistent with respect to the relationship.
- **Non-redundancy** – No two data items in a database should represent the same real-world entity.
- **Independence** – The three levels of schema should be independent of each other so that the changes in the schema at one level should not affect the other levels.

Functions of DBMS:

- Transaction management
- Concurrency control
- Recovery management
- Security management
- Storage management
- Data catalog management

Database Users:

- **Database Administrator (DBA)** – A database administrator is a person having central control over data and programs accessing that data.

- **Database Designers** – Database designers are responsible for identifying the data to be stored in the database and choosing the appropriate structures to represent and store this data.
- **End-users** - The end-users of a database can be application programmers, application programs, managers, data entry operators, etc.
- **System Administrator** – System administrator is the person responsible for the entire computer system of the organization.

UNIT - IV

COMPUTER NETWORKS:

A computer network is a group of two or more computer systems linked together.

Generally a communications network is any arrangement where a sender transmits a message to a receiver over a channel consisting of some type of medium.

Components:

- **Terminals** – Any input/output device that used a network to transmit or receive data is a terminal.
- **Telecommunication Processors** – The devices are used to support data transmission and reception between terminals and computers. These devices such as modems, multiplexers, and frond-end processors.
- **Telecommunication channels and media** – The media over which data are transmitted and received are called telecommunication channels.
- **Computer** – Computer of all sizes and types are used for information processing.

- **Telecommunication software** – Telecommunication software controls telecommunication activities of the computer systems and manage the functions of networks.

Communication Processors:

- **Modems** – Modem is used to convert the digital signals into analog signals and vice-versa.
- **Multiplexers** – A multiplexor collects messages from various senders, puts them in order and transmits them along a broadband channel at very high speeds to the receiver.
- **Message switchers** – A message switcher is a processor that receives data messages from terminals, determines their destination, and routes them one at a time to the CPU.

Communication Media:

Channels are used to transmit data between the sender and the receiver. A channel makes use of a variety of media, includes: twisted-pair wire, coaxial cables and fiber optic cables, radio, microwave systems and communication satellites.

- **Twisted-pair Wire:** It consists of copper wires twisted into pairs. It is used for both voice and data transmission.
- **Coaxial cable:** A coaxial cable consists of a stiff copper wire as the core, surrounded by an insulating material. Ex: used in cable TV network
- **Fiber optics:** Fiber optics use glass fiber wrapped in a protective jacket. They can conduct light pulses generated by lasers at transmission rates as high as two billion bits per second.
- **Microwave systems:** Microwave systems transmit high-speed radio signals that travel in straight lines through the air.

Types of Networks:

There are many different types of networks.

- ✓ **Local Area Networks (LANs)** – The LANs are privately-owned networks within a single building or campus.
- ✓ **Metropolitan Area Networks (MANs)** – MAN covers a city. Ex: Cable TV network.
- ✓ **Wide Area Networks (WANs)** – WAN spans a large geographical area, often a country or continent.
- ✓ **Characteristics for the classification of types of networks:**
 - **Topology** – The geometric arrangement of a computer system.
 - **Protocol** – The protocol defines a common set of rules and signals that computers on the network use to communicate.
 - **Architecture** – Networks can be broadly classified as using either peer-to-peer or client/server architecture.

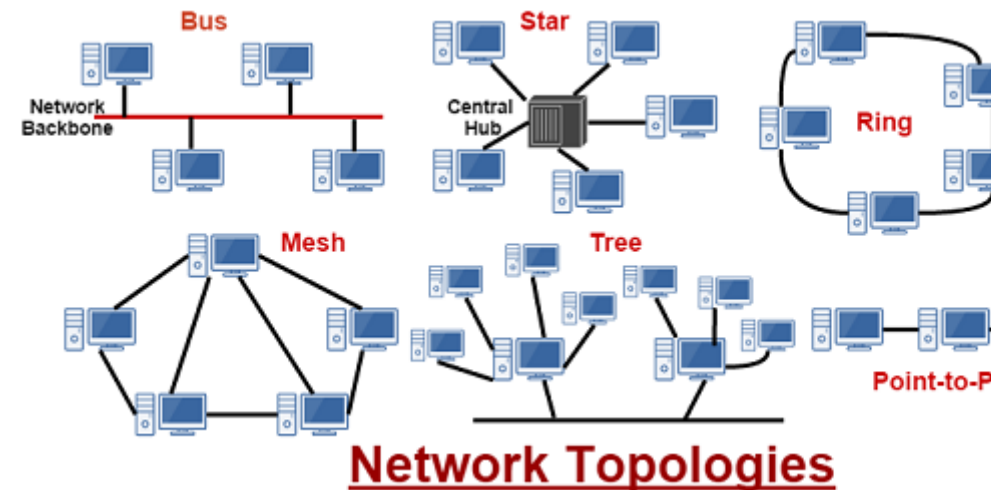
Network Topology:

The topology is concerned with the physical arrangement of the network components.

- ❖ **Star topology:** A star topology is designed with each node connected directly to a central network hub.
 - Data passes through the hub before continuing to the destination.
 - The hub manages and controls all functions of the network.
 - **Advantages:**
 - Easy to install and wire.
 - No disruptions to the network when connecting or removing devices.
 - Easy to detect faults and to remove parts.

○ Disadvantages:

- Requires more cable length than a linear topology.
- If the hub fails, nodes attached are disabled.
- More expensive than linear bus topologies because of the concentrators.



- ❖ **Ring Topology:** In a ring topology, all of the nodes are connected in a closed loop. (It forms a circle).
 - Messages travel around the ring, with each node reading those messages addressed to it.
 - **Advantages:**
 - Growth of system has minimal impact on performance.
 - All stations have equal access.
 - **Disadvantages:**
 - Most expensive topology.

- Failure of one computer may impact others.
- Complex.

❖ **Linear Bus Topology:** A linear bus topology consists of a main run of a cable with a terminator at each end. All nodes are connected to the linear cable.

○ **Advantages:**

- Easy to connect a computer or peripheral to a linear bus.
- Requires less cable length than a star topology.

○ **Disadvantages:**

- Entire network shuts down if there is a break in the main cable.
- Terminators are required at both ends of the backbone cable.
- Difficult to identify the problem if the entire network shuts down.
- Not meant to be used as a stand-alone solution in a large building.

❖ **Tree Topology:** A tree topology combines characteristics of linear bus and star topologies.

○ **Advantages:**

- Point-to-point wiring for individual segments.
- Supported by several hardware and software vendors.

○ **Disadvantages:**

- Overall length of each segment is limited by the type of cabling used.
- If the backbone line breaks, the entire segment goes down.

- More difficult to configure and wire than other topologies.

Protocols:

- ❖ TCP/IP – Transmission Control Protocol / Internet Protocol
- ❖ WAP – Wireless Application Protocol
- ❖ APPC – Advanced Program-to-Program Communications
- ❖ NetBIOS – Network Basic Input/Output System
- ❖ SPX/IPX – Sequenced Packet Exchange / Internetwork Packet Exchange

Network architecture:

- ✓ **Peer-to-peer architecture:** Each workstation has equivalent capabilities and responsibilities.
- ✓ **Client/Server architecture:** Servers are powerful computers manage and provide resources, and the clients are less powerful computers that request information from the server.

E-MAIL (Electronic Mail):

Electronic mail is an electronic message sent from one computer to another.

It is much more convenient and economical to send a message or document by e-mail than by the conventional main.

E-mail is also delivered much faster than the conventional mail.

How e-mail works?

1. Type the message.
2. Key-in the recipient's email address and press the send button of the email program.
3. The email message arrives at the service provider's server.
4. If it recognizes the email address as valid, the main will be sent.

5. The mail is sent via the Internet.
6. It will be received by the recipient's provider and is sent to the provider's mail server where it will be delivered to the recipient's mail box.
7. It will remain there until the recipient next connects to the Internet.
8. Finally, the recipient's modem and computer decode the data, and he or she can read email message.

E-mail Names & Addresses:

An e-mail message can be sent to one or more e-mail addresses. An e-mail address identifies a person and the computer for purposes of exchanging electronic mail messages. The basic structure of an e-mail address is:

[username@host.subdomain.second-level-domain.first-level-domain](#)

Ex:

coetnpsc.tn@nic.in

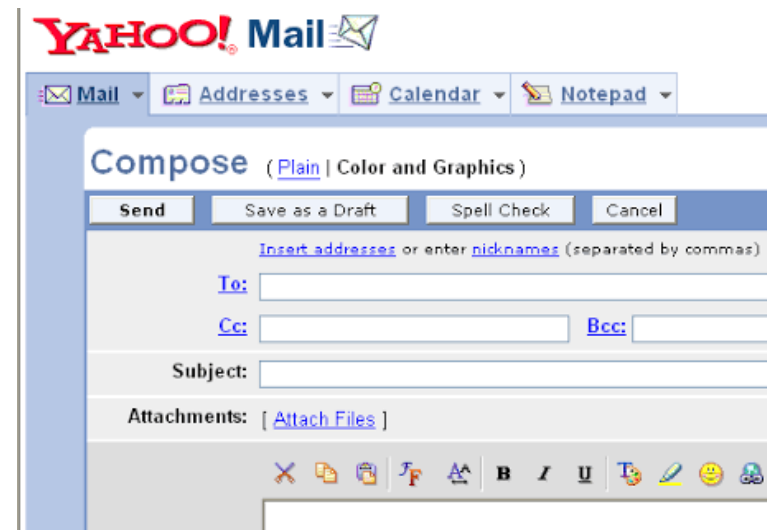
vc@bdu.ac.in

Mailing Basics:

To compose an email message, click on the 'Compose new message' button the toolbar.

The parts of the mail box are:

- **To** – Enter the email address of the person to whom the message is sent.
- **Cc** – Enter the email address of the person to whom the copy of the message is sent.
- **Subject** – Enter a brief description as to what the message is about.
- **Body** – Actual message is entered here.



Address Book: An address book is a place to store information about the people.

File Attachments: Any type of file can be attached with a mail.

Replying and forwarding messages:

Reply sends the receiver's response to the sender.

Forward sends the message to another person or group and will include any attachments included in the original message.

Spam: Email spam or junk mail, is unsolicited (uninvited) bulk messages sent through email with commercial, fraudulent or malicious (unkind) intent.

Advantages:

- Emails are delivered extremely fast.
- Emails can be sent 24 hours a day, 365d days a year.
- Cheap – When using broadband, each email sent is effectively free.

- Emails can be sent to one person or several persons.

Disadvantages:

- The recipient needs access to the Internet to receive the email.
- Viruses are easily spread via email attachments.
- Phishing – Sending an email to a user falsely claiming to be a legitimate company to scam the user into providing information, such as personal and bank account numbers on a bogus (fake or false) website.
- No guarantee the mail will be read until the user logs on and checks their email.
- Spam – Unsolicited email.

INTERNET AND WORLD WIDE WEB:

Internet is the world's largest computer network, the network of networks, scattered all over the world.

Internet is a group of two or more networks that are:

- Interconnected physically.
- Capable of communicating and sharing data with each other.
- Able to act together as a single network.

Internet is the cheapest and fastest means to

- **Get information:** We can get information about people, products, organizations, research data, electronic versions of printed media, etc. from the Internet.
- **Provide information** to the users.

Internet Access:

- ✓ Dial-up connection
- ✓ Direct connection

Internet Basics: Activities can do with the browser

- ✓ Visit websites
- ✓ Send and receive e-mail

- ✓ Download files
- ✓ Chat with other users
- ✓ Play games
- ✓ Do on-line shopping and so on.

Internet Protocols:

- ✓ **Transmission Control Protocol / Internet Protocol (TCP/IP)** is a collection of rules that govern the way data travels from one machine to another across networks.
- ✓ **File Transfer Protocol (FTP)** enables files to be transferred between computers.
 - **Shareware** – Free for a limited period.
 - **Freeware** – Completely free software.
- ✓ **Hypertext Transfer Protocol (HTTP)** governs the transfer of hypertext between two or more computers.
- ✓ **Telnet** enables one computer to connect to another computer. This process is also referred to as remote login.
- ✓ **Gopher** is designed to search, retrieve, and display documents from remote sites on the Internet.
- ✓ **WAIS – Wide Area Information Service** is an Internet search tool.

Internet Addressing:

- ✓ **IP Address:** An IP address is an identifier for a particular machine on a particular network.
 - An IP address consists of four sections separated by periods. Each section contains a number ranging from 0 to 255.
 - Ex: 202.54.1.6
 - IP addresses are unique, global and standardized.
- ✓ **Domain Names:** A domain name is a way to identify and locate computers connected to the Internet.

- It must be unique.
- A domain name contains two or more components separated by periods, called “dots”.
- Ex: www.bdu.ac.in
- Some top level domain names are:
 - edu – educational institutions
 - org – organizations
 - com – commercial entities
 - Country codes: a two-letter abbreviation for a particular country:
 - in – India
 - uk – United Kingdom
 - fr – France

E-Mail Addresses: An e-mail address identifies a person and the computer for purposes of exchanging e-mail messages.

Ex: ercpkt@gmail.com

Uniform Resource Locators (URL): A URL identifies a particular Internet resource; for example a Web page, an image, or a text file.

Ex: <http://www.bdu.ac.in/>

World Wide Web: The WWW is a series of interlinked documents spread out over millions of machines all over the Internet.

Web Pages and HTML: A web page is a single unit of information, often called a document that is available via the WWW. HTML – Hypertext Markup Language is used to design a web page.

Web Browsers: A browser is used to view the web pages.

Search Engines: A web search engine is an interactive tool to help people locate information available via the WWW.

Ex: Google, Ask.com, AltaVista, Yahoo! Search

Internet Chat: Chat is used to communicate one person with people from all over the world, in real time.

WEB DESIGN:

The web has grown very fast. Web page design requires conceptualizing, planning, modeling, and executing, electronic media content and its delivery via the Internet.

The intent of web design is to create a website that presents content to the end users in the form of web pages upon request.

Such elements are text, forms, and images.

Web pages are classified as static or dynamic. Static pages do not change content and layout with every request unless a human manually updates the page.

Dynamic pages adapt their content and/or appearance depending on the end-user’s input or interaction or changes in the computing environment.

Contents can be changed on the client side by using scripting languages JavaScript, Jscript. The server side scripting languages are: Perl, ASP and JSP.

The basic aspects of design are:

- ▲ **Content** - The information on the site should be relevant to the d\site
- ▲ **Usability** – The site should be user-friendly
- ▲ **Appearance** – The graphics and text should include a single style.
- ▲ **Visibility** – The site must also be easy to find via most major search engines and advertisement media.

Creating Web Site:

- ▲ There are many ISPs (Internet Service Providers) offer the website creation free of cost.
- ▲ To create a web page we should have knowledge of HTML, Java, CGI, PHP, Perl.
- ▲ Need a server and Internet connection.

- ▲ After getting the server and Internet connection, we need an address (or URL), so that others can connect to our site.
- ▲ Select domain name.
- ▲ If we have the Internet connection, the web server and the domain name, the next step is designing our web site.
- ▲ The site will have pages, images and other programs.
- ▲ Using HTML and other programming languages design a website.

Web Hosting:

- ▲ The easiest way is to get the services of an Internet Service Provider (ISP).
- ▲ An ISP is a company that provides access to the Internet.
- ▲ Their customers can be businesses, individuals or organizations.
- ▲ We will rent a specified amount of disk space on the ISP server as well as shared or dedicated bandwidth on Internet connection.
- ▲ The ISP will configure their machine so that their computer will respond to our domain name.

Website Promotion:

- ▲ After the website creation and hosting, concentrate on the following major areas.
 - Announcing the website with Internet search engines and directories.
 - Issuing a press release.
 - Announcing in newsgroups.
 - Participating in e-mail lists.
 - Obtaining ad banners on other websites.
 - Issuing an e-newsletter.

- Using letterheads, brochures, annual reports visiting cards, etc.

UNIT - V

Computers at Home, Education, Entertainment, Science, Medicine and Engineering:

- ▲ **Computers at home:** Millions of people use home computers for education and information.
 - Some of the applications that are used in homes are word processors, spreadsheets, database programs, personal information management systems, accounting and income tax programs, etc.
- ▲ Edutainment (Education and entertainment) programs specifically geared toward home markets combine education with entertainment so that they can compete with television and electronic games.
- ▲ Encyclopedias, dictionaries, atlases, telephone directories, medical references, are come in low-cost CD-ROM often with multimedia capability.
- ▲ More up-to-the-minute information is available from the Internet.
- ▲ Internet connections also provide e-mail, discussion groups for home users.
- ▲ Home computers are mainly used for playing games.

Computers at education:

- **Mathematics:** To survive in the high-tech, world students need to be able to see the mathematical systems in the world around them and apply mathematical concepts to solve problems.
- **Culture:** Culture provides a human framework to view the impact of technology.
- **Communication:** Communication is a survival skill.
- **Computers in schools:** Many of the elementary and secondary schools are now introducing computers. Students and teachers are using these computers in a variety of ways to learn.
- **Computer-Aided Instruction (CAI):** Computers allow students to learn based on the drill-and-practice principle. The computer based training software allows students to learn at their own pace, , in small steps and give feedback about how much they have learned.
- **Simulation and games:** With a simulation, the students are in control of the learning environment. Simulations allow students to have experiences that would not be possible otherwise.
- **Distance Learning – Virtual Schools:** Distance learning uses technology to extend the educational process beyond the walls of the school.

Computers in Entertainment, Science, Medicine and Engineering:

- **Computers in Entertainment:** Computers have now become an integral part of the entertainment industry.
 - ✓ **Computers in Movies:** The filmmakers can integrate these backgrounds and characters with the real characters seamlessly.
 - ✓ **Computers in Music:** Any musical composition that we hear goes through a technological process at some point.

- ✓ **Computers in Advertising:** Advertising has been one of the key factors of growth and success in business. Smart businessmen always know how important marketing was.
- ✓ **Computers in Art:** A computer and an artist have a unique relationship, though the nature of the relationship has not yet been fully realized.
- **Computers in Medicine:**
 - ✓ Computers are revolutionizing the medical field.
 - ✓ Computers are used in the medical field for performing a wide variety of tasks.
 - ✓ In medicine, computers are used for everything from diagnosing illnesses and monitoring patients to controlling movements of robotic surgical assistants.
 - ✓ Computers are also used in automating the hospital management systems, so that the information about the patient history, the treatment details, is available to the doctors.
- **Computers in Science:**
 - ✓ Scientists use computers to develop theories, collect and test data, and to exchange information electronically with colleagues around the world.
 - ✓ Researchers can access databases in distant locations all without going any farther than the closest computer.
 - ✓ Computers are used in every field of scientific research, to store, analyze and manipulate information.
- **Computers in Engineering:**
 - ✓ **Electronic Data Interchange (EDI):** EDI is the computer-to-computer exchange of business documents in a standard format.

- ✓ **Computer Aided Design / Computer Aided Manufacturing (CAD / CAM):** CAD systems are computer programs or integrated packages for workstation hardware and software that allow the user to draw and easily modify product designs on a computer screen.
- ✓ **Product Data Management:** In PDM systems the master data is held only once, where its integrity can be assured and all changes to it monitored, controlled and recorded.

INTRODUCTION TO COMPUTER SECURITY:

Computer crime is any crime accomplished through the knowledge or use of computer technology. The computer crimes are increasing by the day.

There are many types of computer crimes ranging from pirating software, stealing information to sabotaging systems.

The main types of computer crimes are:

- **Software piracy** – Piracy or the illegal duplication of copyrighted software is the most common computer crime.
- **Software/hardware sabotage** – Computer saboteurs use software to destruct the computer. They use viruses, worms, logic bombs and Trojan horses to destroy the computer hardware and software.
- **Hacking and electronic trespassing** – The hackers enter corporate and government computers using stolen passwords and security loopholes and steal information, transfer money to their accounts, and do a lot of other criminal activities.

Computer security refers to protecting computer systems and the information they contain against unwanted access, damage, modification or destruction.

Computer owners and administrators use a variety of security techniques to protect their systems. They are as follows:

- **Physical access restrictions** – One way to reduce the risk of security breaches is to make sure that only authorized personnel have access to computer equipment.
- **Passwords** – Passwords are the most common tool for restricting access to computer systems.
- **Firewalls** – Many organizations use firewalls to keep their internal networks secure while allowing communication with the rest of the Internet.
- **Codes** – To protect transmitted information, many organizations use encryption software to scramble their transmissions. When a user encrypts a message by a secret numerical code, called an encryption key, the message can be transmitted as unreadable format. The message can be read only after it has been reconstructed with a matching key.
- **Security audits** – Audit control software is used to monitor and record computer transactions as they happen, so auditors can trace and identify suspicious computer activity.
- **Backups** – For maximum security, many computer user keep copies of sensitive data in several different locations.
Unauthorized users gain access to computer systems by stealing or cracking passwords.
- **Malicious Computer Programs:** Some types of computer programs find their way into our computer, and carry out their instructions without our knowledge.

COMPUTER VIRUSES, BOMBS, AND WORMS:

A **computer virus** is a computer program that can copy itself and infect a computer without the permission or knowledge of the user.

Types:

- A **worm** can spread itself to other computers without needing to be transferred as part of a host.
- A **Trojan horse** is a program that appears harmless but has a hidden agenda.
- A **bomb** is a piece of code embedded in a program or the operating system itself that waits for a particular event to occur. When the event occurs, the logic bomb “goes off” doing some kind of damage.

There are three major categories of viruses – boot sector, program, and macro – named after the types of hosts they affect.

- **Boot Sector Viruses** – A boot sector virus is a computer virus which infects the boot sector on hard disks, floppy disks.
- **Program Viruses:** A program virus contaminates files that contain computer code, especially ‘.exe’ and ‘.com’ files, but also files such as ‘.sys’, ‘.dll’ and ‘.ovl’.
- **Macro Viruses:** A macro virus is a computer virus written in the same macro language used for software programs, including Microsoft Excel or word processors such as MS-Word. When a macro virus infects a software application, it causes a sequence of actions to begin.

The most popular technique to detect viruses is by scanning. Some of the most popular anti-virus vaccines are McAfee Internet Security from McAfee, Inc, Norton Internet Security from Symantec Corporation, Internet Security from Trend Micro, etc.
