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INFORMATION TECHNOLOGY FOR HEALTHCARE MANAGEMENT

MASTER OF BUSINESS ADMINISTRATION
(HOSPITAL ADMINISTRATION)

FIRST YEAR, SEMESTER-I, PAPER-I

DIRECTOR, I/c.

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MBA (HA): INFORMATION TECHNOLOGY FOR HEALTHCARE MANAGEMENT

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FOREWORD

Since its establishment in 1976, Acharya Nagarjuna University has been forging ahead in the path of progress and dynamism, offering a variety of courses and research contributions. I am extremely happy that by gaining 'A+' grade from the NAAC in the year 2024, Acharya Nagarjuna University is offering educational opportunities at the UG, PG levels apart from research degrees to students from over 221 affiliated colleges spread over the two districts of Guntur and Prakasam.

The University has also started the Centre for Distance Education in 2003-04 with the aim of taking higher education to the door step of all the sectors of the society. The centre will be a great help to those who cannot join in colleges, those who cannot afford the exorbitant fees as regular students, and even to housewives desirous of pursuing higher studies. Acharya Nagarjuna University has started offering B.Sc., B.A., B.B.A., and B.Com courses at the Degree level and M.A., M.Com., M.Sc., M.B.A., and L.L.M., courses at the PG level from the academic year 2003-2004 onwards.

To facilitate easier understanding by students studying through the distance mode, these self-instruction materials have been prepared by eminent and experienced teachers. The lessons have been drafted with great care and expertise in the stipulated time by these teachers. Constructive ideas and scholarly suggestions are welcome from students and teachers involved respectively. Such ideas will be incorporated for the greater efficacy of this distance mode of education. For clarification of doubts and feedback, weekly classes and contact classes will be arranged at the UG and PG levels respectively.

It is my aim that students getting higher education through the Centre for Distance Education should improve their qualification, have better employment opportunities and in turn be part of country's progress. It is my fond desire that in the years to come, the Centre for Distance Education will go from strength to strength in the form of new courses and by catering to larger number of people. My congratulations to all the Directors, Academic Coordinators, Editors and Lesson-writers of the Centre who have helped in these endeavors.

Prof. K. Gangadhara Rao
M.Tech., Ph.D.,
Vice-Chancellor I/c
Acharya Nagarjuna University.

MASTER OF BUSINESS ADMINISTRATION
(HOSPITAL ADMINISTRATION)
Programme Code: 197
PROGRAMME SYLLABUS
1st YEAR – 1st SEMESTER SYLLABUS

104HA26: INFORMATION TECHNOLOGY FOR HEALTH CARE MANAGEMENT

Unit - I Introduction: Evolution of Computers- Generations; types of Computers- Hardware and software – Types of software –Storage Devices data representation for Computers

Unit - II Computer Networks Types of Networks- LAN, WAN, MAN- Network Topologies introduction to Internet, Intranet, Extranet, MIS.

Unit - III MS Word & Excel

MS-Word: Creation of Document – Format Document – Text Editing and Saving – Organising information with tables and outlines – Mail merge – Index- Printing

MS Excel: Creating and Editing Worksheets – Cell Formatting – Creating and using formulas and functions – Use of Macros – Sorting and Querying data – Working with Graphs and Charts.

Unit - IV Power Point: Features of power Point- Creation of slides – Use of templates and slide designs – Slide master- Animation Timings Action buttons

Unit - V Data Analysis with Statistical Tools:

MS Access: Create Databases, Tables, Relationships – Create forms to enter data – filter data – use of queries in data manipulation – Generating Reports.

Overview of SPSS: Uses, Data Analysis, Concepts of Main Menu and other features of SPSS Package.

Reference Books

1. Introduction to Computers and Communications, Peter Norton-Sixth Edition-Tata McGraw Hill, 2009.
2. V.Rajaraman – Introduction to Information Technology, Prentice Hall India, 2008.
3. Carver: Doing Data Analysis with SPSS 16.0, 3/e, Cengage, 2009.
4. George: SPSS for Windows Step by Step, 6/e, Pearson Education, 2009.
5. Cox et all – 2007 Microsoft Office System Step – by – Step, First Edition, PHI, 2007.
6. Winston-Microsoft Office Excel 2007 Data Analysis and Business Modeling, First Edition, Prentice Hall India, 2007.
7. Anita Goel, "Computer Fundamentals", Pearson.
8. Sanjay Saxena & P Chopra, Computer Applications in Management, Vikas.

CONTENTS

LESSON-1

HISTORY OF COMPUTERS

LEARNING OBJECTIVES

- Understand the historical development of computers from early calculating devices to modern systems.
- Identify the key generations of computers and their technological advancements.
- Differentiate between vacuum tubes, transistors, integrated circuits, and microprocessors.
- Explain how storage, processing speed, and size improved over time.
- Recognize the impact of computers on society, education, healthcare, business, and communication.
- Appreciate the role of innovation in shaping modern computing technologies.

Structure

1.0 INTRODUCTION

Necessity is the mother of invention. The saying holds true for computers too. Although computers seem like a modern invention, computing dates back to the early 1800s. Computers were invented because of human's search for accurate and fast calculating devices. Basic Pascal invented the first mechanical adding machine in 1642. Later, in 1671, Keyboard machines originated States around 1880, and we use them even today. Around the same period, Herman Hollerith came up with the concept of punched cards that were extensively used as an input medium in computers even in the late 1970s.

A nineteenth-century Professor at Cambridge University, **Charles Babbage**, is considered the father of modern digital computers. Today computers are different from earlier days based on appearance and performance. However, present-day computers have undergone significant changes for the last seven decades.

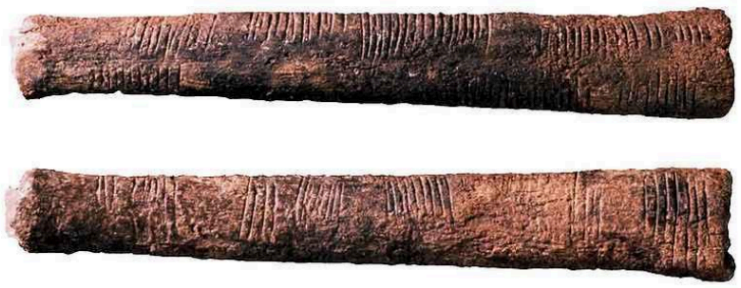
1.1 A Brief History of Computers

Primitive people used the first counting device. Earlier, people used their fingers, stones, bones, and pebbles as counting tools to do calculations. More computing devices were developed as the human mind and technology improved with time. The first use of the word "**Computer**" was documented in 1613, referring to an individual who carried out calculations or

computations, and the term persisted in being used in that sense until the middle of the 20th century.

Some of the popular computing devices, starting with the first to recent ones, are described below:

1. Tally Sticks



Tally Sticks.

A tally stick (or tally) was an ancient memory aid device to record quantities, numbers, or messages. Tally sticks first appear as animal bones carved with notches during the Upper Palaeolithic (also known as **Late Stone Age**). Tallies have been used for numerous purposes, from messaging and scheduling, especially in financial and legal transactions, to being a currency.

2. Abacus

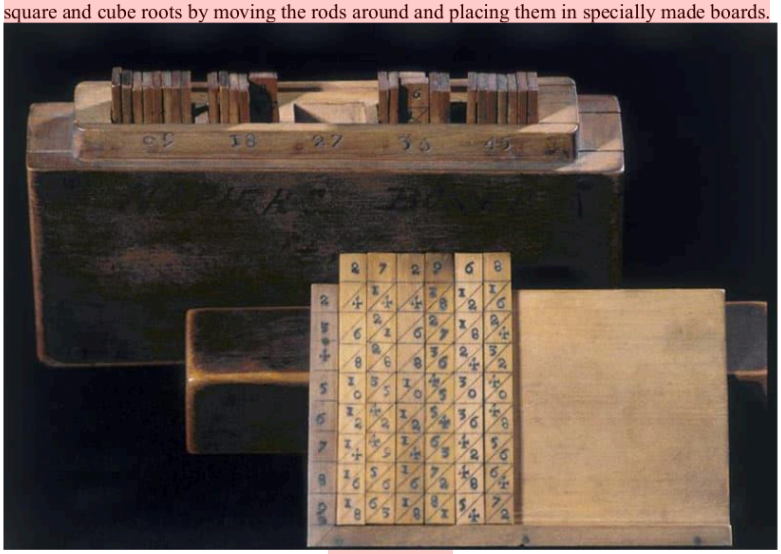
The **Abacus,** which appeared about 5,000 years ago in Asia Minor and is still in use today, is one of the first mechanical calculating devices that lets users do computations using a system of sliding beads arranged on a rack. Early traders used Abacus to keep trading transactions. An image of the Abacus is shown below.

Abacus.

1

3. Napier's Bone

Napier's Bone was invented in 1614 by a Scottish Mathematician, John Napier of Merchiston (1550-1617). He also played a crucial role in the development of Logarithms. Napier's Bone was a manually operated calculating device that let the operator multiply, divide, and calculate square and cube roots by moving the rods around and placing them in specially made boards.

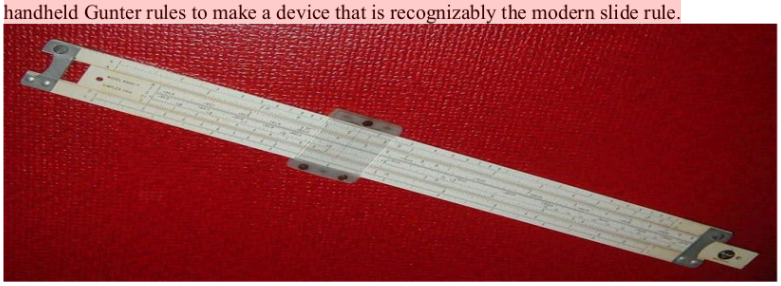


Napier's Bone.

He used 9 different ivory strips or bones marked with numbers to multiply and divide in this calculating tool. So, the device became known as Napier's Bones. It was also the first machine to use the decimal point.

4. The Slide Rule (1620-1230 AD)

The slide rule was invented around 1620–1630 AD, shortly after John Napier publicized the concept of the logarithm. In 1620 Edmund Gunter of Oxford developed a calculating device with a single logarithmic scale. In 1622, **William Oughtred** of Cambridge combined two handheld Gunter rules to make a device that is recognizably the modern slide rule.



The Slide Rule.

The slide rule is considered the first analog computing device that works on the logarithms principle. The slide rule was used until the mid-1970s, when the first handheld calculators and microcomputers appeared.

5. Pascaline (1623-1662 AD)

In 1642, **Blaise Pascal,** a French mathematician, invented the first mechanical machine, a rectangular brass box called **Pascaline** (also known as **Pascal's calculator** or **arithmetic machine**) which could perform the addition and subtraction on whole numbers. Pascal invented this device to help his father, a tax accountant.

Pascal's device was a wooden box with a series of gears and wheels with 10 teeth each. It represents the numbers 0 to 9. As each gear made one turn it. When a wheel is rotated one revolution, it rotates the adjoining wheel. A series of windows is given on the top of the wheels to read the totals. An image of Pascaline is shown below.

A Pascaline signed by Pascal in 1652

A computer programming language, **Pascal**, was later named to honor his contribution.

6. Stepped Reckoner or Leibnitz Wheel

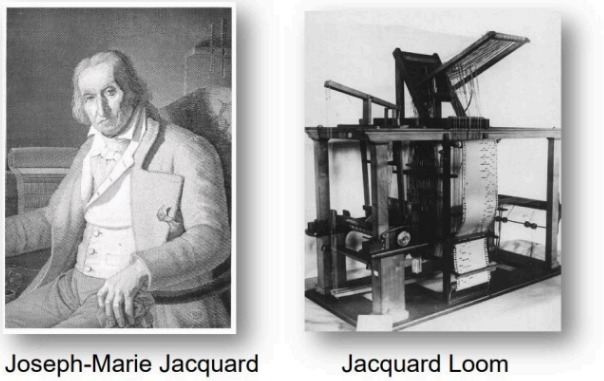
In 1694 AD, a German mathematician-philosopher, Gottfried Welham Von Leibniz, enhanced the Pascaline by creating a machine called **Stepped Reckoner** (also known as **Leibnitz calculator**) that could add, subtract, multiply and evaluate square roots by series of stepped additions. Leibniz was the first to support the use of a binary number system.

Replica of Leibniz's stepped reckoner in the Deutsches Museum.

Leibniz got the idea for a calculating machine in 1672 in Paris from a pedometer. Later he learned about Blaise Pascal's device when he read Pascal's *Pensees*. He focused on expanding Pascal's mechanism so it could multiply and divide.

7. Jacquard's Loom Machine

In 1804, Joseph Marie Jacquard, a French silk weaver, invented a device fitted to an automated loom that used punched cards as a pattern to weave complex designs and patterns. The resulting ensemble of the Jacquard machine and the loom is then called a **Jacquard Loom**.



Jacquard Loom Machine.

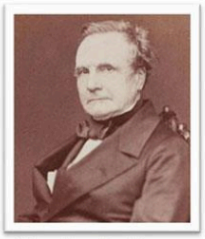
A chain of cards controlled the machine; several punched cards laced together into a continuous sequence. Numerous rows of holes were punched on each card, with one complete card corresponding to one design row. This use of replaceable punched cards to control a series of operations is considered an essential step in the history of computing hardware, having inspired Charles Babbage's Analytical Engine.

8. Difference Engine & Analytical Engine (Babbage's Engine)

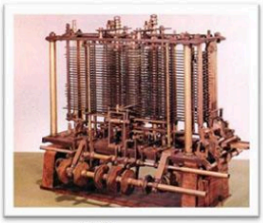
A British mathematician at Cambridge University, Charles Babbage, invented the first **Difference Engine or Analytical Engine.**

In 1822, Charles Babbage conceptualized and began inventing the **Difference Engine**, believed the first automatic computing machine could approximate polynomials. The Difference Engine was adept at computing several sets of numbers and making hard copies of the results. Babbage received some help with inventing the Difference Engine from Ada Lovelace, considered the first computer programmer for her work.

Unfortunately, Babbage could never finish a full-scale functional version of this machine because of funding. In June 1991, the London Science Museum completed the Difference Engine No 2 for the bicentennial year of Charles Babbage's birth and later finished the printing mechanism in 2000.



Charles Babbage



Difference Engine

Analytical Engine

Difference Engine & Analytical Engine.

In 1837, Charles Babbage proposed **Analytical Engine,** the first general mechanical computer. The Analytical Engine contained:

- An Arithmetic Logic Unit (ALU).
- Punch cards (inspired by the Jacquard Loom).
- Integrated memory.
- Basic flow control.

It is the first general-purpose computer concept that could be used for multiple things and not only one particular computation.

Unfortunately, this computer was also never built while Charles Babbage was alive because of budget issues. In 1910, Charles Babbage's youngest son, Henry Babbage, completed a portion of this machine and performed some basic calculations.

Charles Babbage is known as **'the father of the modern digital computer'** for his contributions.

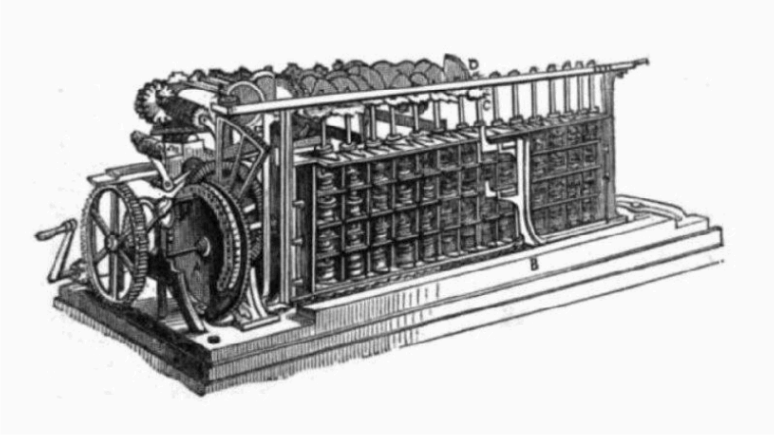
9. Lady Augusta Ada Lovelace (First Computer Programmer)

Lady Augusta Byron, Countess of Lovelace (1815 – 1852 AD), was an English mathematician mainly known for her work on Charles Babbage's proposed mechanical general-purpose computer, the Analytical Engine. She advised Charles Babbage to use a binary number system to feed programs and data into an analytical engine.

She was the first to acknowledge that the machine had applications beyond pure calculation and posted the first algorithm intended to be carried out by such a machine. As a result, she is often considered as the first computer programmer. A programming language named "**Ada**" is named after her.

10. Scheutzian Calculation Engine

Pehr (Per) Georg Scheutz (1785 – 1873 AD) was a Swedish lawyer, translator, and inventor, who is now best known for his excellent work in computer technology. He is most known for the **Scheutzian Calculation Engine**, invented in 1837 and finalized in 1843. This machine, which he made with his son Edvard Scheutz, was based on Charles Babbage's Difference engine.



Scheutzian Calculation Engine.

In 1851 they received funds from the government to build an improved model, built-in 1853 (roughly a piano's size) and subsequently demonstrated at the World's Fair in Paris, 1855. The device was used for creating logarithmic tables.

11. Tabulating Machine

In 1890, Herman Hollerith, an American statistician, invented the **Tabulating Machine**. It was a mechanical tabulator based on punch cards that could tabulate statistics and record or sort data or information. The machine was also used to tabulate the 1890 US census in a record time. Hollerith's machine was approximately ten times faster than manual tabulations and saved the census office millions of dollars.

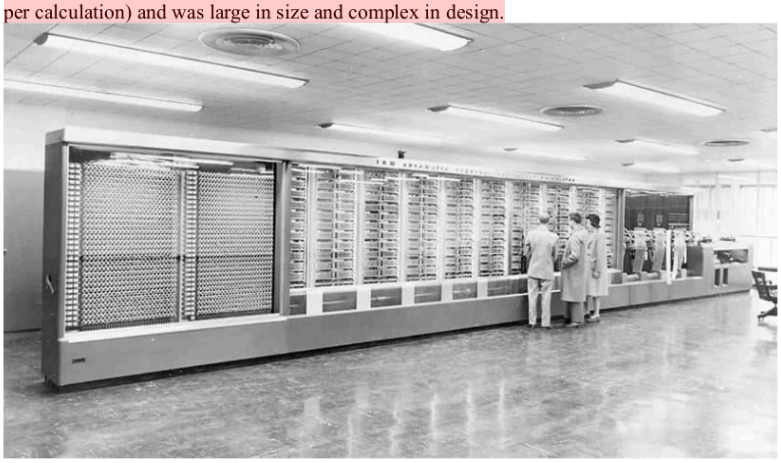
Herman Hollerith 1890 tabulating machine with sorting box.

Hollerith also started Hollerith's Tabulating Machine Company in 1896 AD, which later became **International Business Machine (IBM)** in 1924 AD.

12. Havard Mark 1

Harvard Mark I is also known as **IBM Automatic Sequence Controlled Calculator (ASCC)**. Howard Aiken of Harvard University designed the first fully automatic calculating machine in collaboration with IBM. It was the first programmable digital computer.

Harvard Mark I was an electronic relay computer as Electromagnetic signals were used for the movement of mechanical components. It could perform basic arithmetic and complex equations. Although this device was highly reliable, it was very slow (it took about 3-6 seconds per calculation) and was large in size and complex in design.

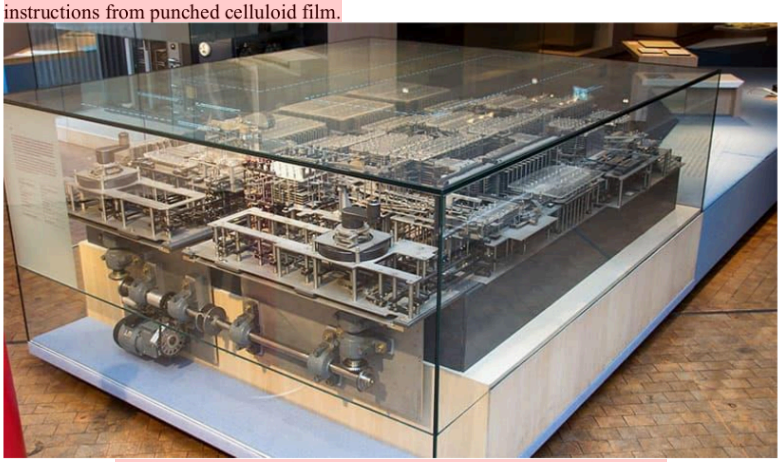


Harvard Mark I

On 29 March 1944, one of the first programs to run on the Mark I was initiated by John von Neumann. Mark I also computed and printed mathematical tables, which had been the initial dream of Charles Babbage for his "Analytical Engine" in 1837.

13. The Z1 – First Programmable Computer

Konrad Zuse invented the **Z1** in his parent's living room from 1936 to 1938. It is considered the first modern computer and the first electromechanical binary programmable computer. It was a binary electrically operated mechanical calculator with limited programmability, reading instructions from punched celluloid film.



Replica of the Z1 in the German Museum of Technology in Berlin.

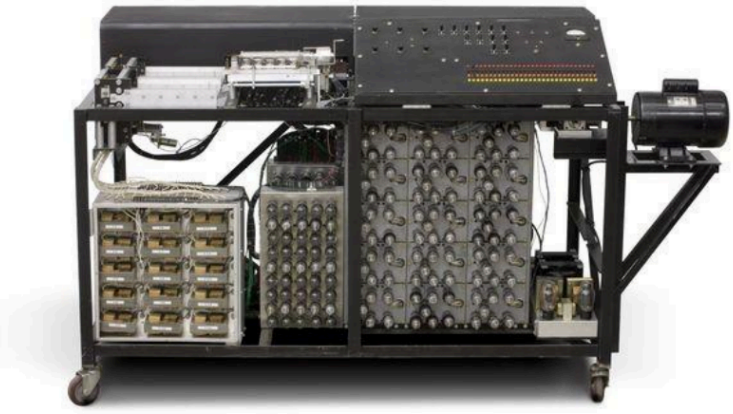
It was completed in 1938 and funded entirely from private funds. This computer was demolished in the bombardment of Berlin in December 1943, during World War II, together with all construction plans.

Konrad Zuse would also later invent the **Z3**, the first functioning programmable computer that could be fully automated.

14. Atanasoff-Berry Computer (ABC) – The First Digital Computer

Short for **Atanasoff-Berry Computer**, the **ABC** was the world's first general-purpose electronic digital computer that began development by Professor John Vincent Atanasoff and his student Cliff Berry in 1937. Its evolution continued until 1942 at the Iowa State College.

The ABC was an electrical computer that used more than 300 vacuum tubes for digital computation, including Boolean logic and binary math, and had no CPU (it was not programmable). It made use of vacuum tubes for internal logic and capacitors for storage.



Atanasoff-Berry Computer (ABC).

On October 19, 1973, US Federal Judge Earl R. Larson signed his judgment that the ENIAC patent by J. Presper Eckert and John Mauchly was invalid. In conclusion, Larson named Atanasoff, the sole inventor.

15. Osborne 1 – The First Portable Computer

The **Osborne 1** is the first portable computer, developed by Adam Osborne and designed by Lee Felsenstein, released on April 3, 1981 AD, by Osborne Computer Corporation. It weighs 11.1 kg, costs $1,795 and runs the CP/M 2.2 OS. It is powered from a wall socket, as it has no battery, but it is still tagged as a portable device since it can be hand-carried when the keyboard is closed.

Osborne 1 Portable Computer.

The computer shipped with a bundle of software that was equivalent in value to the machine itself. The Osborne 1 is about the size and weight of a sewing machine and was publicized as the only computer that would fit under an airline seat.

16. Electronic Controls Company – The First Computer Company

Founded in 1949 by J. Presper Eckert and John Mauchly, **Electronic Controls Company** was the first computer company. The company was founded by the same individuals who helped create the ENIAC computer. Later, the company was renamed Eckert-Mauchly Computer Corporation (EMCC) and released a series of mainframe computers under the UNIVAC name. In 1950, the company was sold to Remington Rand, which later joined with Sperry Corporation to become Sperry Rand and survives today as **Unisys**.

1.2 Generations of Computers

Computer generation is a classification of computers into different groups according to their manufacturing date, memory device, software and hardware technologies. There are five generations of computers. They are as follow:

1. **First Generation (1942-1955)**
2. **Second Generation (1955-1964)**
3. **Third Generation (1964-1975)**
4. **Fourth Generation (1975-1989)**
5. **Fifth Generation (1989-Present)**

Generation Features	First Generation	Second Generation	Third Generation	Fourth Generation	Fifth Generation
Time Period	1945 – 1956 AD	1956 – 1963 AD	1964 – 1971 AD	1971 – Present	Present – Future
Processing Device	Vacuum Tube based	Transistor based	Integrated Circuit based	Microprocessor based	Artificial Intelligence based
Memory	Magnetic Drum	Magnetic Tape	High Memory Devices	CD, DVD & Hard Drive	Artificial Intelligence

Language	Machine & Assembly	COBAL & FORTRAN	COBOL, FORTRAN & C	C++, PERL, PYTHON & SQL	MERCURY, LISP, OPS5 & PROLOG
Operating System	Batch Processing OS	Time Sharing OS	Real Time OS	Micro Kernal, Multiple Windows	KIPS
Example	ENIAC, EDVAC & UNIVAC	IBM 1401, IBM 1620 & CDC 3600	IBM 360 SERIES, IBM 370, UNIVAC 1108 & UNIVAC AC 9000	MAC Notebook, IBM-PC & Pentium I, II & III.	Robots

1. The First-Generation Computers (1945-1956 AD)

First-generation computers bore little resemblance to today's computers, either in appearance or performance. The first generation of computers occurred from 1940 AD to 1956 AD and was extremely large in size. The internal workings of the computers at that time were unsophisticated. These early machines required **vacuum tubes** that worked as switches, amplifiers, and **magnetic drums** for memory. The paper tapes and punch cards were used for input and printouts for output.

The vacuum tubes were primarily responsible for the large size of the devices and the enormous amounts of heat that they released despite large cooling units. First-generation computers also used a very basic programming language that is referred to as machine language.

Features of First Generation Computers

Following are some of the features of first generation computers −

- It was a large mainframe built with vacuum tube technology.
- It occupied large space, was low efficiency and unreliable due to low accuracy.
- The power consumption was very high, and it produced massive heat.
- The operation of speed was in milliseconds.
- It was used only for scientific or research purposes.
- Low-level programming language was used in computers.
- They were very slow.

Limitations of First Generation Computers

Following are some of the limitations of first generation computers −

- The computer needed an air conditioner room, and constant maintenance.
- They were not portable.
- It was expensive commercial product.
- They have minimum programming capabilities.
- The computers have limited uses only.

Examples of First Generation Computers

Some of the examples of the first generation computer are as follows:

1. **ENIAC** (Electronic Numerical Integrator and Calculator)
2. **EDVAC** (Electronic Discrete Variable Automatic)
3. **UNIVAC** (Universal Automatic Computers)
4. **IBM-701**
5. **IBM-650**

ENIAC (Electronic Numerical Integrator and Calculator) (1943-46 AD)

The Electronic Numerical Integrator And Calculator (ENIAC) was the first all-electronic computer. It was constructed at the Moore School of Engineering of the University of Pennsylvania, U.S.A., by a design team led by Professors J. Presper Eckert and John Mauchly.

The team developed ENIAC because of military needs. It was used for many years to solve ballistic-related problems. ENIAC took up wall space in a 20 x 40 square feet room and used 18,000 vacuum tubes. It could add two numbers in 200 microseconds and multiply them in 2000 microseconds.

EDVAC (Electronic Discrete Variable Automatic) (1946-52 AD)

A major disadvantage of ENIAC was that its programs were wired on boards which made it difficult to change the programs. Dr. John Von Neumann later introduced the —stored program concept that aided overcome this problem. The basic idea after this concept is that a sequence of instructions and data can be stored in a computer's memory to direct operations flow automatically. This feature largely influenced the development of modern digital computers because of how various programs can be loaded and executed on the same computer. Because of this feature, we usually refer to modern digital computers as stored-program digital computers.

The Electronic Discrete Variable Automatic Computer (EDVAC) used the stored' program concept in its design. Von Neumann also has a share of the credit for introducing the idea of storing both instructions and data in binary form (a system that uses only two digits – 0 and 1 to represent all characters), instead of decimal numbers or human-readable words.

UNIVAC (Universal Automatic Computers) (1951)

The Universal Automatic Computer (UNIVAC) was the first digital computer that was not —one of a kind. Many UNIVAC machines were manufactured, the first of which was installed the Census Bureau in 1951 and was used continually for 10 years.

In 1952, the International Business Machines (IBM) Corporation introduced the **IBM-701** commercial computer. In quick succession, improved models of the **UNIVAC I** and other IBM 700-series machines were introduced. In 1953, IBM produced the **IBM-650** and sold over 1000 computers.

2. Second Generation Computers (1956-1963 AD)

The interest in computer technology got fast after the first-generation computers. It was the generation of **Transistorized Computers.** Transistors replaced vacuum tubes from the first-generation computers. As a result, first-generation computers were replaced by second-generation computers.

The transistors were more reliable than vacuum tubes, smaller in size, faster in speed, and cheaper than first-generation computers. Magnetic drums are replaced by magnetic disks and magnetic tape for secondary storage. As a result, the size of the machines began shrinking.

The first transistorized computer was **TX-0**. The first large-scale machines that took advantage of the transistor technology were the early supercomputers, LARC by Sperry Rand and Stretch by IBM. These machines were specially developed for atomic energy laboratories. IBM 1400 and IBM 7000 series, General Electric, and Honeywell 200 were the typical computers of the second generation.

IBM 1401 was accepted throughout the industry, and most prominent businesses routinely processed financial information using second-generation computers. The machine language was replaced by assembly language. Thus, the long and challenging binary code was replaced with abbreviated programming code, which was relatively easy to understand.

The programming languages and stored program concept gave the computers flexibility to be cost-effective and productive for business use. The **stored program** concept implied that the instructions to run a computer for a specific task were held inside the computer's memory and could quickly be modified or replaced by a different set of instructions for a different function.

High-level languages like FORTRAN, COBOL, and AL- GOL were developed. Computers started finding varied and vast applications. The entire software industry began with second-generation computers.

Features of Second-Generation Computers

Following are some of the features of second-generation computers −

- This generation's most significant feature was introducing transistors that make the size smaller than the first-generation computer.
- The computer was much faster, more reliable, and better speed and could handle enormous data than first-generation computers.
- The machine-level language was replaced by assembly language and machine-independent language such as COBOL FORTRAN to simplify programming.
- The significant change is in speed from millisecond to microsecond.
- The computer consumes less electrical power than a first-generation computer.
- The computer is widely used in commercial areas.

Limitations of Second-Generation Computers

Following are some of the limitations of second-generation computers −

- It still used a cooling system to cool down the computer.
- It needs constant maintenance.
- Punch cards are still used for inputs.
- It was still costly and versatile.

Examples of Second Generation Computers

Some of the examples of the second generation computer are as follows:

1. **IBM 1401** (Used in Bussiness Application)
2. **IBM 1620** (Used for Scientific Purposes)
3. **CDC 3600** (Used for Scientific Purposes)
4. **IBM 7000**
5. **Honeywell 200**

3. Third Generation Computers (1964-1971 AD)

Its period was around 1964 to 1971. Third-generation computers were characterized by the invention of **Integrated Circuits (ICs)**. IC is a silicon chip made from quartz where multiple transistors were placed over it. Robert Noyce and Jack Kilby developed IC at Texas Instrument in 1958-1959. Later, even more components were rigged onto a single chip, called a **semiconductor**. It reduced the size even further in the third-generation computers. Computers' weight and power consumption decreased, and the speed boosted.

Operating systems were created, allowing the machine to run many different programs simultaneously. Multiprogramming was made possible, whereby the device could perform several jobs simultaneously.

Computers gained the speed of executing millions of instructions per second. Commercial production became more accessible and cheaper. Higher-level languages like Pascal and Report Program Generator (RPG) were introduced. And applications-oriented languages like FORTRAN, COBOL, and PL/1 were developed. Keyboards and mouse were introduced for the input of data. The monitor was introduced for the output of data.

Features of Third Generation Computers

Following are some of the features of third generation computers −

- IC was used in the computer, replacing transistors.
- The mass audience was using computers.
- The computers were highly reliable, relatively inexpensive, faster, and more accurate.
- It can be operated with low energy, and maintenance cost was low also.
- The keyboard and monitor were introduced for data input and output.

- It had a more prominent space capacity.
- A computer has more high-level computer language such as ALGOL-68, FORTRAN-II TO IV, BASIC, COBOL, PASCAL PL/1.
- They were produced commercially and was cheaper than both generations of computer.

Limitations of Third Generation Computers

Following are some of the limitations of third generation computers −

- Still, the air conditioner is used for cooling purposes.
- Highly sophisticated technology was required for the maintenance of the ICS chip.
- For third-generation computers, formal training was needed.

Examples of Third Generation Computers

Some of the examples of the third generation computer are as follows:

1. **IBM 360 SERIES**
2. **IBM 370**
3. **UNIVAC 1108**
4. **UNIVAC AC 9000**
5. **PDP-8, PDP-11**
6. **ICL 2900 series, and so on.**

4. Fourth Generation Computers (1971 – Present)

The fourth-generation computers were developed from 1971 to 1990 AD. The present-day computer we see is the fourth generation of computers. The third-generation computers used Integrated Circuits with 10-20 components on each chip; this was **Small Scale Integration (SSI).** The Fourth Generation acknowledged **Large Scale Integration (LSI),** which could hold hundreds of components on one chip, and **Very Large-Scale Integration (VLSI),** which embraced thousands of components on one silicon chip.

The Intel 4004 chip hold all the components of a computer (central processing unit (CPU), input and output controls, memory unit) on a single chip called a **Microprocessor**, and microcomputers were introduced.

In this generation, the concept of computer networks and CD-ROMS come into existence. GUI and pointing devices facilitate easy use and learning on the computer. Many new operating systems like the MS-DOS and MS-Windows developed during this time. Computer production became affordable, and the era of Personal Computers (PCs) began.

In 1981, IBM introduced its personal computer for home, office, and schools. In direct competition, the Macintosh was introduced in 1984 by Apple. Shared interactive systems and user-friendly environments were the features of these computers.

Features of Fourth Generation Computers

Following are some of the features of fourth generation computers −

- Computer sizes change from desktop to laptop and from laptop to palmtop.
- Electronic Mail (E-mail) and the Internet were developed in this generation.
- The computer is used for all scientific, engineering, and commercial purposes.
- On the computer, we can perform multiprocessing and multitasking.
- The computer has GUI (Graphical User Interface) and is user-friendly.
- Multiple high-level languages like PASCAL, BASIC COBOL, FORTRAN, and C language were developed in this generation of computers.
- They emerged as single-board computers and a single-chip processor called Microprocessors.

Limitations of Fourth Generation Computers

Following are some of the limitations of fourth generation computers −

- They were highly sophisticated.
- The manufacturing of a Very Large-Scale Integration Chip needed very advanced technology.

Examples of Fourth Generation Computers

Some of the examples of the fourth generation computer are as follows:

1. **MAC Notebook**
2. **IBM-PC**
3. **Pentium I, II & III**
4. **Apple II**
5. **VAX 9000**
6. **CRAY 1**

5. Fifth Generation Computers (Present – Future)

Defining the fifth generation of computers is tricky because the field is still in its infancy. Tomorrow's computers would be characterized by Artificial Intelligence (AI) and ULSI (Ultra Large-Scale Integration) technology that can store millions of components in a single chip. An example of Al is Expert Systems. Computers could be developed to think and sense much the same way as humans. Computers would be able to accept verbal words as input (voice recognition).

Numerous advancements in the science of computer design and technology are coming together to enable the creation of fifth-generation computers. Two such advances are in **superconductor technology** that allows electricity flow with little or no resistance, significantly enhancing the speed of information flow, and advances in **parallel processing,** where many CPUs work as one.

Scientists are now working on fifth-generation computers – a promise but not yet a reality. They seek to bring us machines with genuine I.Q., the ability to reason logically, and real-world knowledge.

Features of Fifth Generation Computers

Following are some of the features of fifth generation computers −

- These machines will incorporate ULSI (Ultra Large Scale Integration).
- It can perform a large number of parallel processing.
- The speed of this generation of computers is going to be very high.
- Bio-chips and Gallium Arsenide (GaAs) are used as memory devices.
- The concept of AI (Artificial Intelligence) has been introduced.
- This generation of computers can understand human language and recognize pictures and graphs.

Limitations of Fifth Generation Computers

Following are some of the limitations of fifth generation computers −

- The major limitation of this generation is that the computer will overtake all employment, creating unemployment in the country.
- The highly advanced robots can overtake the world, which leads to destruction for humans.

1.3 TYPES OF COMPUTERS

Computers can be classified in several ways based on **size**, **purpose**, **functionality**, and **data handling capability**. Understanding these classifications helps learners appreciate how different systems support different tasks across industries.

1. Classification Based on Size and Processing Power

1.1 Microcomputers (Personal Computers)

Definition:

Small, low-cost computers designed for individual use.

Examples: Desktop PCs, Laptops, Tablets, Smartphones.

Characteristics:

- Single-user systems
- Moderate processing capability
- Widely used for office work, browsing, education

Applications:

- Word processing, spreadsheets, presentations
- Internet use
- Personal entertainment

1.2 Minicomputers

Definition:

Mid-range systems used by small and medium organizations to support multiple users simultaneously.

Examples: IBM AS/400, PDP-11.

Characteristics:
- Multi-user system
- Higher processing power than microcomputers
- Support 4 to 200 users

Applications:
- Small enterprise servers
- Manufacturing process control systems
- Laboratory data management

1.3 Mainframe Computers
Definition:
Large, powerful systems designed to process massive amounts of data and run multiple applications simultaneously.

Examples: IBM Z-series.

Characteristics:
- Support thousands of users
- Very high speed and storage capacity
- Extremely reliable—designed for 24×7 operation
- Highly secure systems

Applications:
- Banking transaction systems
- Airline ticketing systems
- Healthcare patient record systems
- Large e-commerce platforms

1.4 Supercomputers
Definition:
Fastest and most powerful computers designed for complex scientific and engineering calculations.

Examples: Cray, Param (India).

Characteristics:

- Perform trillions of calculations per second
- Use parallel processing
- Require advanced cooling systems
- Extremely expensive and large in size

Applications:

- Weather forecasting
- Space research
- Nuclear simulations
- Genome analysis
- Artificial Intelligence model training

2. Classification Based on Purpose

2.1 General-Purpose Computers

Designed to perform a variety of tasks.

Examples: Laptops, desktops, tablets.

Applications:

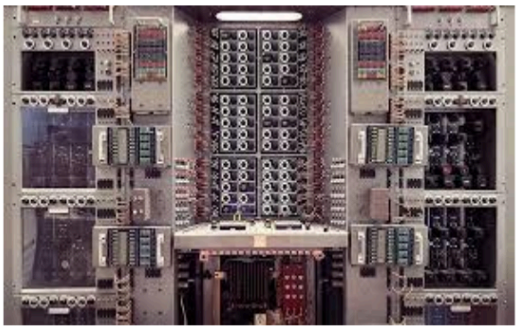
Office work, communication, browsing, data analysis.

2.2 Special-Purpose Computers
Designed to perform one specific task.
Examples:
- ATMs
- Microwave oven controllers
- Automatic car transmission systems
- ECG machines
- Industrial robots

Applications:
Highly specialized tasks requiring precision and consistency.

3. Classification Based on Data Processing Method
3.1 Analog Computers
Definition:
Computers that process **continuous data** (physical quantities).
Characteristics:
- No binary processing
- Use electrical, mechanical, or hydraulic signals

Applications:
- Speedometers
- Thermometers
- Flow meters
- Analog aircraft instruments



3.2 Digital Computers
Definition:
Computers that process **binary data (0s and 1s)**.
Characteristics:
- Most widely used
- Accurate, fast, programmable

Applications:
Used everywhere—education, business, healthcare, research.
Examples: PCs, laptops, servers.

3.3 Hybrid Computers
Definition:
Combine features of **analog** and **digital** computers.
Characteristics:
- Convert analog signals to digital
- Offer speed + accuracy

Applications:
- Hospital ICU machines (BP + ECG)
- Petrol pump flow meter systems
- Industrial monitoring systems

4. Classification Based on Portability

4.1 Desktop Computers

- Stationary
- High performance
- Used in offices, hospitals, labs

4.2 Laptop Computers

- Portable
- Battery-powered
- Used by students and professionals

4.3 Tablets

- Touch-screen based
- Lightweight

4.4 Smartphones

- Smallest portable computers
- Multi-functional (internet, apps, communication)

5. Classification Based on Functionality and Architecture

5.1 Workstations

High-end computers for professionals (designers, engineers, architects).

Use cases:

- CAD/CAM
- Scientific simulations
- Animation and video editing

5.2 Servers

Provide centralized resources and services.

Types of Servers:

- File server
- Database server
- Application server
- Web server

5.3 Embedded Computers

Microprocessor-based systems embedded within larger devices.

Examples:

- Smart TVs
- Washing machines
- Medical devices
- Automobiles

1.4 SUMMARY

The evolution of computers is a journey from simple mechanical devices to highly advanced electronic systems. Early computing began with tools like the abacus and mechanical calculators, which helped in basic arithmetic operations. The first generation of computers used vacuum tubes, were very large in size, consumed more power, and generated a lot of heat. These machines were mainly used for scientific calculations and military purposes.

The second generation introduced transistors, which made computers smaller, faster, and more reliable. The third generation saw the use of integrated circuits, enabling more compact designs and improved performance. The fourth generation introduced microprocessors, which led to the development of personal computers and widespread computer usage in offices and homes. Today, we are in the era of fifth-generation computers, focusing on artificial intelligence, machine learning, and quantum computing. Modern computers are highly powerful, portable, and connected through the internet. The evolution of computers has greatly influenced every field, including education, healthcare, banking, and communication, making technology an essential part of daily life.

1.5 Keywords

Abacus – An ancient manual calculating tool used for basic arithmetic operations.
ENIAC – The first electronic general-purpose computer developed in the 1940s.
Vacuum Tubes – Electronic components used in first-generation computers to control and amplify signals.
Transistors – Small semiconductor devices that replaced vacuum tubes and made computers smaller and more reliable.
Microprocessor – A single chip that contains the CPU and performs all major processing functions of a computer.

1.6 SELF-ASSESSMENT QUESTIONS

1. Explain the contribution of Charles Babbage to computer development.
2. Describe the features of first-generation computers.
3. Compare second and third-generation computers.
4. Explain the role of microprocessors in computer evolution.
5. Discuss the importance of personal computers in society.

1.7 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner*. Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-2

COMPUTER HARDWARE

LEARNING OBJECTIVES

- Understand the concept and components of computer hardware.
- Identify different types of input, output, and storage devices.
- Explain the functions of major internal hardware components.
- Differentiate between primary and secondary memory devices.
- Describe the importance of hardware in overall computer performance.

Structure

1.0 INTRODUCTION TO COMPUTER HARDWARE

Computer hardware refers to the **physical components** of a computer system that you can see and touch. These components work together to receive input, process data, store information, and present output.

Categories of Hardware

1. Input Devices
2. Output Devices
3. Storage Devices
4. Processing Unit (CPU)
5. Memory (Primary & Secondary)
6. Motherboard & Supporting Chips
7. Peripheral Devices

1.1 COMPUTER INPUT DEVICES

1. Introduction to Input Devices

Input devices are hardware components that allow users to enter data, instructions, and control signals into a computer. They serve as the primary interface between the user and the system.

Functions of Input Devices

- Capture raw data
- Convert data into machine-readable form
- Send commands for system operations
- Enable interaction with software applications

Classification of Input Devices

Input devices can be broadly classified into:

1. **Text Input Devices**
2. **Pointing Devices**
3. **Image/Video Input Devices**
4. **Audio Input Devices**
5. **Biometric Input Devices**
6. **Special-Purpose Input Devices**

2. Text Input Devices

2.1 Keyboard

A keyboard is the most common text entry device.

Types of Keyboards

- **QWERTY Keyboard** – Standard layout
- **Wireless Keyboard** – Uses Bluetooth/RF
- **Ergonomic Keyboard** – Reduces strain
- **Virtual/On-screen Keyboard** – Touchscreen based
- **Mechanical Keyboard** – Uses mechanical switches

Key Groups

- **Alphanumeric Keys**
- **Function Keys (F1–F12)**
- **Control Keys (Ctrl, Alt, Esc)**
- **Navigation Keys (Arrow keys, Home, End)**
- **Numeric Keypad**

3. Pointing Devices

3.1 Mouse

A mouse is used to control the position of the cursor.

Types

- **Mechanical Mouse** – Uses a rubber ball
- **Optical Mouse** – Uses LED and sensors
- **Laser Mouse** – High precision
- **Wireless Mouse** – Bluetooth/RF

Functions

- Clicking (Left, Right)
- Double-clicking
- Scrolling
- Drag and drop

3.2 Touchpad / Trackpad
Common in laptops; senses finger movement using capacitance.
Features
- Tapping
- Multi-touch gestures
- Two-finger scrolling

3.3 Trackball
A stationary ball rotated by the user.
Advantages
- Requires less space
- Precision input for design and gaming

3.4 Joystick
Used mostly for gaming and simulations.
Types
- Digital joystick
- Analog joystick
- Wireless joystick

3.5 Light Pen
A pen-shaped device that detects light from the screen.
Uses
- Computer-aided design (CAD)
- Older graphic terminals

3.6 Stylus & Graphic Tablet
Used to draw directly into software applications.
Components
- Stylus pen
- Drawing tablet surface

Applications
- Graphic design
- Animation
- Handwriting input

4. Image, Video, and Object Input Devices
4.1 Scanner
Used to convert physical documents into digital format.
Types of Scanners
- **Flatbed Scanner**
- **Sheet-fed Scanner**
- **Handheld Scanner**
- **3D Scanner**

Output Format
JPEG, PNG, PDF, TIFF

4.2 Barcode Reader
Reads printed barcodes using laser light.
Types

- Pen-type
- Laser scanner
- CCD scanner
- 2D barcode scanner (QR code readers)

4.3 QR Code Scanner
Reads Quick Response Codes; widely used in mobile payments, authentication, and inventory.

4.4 Digital Camera / DSLR Camera
Captures images and videos, stores in digital memory.

4.5 Webcam
Used for video conferencing.
Features
- Autofocus
- High-resolution capture
- Microphone integration

5. Audio Input Devices
5.1 Microphone
Captures audio signals and converts them into electrical signals.
Types
- Dynamic
- Condenser
- USB Microphone
- Wireless Microphone

5.2 Voice Recognition Systems
Convert spoken words into text.
Examples
- Siri
- Google Assistant
- Speech-to-text tools

6. Biometric Input Devices
6.1 Fingerprint Scanner
Uses patterns of ridges and valleys on a finger.
Types
- Optical
- Capacitive
- Ultrasonic

6.2 Iris Scanner
Captures the iris pattern of the eye; high-security applications.

6.3 Face Recognition Systems
Analyze facial features using a camera.

7. Special-Purpose Input Devices
7.1 Touchscreen

Combines input and display; user interacts by touching the screen.

Technology Types

- Resistive
- Capacitive
- Infrared
- Surface acoustic wave

7.2 Sensors

Used in IoT devices and smartphones.

Examples

- GPS
- Gyroscope
- Accelerometer
- Proximity sensor
- Temperature sensor

7.3 Magnetic Ink Character Recognition (MICR)

Used in banks to read cheques.

7.4 Optical Character Recognition (OCR)

Converts printed text into digital text.

7.5 Game Controllers

Keyboards, joypads, and steering wheels for gaming applications.

8. Future Trends in Input Devices

- Brain–Computer Interfaces (BCI)
- Gesture Recognition (e.g., Kinect)
- Holographic Input Systems
- AI-powered Voice Assistants
- Smart Gloves for VR/AR

1.2 COMPUTER OUTPUT DEVICES

1. Introduction to Output Devices

Output devices are hardware components that allow a computer to communicate information to the user or another machine. They convert digital data from the computer into human-understandable form such as text, images, sound, or physical movement.

Functions of Output Devices

- Present information to users
- Convert digital signals into visual, audio, or physical output
- Support interaction with applications
- Enable data interpretation and communication

Types of Output Devices

Output devices can be classified into:

1. **Visual Output Devices**
2. **Audio Output Devices**
3. **Print Output Devices**
4. **Plotting and Drawing Devices**
5. **Control / Actuator Devices**

2. Visual Output Devices

2.1 Monitor

Monitors display visual information such as text, images, and videos.

Types of Monitors

a) CRT (Cathode Ray Tube) Monitor

- Uses electron beams and fluorescent screen
- Bulky and heavy
- Rarely used today

b) LCD (Liquid Crystal Display) Monitor

- Thin and energy-efficient
- Uses liquid crystals controlled by electric charge
- Better color accuracy

c) LED (Light Emitting Diode) Monitor

- Advanced version of LCD
- Uses LEDs for backlighting
- Higher contrast, brightness, and power efficiency

d) OLED (Organic LED) Monitor

- Uses organic compounds to emit light
- Superior color and contrast
- Used in high-end displays

e) Touchscreen Monitor

- Acts as both input and output
- Used in mobile devices, kiosks, ATMs

2.2 Projector

Projectors display data by projecting images onto a screen or wall.

Types of Projectors

- **LCD Projector** – Uses 3 LCD panels
- **DLP Projector (Digital Light Processing)** – Uses micro-mirrors
- **LED Projector** – Uses LEDs as a light source
- **Laser Projector** – High clarity and brightness

Applications

- Classrooms
- Seminars
- Home theaters
- Business presentations

2.3 Smart Board / Interactive Display

A large interactive screen combining output with touch-based input.

Features

- Real-time annotation
- Video playback
- Multi-touch gestures
- Used in smart classrooms

3. Print Output Devices

3.1 Printer

Printers produce hard copy output on paper.

Types of Printers

a) Impact Printers
Print by physically striking the paper.
i) Dot Matrix Printer
- Prints using pins and ink ribbon
- Low cost
- Used for receipts, invoices

ii) Line Printer
- Prints one line at a time
- Used in large-scale industrial printing

b) Non-Impact Printers
Do not physically strike the paper.
i) Inkjet Printer
- Uses liquid ink sprayed through tiny nozzles
- Ideal for color printing
- Used in homes and offices

ii) Laser Printer
- Uses laser technology and toner powder
- Fast, high-quality output
- Suitable for high-volume printing

iii) Thermal Printer
- Uses heat-sensitive paper
- Used in billing machines, POS machines, ATMs

3.2 3D Printer
Produces 3D physical objects layer by layer using materials like plastic, resin, or metal.
Applications
- Prototyping
- Medical implants
- Architecture
- Engineering
- Education

4. Plotting and Drawing Devices
4.1 Plotter
A plotter is used to produce large-size technical drawings.
Types of Plotters
- **Drum Plotter** – Paper moves over a rotating drum
- **Flatbed Plotter** – Paper is stationary; pens move
- **Inkjet Plotter** – Modern version using inkjet technology

Uses
- Engineering drawings
- Architectural blueprints
- Maps and graphs

5. Audio Output Devices
5.1 Speakers
Speakers convert digital audio signals into sound waves.
Types

- Wired / Wireless
- Surround sound systems
- Bluetooth speakers

Applications

- Music playback
- Videos, presentations
- Alerts and notifications

5.2 Headphones / Earphones

Deliver audio directly to the user.

Types

- In-ear
- Over-ear
- Bluetooth
- Noise-cancelling

5.3 Sound Cards

Internal hardware that processes audio input/output.

6. Control Output / Actuator Devices

These devices convert digital output into physical action.

6.1 Motors

Used in robotics, manufacturing, and automation.

6.2 Robotic Arms

Perform automated tasks like assembly, welding, and packing.

6.3 LEDs / Indicator Lights

Provide status indications in machines.

6.4 Smart Home Output Devices

Examples: smart bulbs, smart alarms.

7. Softcopy vs. Hardcopy Output

Output Type	Description	Examples
Softcopy	Electronic form displayed on screen	Monitor, projector, VR headset
Hardcopy	Physical permanent output	Printer, plotter, 3D printer

9. Emerging Output Technologies

9.1 Virtual Reality (VR) Headsets

Provides immersive 3D visual output.

9.2 Augmented Reality (AR) Devices

Overlay digital information on the real world.

9.3 Holographic Displays

Produce 3D holograms without glasses.

9.4 Flexible/Transparent Displays

Used in foldable phones and modern gadgets.

9.5 Wearable Output Devices

Smartwatches, smart glasses (e.g., Google Glass).

1.3 COMPUTER STORAGE DEVICES

1. Introduction to Storage Devices

Storage devices are hardware components used to store digital data permanently or temporarily. They hold operating systems, applications, files, and system data required for computer operation.

Why Storage Devices Are Important

- Retain data even when the computer is powered off
- Provide space for software installation
- Enable backup, portability, and sharing of data
- Ensure system performance through fast read/write operations

Categories of Storage

Storage can be categorized into three main types:

1. **Primary Storage (Main Memory)**
2. **Secondary Storage (Non-Volatile Storage)**
3. **Tertiary / Backup Storage**

2. Primary Storage (Main Memory)

Primary storage is directly accessible by the CPU and provides temporary storage.

2.1 RAM (Random Access Memory)

RAM is volatile memory used to store data and instructions currently in use.

Types of RAM

a) DRAM (Dynamic RAM)

- Stores data using capacitors
- Needs constant refreshing
- Used in main system memory

b) SRAM (Static RAM)

- Uses flip-flops
- Faster and expensive
- Used in CPU cache

Features

- Fast data access
- Temporary storage
- Volatile (data lost when power is off)

2.2 ROM (Read Only Memory)

ROM stores permanent instructions needed for system booting.

Types of ROM

- **PROM (Programmable ROM)**
- **EPROM (Erasable PROM)**
- **EEPROM (Electrically Erasable PROM)**
- **Flash ROM**

Uses

- BIOS/UEFI firmware
- Embedded systems

2.3 Cache Memory

High-speed memory between CPU and RAM.

Levels

- **L1 Cache** – inside CPU core
- **L2 Cache** – near core
- **L3 Cache** – shared between cores

3. Secondary Storage Devices (Permanent Storage)
Secondary storage holds data long-term, even without power.

3.1 Hard Disk Drive (HDD)
Definition
A mechanical storage device that uses magnetic disks (platters) to store data.
Components
- Platters
- Spindle
- Read/write head
- Actuator arm
- Controller board

How HDD Works
Data is stored magnetically on spinning platters. Read/write heads move across platters to access data.
Advantages
- Low cost per GB
- High storage capacity

Disadvantages
- Slow compared to SSDs
- Mechanical failure risks
- Noisy and power-consuming

3.2 Solid State Drive (SSD)
Definition
A storage device that uses NAND flash memory (no moving parts).
Types of SSDs
- **SATA SSD** – slower, compatible with HDD ports
- **NVMe SSD** – faster, uses PCIe interface
- **M.2 SSD** – thin, used in modern laptops
- **U.2 SSD** – enterprise-level

Advantages
- Extremely fast read/write speed
- No mechanical parts → durable
- Low heat and noise

Disadvantages
- More expensive than HDD
- Limited write cycles (improving with technology)

3.3 Hybrid Drive (SSHD)
Combination of HDD + small SSD cache.
Purpose
- Faster than HDD
- Cheaper than SSD

3.4 Optical Storage Devices
These store data using laser technology.

a) CD (Compact Disc)
- Capacity: ~700 MB
- Used for music, software distribution

b) DVD (Digital Versatile Disc)
- Capacity: 4.7 GB – 8.5 GB
- Used for movies, software

c) Blu-ray Disc
- Capacity: 25 GB – 50 GB
- High-definition video storage

Advantages
- Cheap
- Good for distribution

Disadvantages
- Easily scratched
- Slower access speed

3.5 Flash Memory Devices

Flash memory is non-volatile, portable, and widely used.

a) USB Flash Drive
- Portable plug-and-play device
- Capacities: 4 GB to 1 TB

b) Memory Cards
- **SD Card**
- **microSD Card**
- **CF Card (CompactFlash)**
  Used in cameras, mobile phones, IoT devices.

c) Flash Chips
Used in smartphones and embedded systems.

3.6 External Hard Drives

Portable versions of HDDs or SSDs used for data backup and transfer.

Advantages
- High capacity
- Portable

Disadvantages
- Susceptible to drops (HDD)

3.7 Magnetic Tape Storage

Long-term, high-capacity storage used in enterprises.

Features
- Sequential access
- Very cheap for bulk storage
- Used for backups, archives

4. Cloud Storage (Online Storage)

Cloud storage allows users to store data on remote servers accessible via the internet.

Examples

- Google Drive
- Dropbox
- OneDrive
- iCloud

Advantages

- Accessible anywhere
- Automatic backup
- Scalable storage

Disadvantages

- Requires internet
- Data privacy concerns

5. Tertiary / Backup Storage

Designed for data recovery, archiving, and long-term storage.

Devices Used

- Tape drives
- External HDDs/SSDs
- NAS (Network Attached Storage)
- Cloud backup services

6. Characteristics of Storage Devices

Characteristic	Description
Capacity	Amount of data stored
Speed	Read/write speed
Volatility	Whether data is retained without power
Portability	Ease of carrying
Durability	Resistance to damage
Cost per GB	Expense relative to size

7. Comparison of Major Storage Devices

Device	Speed	Cost	Durability	Capacity	Used In
HDD	Medium	Low	Medium	High	PCs, servers
SSD	Very High	Medium-High	High	Medium-High	Laptops, gaming PCs
USB Drive	Medium	Low	Medium	Low-Medium	Data transfer
SD Card	Medium	Low	Medium	Medium	Mobiles, cameras
Magnetic Tape	Low	Very Low	High	Very High	Archives
Cloud Storage	Variable	Subscription	Very High	Very High	Backup, sync

8. File Systems Used in Storage Devices

File System	Used In	Features
NTFS	Windows	High security, large files
FAT32	USB drives	Simple, widely compatible
exFAT	SD cards/USB	Supports large files
EXT4	Linux	Reliable and fast
APFS	macOS	Encryption-focused

9. Modern & Emerging Storage Technologies

9.1 NVMe Storage

Ultra-fast PCIe-based SSDs.

9.2 Holographic Storage

Uses 3D holograms to store massive data.

9.3 DNA Storage

Stores data using synthetic DNA strands.

9.4 Phase Change Memory (PCM)

High-speed memory combining RAM and storage features.

9.5 Storage-Class Memory (SCM)

Next-generation non-volatile memory for enterprise servers.

1.4 COMPUTER PROCESSING DEVICES

1. Introduction to Processing Devices

Processing devices are the core components of a computer responsible for executing instructions, performing calculations, and managing the flow of data. These devices form the **brain** of the computer system.

Key Functions of Processing Devices

- Execute instructions from software
- Perform arithmetic and logical operations
- Control data movement between memory, I/O devices, and storage
- Manage system resources
- Maintain synchronization of operations

Processing devices ensure that the system works efficiently, rapidly, and accurately.

2. Central Processing Unit (CPU)

The CPU is the primary processing device of a computer. It carries out most of the computational and control tasks.

2.1 Components of CPU

The CPU consists of three main components:

a) ALU (Arithmetic Logic Unit)

- Performs arithmetic operations (add, subtract, multiply, divide)
- Performs logical operations (AND, OR, NOT, compare)
- Handles decision-making tasks

b) CU (Control Unit)

- Directs the operation of the processor
- Fetches instructions from memory
- Decodes and executes instructions
- Controls communication between CPU and other components

c) Registers

Registers are small, high-speed storage locations inside the CPU.

Types of Registers:

- **Program Counter (PC)**
- **Instruction Register (IR)**
- **Accumulator (ACC)**
- **Buffer Registers**
- **General Purpose Registers**

2.2 CPU Clock Speed
Measured in **GHz** **(Gigahertz)**.
Higher clock speed → faster processing.

2.3 CPU Cores
Modern CPUs have multiple cores like:
- Dual-core
- Quad-core
- Hexa-core
- Octa-core
- Multi-core servers (up to 64 cores)

Each core can execute tasks independently.

2.4 CPU Architecture
- **32-bit and 64-bit Processors**
- **RISC (Reduced Instruction Set Computer)**
- **CISC (Complex Instruction Set Computer)**

Examples:
- Intel Core i5, i7, i9
- AMD Ryzen series
- ARM processors (used in mobiles)

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3. Graphics Processing Unit (GPU)
A GPU is a specialized processor designed to handle graphics and parallel processing tasks.

3.1 Functions
- Render 2D/3D graphics
- Accelerate gaming performance
- Support machine learning and AI
- Handle video editing and rendering

3.2 Types of GPUs
1. **Integrated GPU**
   - Built into CPU
   - Low power, basic performance
   - Example: Intel UHD Graphics, AMD Vega
2. **Dedicated/Discrete GPU**
   - Separate hardware
   - High performance
   - Example: NVIDIA GeForce, AMD Radeon

3.3 GPU Architecture
- Thousands of small cores for parallel tasks
- Ideal for large-scale data processing

4. Coprocessors
Coprocessors assist the CPU in performing specific functions more efficiently.
Types of Coprocessors
- **Math Coprocessor** for scientific calculations
- **Graphics Coprocessor** (GPU)
- **Audio Coprocessor**
- **AI Coprocessor / Neural Engine** (used in mobile devices)

5. Microprocessors
Microprocessors are compact, complete CPUs built on a single chip.
Applications
- Personal computers
- Embedded systems
- Home appliances
- Industrial machinery

Examples
- Intel Pentium series
- ARM Cortex processors
- Motorola 68000

6. Microcontrollers
A microcontroller is a combination of:
- Processor (CPU)
- Memory (RAM, ROM)
- Input/output ports

on a single chip.
Applications
- IoT devices
- Washing machines
- Medical instruments
- Arduino boards

Popular microcontrollers
- Arduino ATmega328
- PIC Microcontroller
- ESP32

7. System on Chip (SoC)
An SoC integrates:
- CPU
- GPU
- Memory
- Modem
- Sensors

on a single chip.
Used In
- Mobile phones
- Tablets
- Smart wearables
- Smart TVs

Examples
- Apple A-series & M-series chips
- Qualcomm Snapdragon
- Samsung Exynos

Digital Signal Processor (DSP)
DSPs are specialized processors for high-speed signal processing.
Functions
- Audio filtering
- Image compression
- Wireless communication
- Video streaming

Applications
- Smartphones
- Medical devices
- Radar systems

9. AI Processing Units (Neural Processing Units – NPUs)
Designed for artificial intelligence and machine learning tasks.
Functions
- Facial recognition
- Natural language processing
- Real-time data analysis

Examples
- Google Tensor Processing Unit (TPU)
- Apple Neural Engine
- Qualcomm Hexagon AI Engine

10. Cloud Processing
Processing is performed on remote servers.
Advantages
- Scalability
- High computational power
- Available anywhere

Examples
- AWS EC2
- Google Cloud Compute
- Microsoft Azure

11. Quantum Processors (Emerging Technology)
Quantum processors use qubits instead of bits, enabling exponential processing speeds for certain tasks.
Applications
- Cryptography
- Molecular modeling
- Optimization problems

Examples
- IBM Quantum Processor
- Google Sycamore

12. Characteristics of Processing Devices

Feature	Description
Speed	Execution rate of instructions
Cores	Number of independent processors within CPU
Architecture	RISC/CISC, 32/64-bit
Cache Size	Memory close to CPU for fast processing
Thermal Capacity	Ability to handle heat
Instruction Set	Types of operations supported

1.5 COMPUTER MEMORY (PRIMARY & SECONDARY)

1. Introduction to Computer Memory

Computer memory refers to the electronic components that store data, instructions, and information needed for processing. Memory is essential for the computer to function efficiently.

Why Memory Is Important

- Stores data temporarily or permanently
- Supplies data and instructions to the CPU
- Stores results of processing
- Maintains smooth execution of programs
- Enhances system performance

Computer memory is broadly classified into:

1. **Primary Memory (Main Memory)**
2. **Secondary Memory (Auxiliary/External Storage)**

2. Primary Memory (Main Memory)

Primary memory is directly accessible by the CPU. It is fast and volatile. It temporarily holds data and instructions currently in use.

Primary Memory Includes:

- RAM (Random Access Memory)
- ROM (Read Only Memory)
- Cache Memory

2.1 RAM (Random Access Memory)

RAM is a **volatile** memory—data is lost when power is turned off.

Functions of RAM

- Stores data and instructions needed for running programs
- Holds the operating system (temporarily)
- Allows multitasking

Types of RAM

a) DRAM (Dynamic RAM)

- Stores data using capacitors
- Needs continuous refreshing
- Slower but cheaper
- Used in system memory of computers

b) SRAM (Static RAM)

- Uses flip-flop circuits
- No need for refreshing
- Much faster but expensive
- Used in cache memory

Features of RAM

- Volatile
- High read/write speed
- Measured in GB (e.g., 4GB, 8GB, 16GB)
- Directly accessible by CPU

2.2 ROM (Read Only Memory)

ROM is **non-volatile memory**—data remains even when power is off.

Functions of ROM

- Stores permanent instructions
- Used in the computer's booting process
- Contains BIOS/UEFI firmware

Types of ROM

a) PROM (Programmable ROM)

- Can be programmed once by the user

b) EPROM (Erasable PROM)

- Can be erased using UV light
- Can be reprogrammed

c) EEPROM (Electrically Erasable PROM)

- Can be erased electrically
- Supports partial rewriting

d) Flash ROM

- Used in modern BIOS, pen drives, memory cards

2.3 Cache Memory

Cache memory is ultra-fast memory located close to the CPU.

Why Cache Is Needed

- Reduces data access time
- Stores frequently used instructions
- Improves CPU efficiency

Types of Cache

- **L1 Cache** – inside CPU core (fastest, smallest)
- **L2 Cache** – near the core (larger, slower than L1)
- **L3 Cache** – shared cache for all cores

2.4 Registers

Small, ultra-fast memory units inside the CPU.

Examples of Registers:

- Program Counter (PC)
- Instruction Register (IR)
- Stack Pointer
- Accumulator

Secondary Memory (Auxiliary Storage)

Secondary memory is non-volatile and used for long-term storage of data and programs.

Features of Secondary Memory

- Permanent storage
- Higher capacity
- Slower than primary memory
- Not directly accessed by the CPU

Examples include:

- Hard Disk Drive (HDD)
- Solid State Drive (SSD)
- Optical Discs (CD/DVD/Blu-ray)
- Flash Drives
- SD Cards
- Magnetic Tapes
- Cloud Storage

3.1 Hard Disk Drive (HDD)

Definition

A mechanical device using magnetic platters to store data.

Characteristics

- High capacity (500GB – 10TB)
- Low cost
- Slower than SSD
- Mechanical parts may fail

Used In

- Desktops
- Laptops
- Servers

3.2 Solid State Drive (SSD)

Definition

Stores data using NAND flash memory with no moving parts.

Characteristics

- Very fast read/write speed
- Durable and silent
- More expensive
- Uses SATA, M.2, or NVMe interfaces

Used In

- Modern laptops
- Gaming PCs
- Enterprise servers

3.3 Hybrid Drive (SSHD)

Combines HDD + SSD (small flash memory cache). Balances cost and speed.

3.4 Optical Storage Devices

a) CD (Compact Disc)

- Capacity: 700MB
- Used for music, small software

b) DVD (Digital Versatile Disc)

- Capacity: 4.7GB – 8.5GB
- Used for movies, software

c) Blu-ray Disc

- Capacity: 25GB – 50GB
- High-definition video

3.5 Flash Memory Devices

a) Pen Drive / USB Flash Drive

- Portable and easy to use
- Capacity: 4GB – 1TB

b) Memory Cards (SD, microSD)

- Used in smartphones, tablets, cameras

c) SSD Flash Chips

- Used in mobile phones and embedded systems

3.6 External Hard Drives

Used for backup and bulk storage.
Available in HDD and SSD formats.

3.7 Magnetic Tape Storage

Used for archival storage in organizations.

Characteristics

- Very high capacity
- Low cost
- Sequential access (slower)

3.8 Cloud Storage

Data stored on remote servers accessible online.

Examples

- Google Drive
- Dropbox
- OneDrive
- AWS S3

Advantages

- Accessible anywhere
- Automatic sync
- No hardware maintenance

4. Differences Between Primary and Secondary Memory

Feature	Primary Memory	Secondary Memory
Volatility	Mostly volatile	Non-volatile
Speed	Very fast	Moderate to slow
Cost	Expensive	Cheaper per GB
Capacity	Limited (GBs)	Very high (GBs to TBs)
Access	Direct by CPU	Through I/O controller
Purpose	Temporary data	Permanent data

5. Classification of Memory Hierarchy

1. Registers (fastest, smallest)
2. Cache Memory
3. Primary Memory (RAM)
4. Secondary Storage (HDD/SSD)
5. Tertiary Storage (Tape, cloud archive)

This structure ensures optimal performance and balanced cost.

6. Modern Memory Technologies

a) NVMe Storage

Used in high-speed SSDs for lightning-fast performance.

b) 3D NAND Technology

Increases storage density in flash memory.

c) HBM (High Bandwidth Memory)

Used in high-end GPUs.

d) Storage Class Memory (SCM)

Bridges the gap between RAM and storage.

e) DNA Storage (Future)

Uses biological molecules for massive data storage.

7. Applications of Each Memory Type

Memory	Common Applications
RAM	Running OS, apps, games
ROM	System firmware
Cache	Speeding up processing
HDD	Storing downloads, movies, files
SSD	Faster OS booting & applications
USB Drive	Portability & file transfer
SD Cards	Mobile devices & cameras
Cloud Storage	Backup & remote access
Magnetic Tape	Archiving business data

1.6 COMPUTER MOTHERBOARD & SUPPORTING CHIPS

Introduction to Motherboard

The **motherboard** is the **main printed circuit board (PCB)** of a computer. It connects and communicates with all other hardware components such as CPU, memory, storage, input/output devices, and expansion cards.

It is also known as:

- System board
- Mainboard
- Logic board (in Apple systems)

2. Functions of the Motherboard

- Holds and allows communication between CPU, RAM, GPU, and other components
- Distributes power to all components
- Houses BIOS/UEFI firmware
- Provides expansion slots
- Manages data flow through chipsets
- Interfaces with internal and external devices

3. Motherboard Form Factors

3.1 ATX (Advanced Technology Extended)

- Standard size: 305mm × 244mm
- More expansion slots and ports
- Used in desktops and servers

3.2 Micro ATX
- Smaller than ATX
- Moderate expansion slots
- Used in budget desktops

3.3 Mini-ITX
- Very compact
- Low power consumption
- Ideal for small form-factor PCs

3.4 AT (Advanced Technology)
- Older form factor
- Used in early computers

4. Major Components on a Motherboard

4.1 CPU Socket

92 special slot designed to hold the CPU.

Types:
- **LGA (Land Grid Array)** – Intel
- **PGA (Pin Grid Array)** – AMD
- **BGA (Ball Grid Array)** – permanently soldered (laptops)

4.2 RAM Slots (DIMM Slots)

Holds the primary memory modules
Supports DDR3 / DDR4 / DDR5 depending on motherboard design.

4.3 Chipset (Northbridge & Southbridge)

The **chipset** controls communication between CPU, memory, and peripherals.

Traditional Architecture
- **Northbridge**
  - Connects CPU, RAM, GPU
  - High-speed communication
- **Southbridge**
  - Connects I/O devices (USB, audio, network, storage)
  - Slower communication

Modern Architecture

Modern CPUs integrate Northbridge functions inside the processor. Motherboards now use a **Platform Controller Hub (PCH)** instead of traditional Northbridge/Southbridge.

4.4 BIOS/UEFI Chip

A small ROM chip that stores the firmware.

Functions
- Performs POST (Power-On Self-Test)
- Loads bootloader
- Provides basic hardware configuration settings

UEFI is the modern firmware standard with graphical interface and secure boot.

4.5 CMOS Battery
- A coin-cell battery (CR2032)
- Powers the CMOS memory which stores BIOS settings (date/time, boot settings)
- Maintains settings when PC is off

4.6 Expansion Slots
Used to insert additional cards.
Types:
- **PCI Slot** – older expansion slot
- **PCI Express (PCIe)** – modern, high-speed
  - PCIe x1
  - PCIe x4
  - PCIe x8
  - PCIe x16 (used for graphics cards)

Expansion Cards Include:
- Graphics card
- Sound card
- Network card
- TV tuner card
- RAID controller

4.7 Storage Connectors
SATA Ports
- Connect SSDs, HDDs, and optical drives
- SATA III offers 6 Gbps speed

M.2 Slots
- Used for NVMe SSDs
- Very fast storage interface
- Sizes: 2280, 2260, 2230

4.8 Power Connectors
- **24-pin ATX power connector** – main power supply
- **4/8-pin CPU power connector** – supplies CPU
- **PCIe power connectors** – for graphics cards

4.9 USB Headers
Provide connections for front panel USB ports (USB 2.0, USB 3.0, 3.1, Type-C).

4.10 Audio Chip (Sound Card Chip)
Often integrated on motherboard.
Responsibilities:
- Produces input/output audio
- Manages microphone and speaker signals

Examples:
- Realtek HD Audio chipset
- Creative Sound Core

4.11 LAN Controller Chip
Handles network communication.
- Gigabit Ethernet controller
- Wi-Fi/Bluetooth modules on advanced boards

Examples:
- Intel I219-V
- Realtek RTL8111

4.12 VRM (Voltage Regulator Module)
Ensures stable voltage supply to CPU, RAM, and GPU.
Consists of:
- MOSFETs
- Chokes/inductors
- Capacitors

High-quality VRMs improve system stability.

5. Supporting Chips on Motherboard
5.1 Super I/O Chip
Manages legacy devices:
- Serial port
- Parallel port
- Keyboard controller
- Fan control
- Temperature sensors

5.2 Clock Generator Chip
Provides timing signals to synchronize components.

5.3 TPM (Trusted Platform Module)
A security chip used for:
- Encryption
- Secure boot
- BitLocker functionality

5.4 USB Controller Chip
Handles USB communication and power control for:
- Keyboard
- Mouse
- Storage devices
- Printers

5.5 RAID Controller Chip
Combines multiple storage drives for:
- Redundancy
- Performance improvement
- Data security

5.6 Embedded Controller (EC)
Used mostly in laptops.
Manages:
- Battery
- Keyboard shortcuts
- Thermal sensors
- Power management

6. Back Panel Ports on the Motherboard

- USB 2.0 / USB 3.0 / USB-C
- HDMI / DisplayPort / VGA
- Ethernet port
- PS/2 ports (for older keyboard & mouse)
- Audio jacks
- Optical S/PDIF

7. Front Panel Connectors

- Power button
- Reset button
- HDD LED
- Power LED
- Audio ports
- USB ports

8. Cooling Support on Motherboard

Types:

- CPU fan header
- System fan headers
- Liquid cooling support (AIO pump header)

Cooling prevents overheating and improves performance.

9. Laptop vs Desktop Motherboards

Desktop Motherboard

- Larger
- More upgrade options
- Replaceable components

Laptop Motherboard

- Compact
- Custom designed
- Many components soldered directly
- Difficult to replace

10. Importance of Motherboard in System Performance

- Determines the type of CPU, RAM, and expansion cards
- Affects data transfer speed
- Influences system stability
- Supports overclocking features
- Improves connectivity

1.7 COMPUTER PERIPHERAL DEVICES

1. Introduction to Peripheral Devices

Peripheral devices are **external hardware components** that are connected to a computer to expand its functionality. They allow users to **input data, output information, store data, communicate**, and enhance user interaction.

Peripheral devices are not part of the computer's core architecture (CPU, motherboard, RAM) but support system operations.

2. Types of Peripheral Devices

Peripheral devices are generally classified into:

1. **Input Devices**
2. **Output Devices**
3. **Storage Devices**
4. **Communication Devices**
5. **Multifunction Devices**

3. Input Peripheral Devices

Used to send data or control signals to the computer.

3.1 Keyboard

- Standard input device
- QWERTY layout
- Types: Mechanical, membrane, wireless, ergonomic

3.2 Mouse

- Pointing device
- Types: Optical, laser, wireless, vertical, gaming

3.3 Scanner

- Converts physical documents/images into digital form
- Types: Flatbed, handheld, sheet-fed, fingerprint scanner

3.4 Microphone

- Converts sound to digital signals
- Used in calls, recordings, speech recognition

3.5 Web Camera (Webcam)

- Captures video
- Used for video conferencing, surveillance

3.6 Barcode Reader

- Reads barcodes in retail, warehouses, libraries

3.7 Biometric Devices

- Fingerprint scanners
- Retina scanners
- Facial recognition devices

3.8 Touchscreen

- Both input & display
- Used in mobiles, ATMs, kiosks

3.9 Graphics Tablet / Stylus

- Used for drawing, design, digital art

4. Output Peripheral Devices

Used to show information to the user.

4.1 Monitor

- Primary output device
- Types: LCD, LED, OLED, curved, touch monitors

4.2 Printer

- Converts digital text/images into paper format
- Types:
  - Inkjet
  - Laser
  - Dot Matrix

- Thermal printer
- 3D printer

4.3 Speakers
- Produce audio output
- Used in entertainment, alerts, communication

4.4 Headphones / Earphones
- Personal audio devices

4.5 Projector
- Displays enlarged visuals on screens/walls
- Used in classrooms, offices, cinemas

4.6 Plotter
- Produces large-scale drawings (engineering, architecture)

5. Storage Peripheral Devices

They store data externally.

5.1 External Hard Drive
- High capacity
- Portable
- HDD/SSD-based

5.2 Pen Drive (USB Flash Drive)
- Compact storage
- Plug-and-play device

5.3 Memory Cards
- SD, microSD
- Used in cameras, mobiles

5.4 Optical Discs
- CD, DVD, Blu-Ray
- Used for media distribution

5.5 Network Attached Storage (NAS)
- Storage accessible through a network

6. Communication Peripheral Devices

Enable communication between computers or networks.

6.1 Modem
- Converts digital signals into analog and vice versa
- Used for internet connectivity

6.2 Network Interface Card (NIC)
- Hardware to connect a computer to a network
- Wired (Ethernet) or wireless (Wi-Fi)

6.3 Bluetooth Adapter
- Short-range wireless communication

6.4 Wi-Fi Adapter
- Connects computers to wireless networks

6.5 Router (External Peripheral)
- Directs network traffic
- Provides Wi-Fi and LAN connections

7. Multifunction Peripheral Devices

Devices that combine multiple features.

7.1 All-in-One Printer
- Printer + Scanner + Copier + Fax

7.2 Photocopy Machines
- Copying + scanning + printing

7.3 Smartboards
- Display + input (writing/drawing)
- Used in classrooms/offices

8. Specialized Peripheral Devices
These support specific industries.

8.1 POS (Point of Sale) Terminals
- Billing machines used in shops
- Integrated with barcode scanner, receipt printer

8.2 Medical Peripheral Devices
- ECG reader
- Glucometer
- Digital stethoscopes

8.3 Industrial Sensors
- Temperature sensors
- Motion detectors
- Pressure sensors

8.4 VR/AR Headsets
- Virtual & augmented reality experiences

9. Connectivity Ports for Peripheral Devices
Peripheral devices are connected through:

9.1 USB Ports
- Most common
- USB 2.0, 3.0, 3.1, USB-C

9.2 HDMI
- For monitors, projectors

9.3 DisplayPort / VGA / DVI
- Video output

9.4 Audio Jacks (3.5mm)
- Speakers, headphones

9.5 Bluetooth
- Wireless headphones, keyboards, mice

9.6 Wi-Fi & NFC
- Wireless communication
- Smartphones, printers

10. Importance of Peripheral Devices
Peripheral devices improve a computer's ability to:
- **Input data faster**
- **Display information better**
- **Store data externally**
- **Communicate with other devices**
- **Expand functionality for specific industries**

They convert a base computer into a **functional, user-oriented system**.

11. Characteristics of Peripheral Devices

Feature	Description
Connectivity	Wired/Wireless
Functionality	Input, Output, Storage, Communication
Compatibility	OS & port support
Speed	Transfer/data rate
Portability	Ease of carrying
Reliability	Durability & performance

12. Examples of a Full Peripheral Setup

A modern office PC may have:

- Keyboard, mouse → Input
- Monitor, printer → Output
- External hard disk → Storage
- Wi-Fi router → Communication
- Webcam, microphone → Multimedia

1.8 SUMMARY

Computer hardware refers to the physical parts of a computer system that can be seen and touched. It includes input devices like keyboard and mouse, processing components such as the CPU and motherboard, storage devices such as hard disks and RAM, and output devices like monitors and printers. Hardware works together with software to perform tasks, process data, and produce useful results. Proper functioning and maintenance of hardware are essential for the efficient performance of a computer system.

1.9 Keywords

CPU (Central Processing Unit) – The main processing component of the computer that performs calculations and controls operations.

RAM (Random Access Memory) – The temporary memory that stores data and programs currently in use.

Hard Disk – A secondary storage device used to store data permanently.

Motherboard – The main circuit board that connects and allows communication between hardware components.

Input Devices – Hardware components used to enter data and instructions into a computer.

1.10 Self-Assessment Questions

1. Explain the major components of computer hardware and their functions.
2. Discuss the role of the CPU in computer operations.
3. Describe different types of memory in a computer system.
4. Explain the differences between primary and secondary storage devices.
5. Write an essay on the importance of input and output devices in computer systems.

1.11 Suggested Readings

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-3

COMPUTER SOFTWARE

LEARNING OBJECTIVES

- Understand the concept and types of computer software.
- Differentiate between system software and application software.
- Explain the functions of operating systems.
- Identify common software used in daily tasks.
- Recognize the role of software in controlling hardware operations.

STRUCTURE

1.0 INTRODUCTION TO COMPUTER SOFTWARE

Computer software is a collection of programs, instructions, and data that tell a computer how to perform tasks. While hardware is the physical part of a computer, software is the intelligence that makes hardware functional.

Definitio

Software is a set of instructions written using programming languages that directs the computer to perform specific operations.

2. Characteristics of Software

- Intangible (cannot be touched)
- Developed, not manufactured
- Does not wear out
- Easy to modify and update
- Can run across multiple hardware platforms
- Requires installation and configuration

3. Types of Computer Software

Computer software is broadly classified into two categories:

1. **System Software**
2. **Application Software**

Additionally, we also include:

- **Utility Software**
- **Programming Software**
- **Middleware**
- **Open-source vs Proprietary Software**

1.2 SYSTEM SOFTWARE

1. Introduction to System Software

System software is a category of computer software designed to **manage hardware components**, run application software, and control overall system operations.

Definition:

System software is a set of programs that acts as an interface between the hardware and the user/application software.

Key Functions

- Controls hardware devices
- Manages system resources
- Enables application execution
- Ensures security and stability
- Provides user interface
- Handles file management

2. Characteristics of System Software

- Close interaction with hardware
- Written in low-level or assembly languages
- Fast and efficient execution
- Less interactive for users
- Difficult to design and modify
- Essential for computer functioning

3. Types of System Software

System software is broadly classified into:

1. Operating System (OS)
2. Device Drivers
3. Firmware
4. Utility Software
5. System Management Software
6. Compilers and Translators

Let us understand each in detail.

4. Operating System (OS)

The operating system is the most important system software that manages hardware resources and provides services for application programs.

4.1 Functions of Operating System

A. Process Management
- Controls running programs (processes)
- Schedules tasks (multitasking, multiprocessing)

B. Memory Management
- Allocates and deallocates RAM
- Manages virtual memory

C. File System Management
- Creates, reads, writes, deletes files
- Organizes them into folders/directories

D. Device Management
- Controls input/output devices
- Uses device drivers for communication

E. Security & Protection
- Authentication (password/PIN/biometric)
- Authorization and access control
- Firewalls and permissions

F. User Interface
- GUI (Windows, macOS)
- CLI (Linux terminal, Command Prompt)

G. Networking
- Supports internet, TCP/IP, Wi-Fi, LAN, Bluetooth

4.2 Types of Operating Systems

1. Single-User OS
- Used by one person at a time
- Example: Windows 11 Home

2. Multi-User OS
- Allows simultaneous users
- Example: UNIX, Linux

3. Real-Time Operating System (RTOS)
- Fast response
- Used in robotics, medical instruments, defence systems
- Example: VxWorks

4. Embedded OS
- Used in embedded systems
- Example: Android, iOS, Smart TV OS

5. Distributed OS
- Manages a group of computers as one system
- Example: Amoeba OS

6. Mobile OS
- Used in smartphones and tablets
- Example: Android, iOS

5. Device Drivers

Device drivers are specialized system software programs that help the OS communicate with hardware.

Need for Drivers

- OS cannot directly understand hardware signals
- Driver acts as a translator

Examples

- Printer driver
- Graphic card driver (NVIDIA/AMD)
- Audio driver
- USB driver
- Network driver

Types of Device Drivers

- Kernel-mode drivers
- User-mode drivers
- Virtual device drivers

6. Firmware

Firmware is a set of instructions permanently stored in ROM or flash memory.

Functions

- Controls low-level operations
- Initializes hardware
- Provides boot instructions

Examples

- BIOS/UEFI
- Router firmware
- Smartwatch firmware
- Medical device firmware

Characteristics

- Non-volatile
- Hard to modify
- Highly reliable

14 **Utility Software**

Utility software helps in the **maintenance, optimization, and security** of the computer system.

Types of Utility Software

1. Security Utilities

- Antivirus
- Firewall
- Encryption tools

2. Storage Utilities

- Disk cleanup
- Disk defragmenter
- Backup utilities

3. File Management Utilities

- Compression tools (WinRAR, 7-Zip)
- File recovery tools

4. System Monitoring Utilities

- Task Manager
- Performance Monitor

5. Networking Utilities

- Ping tools
- Wi-Fi analyzers
- Remote desktop

8. System Management Software
Helps administrators manage computer networks, servers, and security.
Examples
- Device management tools
- Server monitoring tools
- Patch management systems
- Virtualization software (VMware, Hyper-V)

9. Translators (Part of System Software)
Translators convert high-level programming code into machine language.
Types
- **Compiler** – Converts entire program at once
- **Interpreter** – Converts one line at a time
- **Assembler** – Converts assembly language into machine code

Examples
- GCC Compiler
- Python Interpreter
- MASM Assembler

10. System Software vs Application Software

Feature	System Software	Application Software
Purpose	Manages hardware	Helps user perform tasks
Runs	Background	As per user request
Examples	OS, drivers, utilities	MS Word, browsers
Developed using	Low-level languages	High-level languages
Dependency	Needed for system startup	Runs on top of OS

11. Installation & Maintenance of System Software
Installation Includes:
- OS setup
- Driver installation
- Firmware updates
- Security configuration

Maintenance Includes:
- System updates
- Disk and memory cleaning
- Security patches
- Backup scheduling

12. Importance of System Software
- Essential for system functioning
- Provides platform for application software
- Ensures efficient resource utilization
- Enhances system performance
- Protects from security threats
- Manages hardware reliability

13. Trends in Modern System Software

- Cloud-based operating systems
- AI-powered system monitoring
- Container-based systems (Docker)
- Virtualization and hypervisors
- Edge and IoT operating systems
- Enhanced security features (Secure Boot, TPM)

14. Examples of Popular System Software

Operating Systems

- Windows 10/11
- macOS Ventura
- Linux distributions: Ubuntu, Fedora, Mint

Drivers

- NVIDIA GeForce drivers
- Realtek audio drivers

Utilities

- CCleaner
- Windows Defender
- macOS Disk Utility

Firmware

- UEFI BIOS
- Router firmware (Netgear, TP-Link)

1.2 Application Software

1. Introduction to Application Software

Application software refers to **programs designed to help users perform specific tasks** on a computer. Unlike system software (which manages hardware), application software focuses on enhancing productivity, creativity, and communication.

Key Characteristics

- Designed for **end-users**
- Performs specific **functional tasks**
- Runs on top of **system software/OS**
- Can be standalone or part of a **software suite**
- Regular updates to improve features and security

2. Categories of Application Software

Application software can be broadly classified into the following major categories:

A. General-Purpose Application Software

Used in day-to-day tasks across all industry sectors.

Examples & Descriptions

Word Processing Software

Used for creating and editing textual documents.

Examples: MS Word, Google Docs, LibreOffice Writer

Features: Spell check, formatting, templates, mail merge, collaboration.

2. Spreadsheet Software

Used for performing calculations, data analysis, and visualization.

Examples: MS Excel, Google Sheets, Lotus 1-2-3

Features: Formulas, charts, pivot tables, macros, conditional formatting.
3. Presentation Software
Used to create slideshow presentations.
Examples: MS PowerPoint, Google Slides, Keynote
Features: Animations, transitions, templates, multimedia integration.
4. Database Management Software (DBMS)
Used to store, retrieve, and manage large amounts of structured data.
Examples: MS Access, MySQL Workbench, Oracle SQL Developer
Features: Query creation, reports, forms, relational data management.
5. Communication Software
Enables exchange of information electronically.
Examples: Outlook, Gmail, WhatsApp Web, Zoom, MS Teams
Features: Email, chat, video conferencing, file sharing.
6. Web Browsers
Provide access to the internet and websites.
Examples: Chrome, Firefox, Edge, Safari
Features: Bookmarks, extensions, privacy controls, tab management.

B. Specialized / Domain-Specific Application Software
Designed for particular industries or professional tasks.
Examples
1. Accounting Software
Used by businesses to manage financial transactions.
Examples: Tally ERP, QuickBooks, Zoho Books
Features: Ledger management, GST support, payroll, invoicing.
2. Graphic Design & Multimedia Software
Used to create images, videos, animations, and audio.
Examples: Adobe Photoshop, Illustrator, Premiere Pro, CorelDRAW
Features: Layer editing, color correction, rendering, timeline editing.
3. Engineering & Scientific Software
Used for modeling, simulation, and analysis.
Examples: MATLAB, AutoCAD, ANSYS, SolidWorks
Features: 3D modeling, simulation, mathematical computation.
4. Medical & Healthcare Software
Used in hospitals/healthcare setups.
Examples: HIS, PACS, LIS, EMR/EHR systems
Features: Patient data management, test results, imaging, billing.
5. Education & E-learning Software
Used in academic institutions.
Examples: Moodle, Google Classroom, Byju's
Features: Online tests, content management, performance tracking.
6. Project Management Software
Used for planning, tracking, and executing projects.
Examples: MS Project, Trello, Jira, Asana
Features: Gantt charts, task assignments, progress tracking.

C. Custom Software
Developed specifically for an organization to meet unique requirements.

Examples
- Hospital Management Systems
- Hotel Reservation Systems
- Inventory Management Systems
- Banking Systems

Advantages
- Tailor-made
- Higher efficiency
- Integration with organizational workflows

Disadvantages
- Higher cost
- Longer development time
- Requires maintenance

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D. Open-Source Application Software

Software whose source code is freely available for modification and distribution.

Examples
- LibreOffice
- GIMP
- Blender
- VLC Media Player

Advantages
- Free to use
- Highly customizable
- Large community support

Disadvantages
- Limited official support
- Compatibility issues sometimes

3. Distribution Methods of Application Software

1. Freeware
Free to use but source code not editable.
Examples: Adobe Reader, Skype.

2. Shareware
Initially free, but payment needed for full features.
Examples: WinRAR, IDM trial.

3. Commercial Software
Paid licensed software.
Examples: MS Office, Adobe Suite.

4. Subscription-Based Software
Users pay monthly or yearly charges.
Examples: Office 365, Google Workspace.

5. Software-as-a-Service (SaaS)
Cloud-based, accessed over internet.
Examples: Salesforce, Dropbox, Zoho CRM.

4. Advantages of Application Software

- Enhances productivity
- Easy to use for specific tasks
- Automates complex processes
- Improves accuracy and efficiency
- Enables professional-quality output

5. Disadvantages of Application Software

- Can be expensive
- Needs regular updates
- May require training
- Compatibility issues between software versions
- Security risks if not updated

6. Trends in Application Software

- **AI-powered applications** (ChatGPT, Copilot, AI writing tools)
- **Cloud-based applications**
- **Mobile-first software development**
- **Cross-platform and hybrid apps**
- **Low-code / No-code development tools**
- **Augmented & Virtual Reality apps**

1.3 Programming Software

1. Introduction to Programming Software

Programming software refers to **tools that help developers create, test, debug, and maintain computer programs**. These tools provide an environment where programmers can write code efficiently, organize large projects, test logic, and correct errors.

Programming software forms the backbone of software development and supports all stages of the Software Development Life Cycle (SDLC).

2. Functions of Programming Software

Programming software helps in:

- Writing source code in programming languages
- Editing and organizing code
- Compiling or interpreting programs
- Debugging errors
- Testing software functionality
- Documentation and version control
- Managing large software projects

3. Types of Programming Software

Programming software consists of several tools and categories:

A. Text Editors / Code Editors

Used for writing and editing programming code.

Features

- Syntax highlighting
- Auto-indentation
- Code suggestions (IntelliSense)

- Search and replace
- Extensions and plugins

Examples

- Notepad++
- Visual Studio Code
- Sublime Text
- Atom

B. Integrated Development Environments (IDE)

An IDE is a complete environment that integrates editor, compiler/interpreter, debugger, and project management tools.

Components of an IDE

- Code Editor
- Compiler/Interpreter
- Debugger
- Build automation tools
- UI designers
- Version control support

Examples

- Eclipse
- PyCharm
- Visual Studio
- NetBeans
- Android Studio
- Turbo C / Turbo C++

Advantages of IDEs

- Faster development
- Automatic error detection
- Easy project management
- Integrated testing and debugging

C. Compilers

A compiler translates **high-level programming code** into **machine language (binary)** in a single step.

Features

- Converts entire code at once
- Generates an executable file
- Provides error list after full compilation
- Optimization of code

Examples

- GCC (GNU Compiler Collection)
- Clang
- Microsoft C++ Compiler
- Java Compiler (javac)

Suitable Languages

- C, C++, Java, Go, Rust

D. Interpreters

An interpreter translates and executes code **line-by-line**.

Features
- Executes code step-by-step
- Easier debugging
- No separate executable file created

Examples
- Python Interpreter (CPython)
- Ruby Interpreter (MRI)
- JavaScript Engines (V8, SpiderMonkey)
- PHP Interpreter

Suitable Languages
- Python, JavaScript, Ruby, PHP

E. Debuggers

Used to test and detect errors ("bugs") in software.

Functions
- Breakpoints
- Step-in, step-out execution
- Variable analysis
- Memory dump
- Runtime behavior observation

Examples
- GDB (GNU Debugger)
- Visual Studio Debugger
- Chrome Developer Tools
- WinDbg

F. Assemblers

Convert **assembly language** into **machine code**.

Examples
- MASM (Microsoft Assembler)
- NASM (Netwide Assembler)
- GNU Assembler (GAS)

G. Linkers

Linkers combine multiple object files into a single executable program.

Functions
- Resolves function calls
- Manages libraries
- Produces final executable file

Examples
- LD (GNU Linker)
- MS Linker

H. Loaders

Loaders load programs into memory for execution.

Functions
- Allocate memory
- Load libraries
- Prepare the program for execution

I. Version Control Software
Used to track code changes, collaborate, and maintain project history.
Examples
- Git
- GitHub
- GitLab
- Bitbucket

Features
- Branching and merging
- Change history
- Collaboration
- Backup of code

J. Build Automation Tools
Used to compile, test, and deploy software automatically.
Examples
- Maven
- Gradle
- Jenkins
- Make

K. Testing Tools
Used to verify correctness and performance.
Examples
- JUnit
- Selenium
- Postman (API Testing)
- PyTest

L. Scripting Tools
Used for automating repetitive development tasks.
Examples
- Shell scripting (Bash)
- PowerShell
- Python scripts

4. Examples of Programming Languages and Their Tools

Language	Common Tools
C/C++	GCC, Clang, Visual Studio, Code::Blocks
Java	JDK, Eclipse, NetBeans, IntelliJ
Python	IDLE, PyCharm, VS Code, Jupyter
JavaScript	Node.js, npm, browser dev tools
PHP	XAMPP, WAMP, PHPStorm
Android	Android Studio, Gradle
.NET	Visual Studio, Roslyn

5. Advantages of Programming Software

- Increases development speed
- Improves accuracy and reduces bugs
- Helps manage complex projects
- Supports multiple programming languages
- Provides advanced debugging and testing tools
- Encourages collaboration through version control

6. Disadvantages of Programming Software

- Advanced IDEs require high system resources
- Learning curve for beginners
- Commercial tools may be expensive
- Compatibility issues between tool versions

7. Role of Programming Software in SDLC

Programming software supports these SDLC phases:

- **Development** – writing code
- **Testing** – detecting and fixing errors
- **Deployment** – building final software
- **Maintenance** – updating and enhancing code

1.4 Utility Software

1. Introduction to Utility Software

Utility software refers to **system support programs** that help manage, maintain, optimize, and secure the computer system.

They are not directly involved in performing user tasks, but they ensure **smooth, reliable, secure, and efficient functioning** of the system.

Utility software works alongside system software to:

- Improve performance
- Protect data
- Manage files
- Monitor system resources
- Perform backups and recovery

2. Characteristics of Utility Software

- Performs **specific maintenance tasks**
- Enhances the **functionality** of operating systems
- Focused on **system health, performance, and security**
- Lightweight and simple user interface
- Often works in the background

3. Types of Utility Software

Utility software can be classified into several categories:

A. File Management Utilities

These utilities help users manage, organize, and manipulate files and folders.

Examples

- File Explorer (Windows)
- Finder (MacOS)
- WinRAR
- 7-Zip

Functions

- Copy, paste, delete, rename
- Compress or decompress files
- Search and organize files
- Manage storage and partitions

B. Disk Management Utilities

These help manage hard disks and storage devices.

Examples

- Disk Cleanup
- Disk Management (Windows)
- CHKDSK
- Defragmentation tools
- Partition Manager

Functions

- Create, delete, or format partitions
- Defragment disk to boost speed
- Check and repair disk errors
- Remove temporary and junk files

C. Backup and Recovery Utilities

Used for creating copies of data and restoring them during system failures.

Examples

- Windows Backup & Restore
- Time Machine (Mac)
- Acronis True Image
- Cloud backup services (Google Drive, OneDrive)

Functions

- Automatic backup scheduling
- System restore
- File recovery
- Cloud and local backups

4. Security Utilities

Protect the system from threats such as viruses, malware, and unauthorized access.

Types & Examples

- **Antivirus:** Windows Defender, QuickHeal, McAfee
- **Anti-Malware:** Malwarebytes, Spybot
- **Firewall:** Windows Firewall, ZoneAlarm
- **Encryption Tools:** BitLocker, VeraCrypt

Functions

- Detect and remove threats
- Real-time protection
- Safe browsing
- Firewall monitoring
- Encrypt sensitive data

E. Performance Monitoring Utilities

These tools track and report the performance of system resources.

Examples

- Task Manager (Windows)
- Activity Monitor (MacOS)
- Resource Monitor
- CPU-Z
- GPU-Z

Functions

- Monitor CPU, RAM, disk, GPU usage
- Manage startup programs
- Kill unresponsive applications
- Performance analytics

F. Compression Utilities

These utilities reduce file size for storage and sharing.

Examples

- WinZip
- WinRAR
- 7-Zip
- RAR

Functions

- Compress large files
- Decompress ZIP, RAR, 7Z formats
- Password protection for archives
- Better storage management

G. Networking Utilities

Used to test, manage, and troubleshoot network connections.

Examples

- Ping
- Traceroute
- ipconfig / ifconfig
- FTP clients (FileZilla)
- Network analyzers (Wireshark)

Functions

- Test connectivity
- Diagnose network problems
- Manage file transfers
- Analyze network traffic

H. System Maintenance Utilities

Tools designed to improve overall system health and stability.

Examples

- CCleaner
- Glary Utilities
- System Restore
- Windows Update

Functions

- Remove junk files
- Manage registry
- Fix system issues
- Update OS and drivers

I. Device Management Utilities
Used to manage connected devices and drivers.
Examples
- Device Manager (Windows)
- Driver Booster
- Printer utilities

Functions
- Update drivers
- Install/uninstall hardware
- Troubleshoot device errors

J. File Conversion Utilities
Convert one file format into another.
Examples
- Format Factory
- PDF converters
- Audio/video converters

Functions
- Convert documents, images, videos, audio
- Reduce file format compatibility issues

K. Accessibility Utilities
These utilities help users with physical disabilities use a computer effectively.
Examples
- Magnifier, Narrator (Windows)
- Screen readers
- On-screen keyboard
- Speech-to-text tools

Functions
- Assist visually impaired users
- Support for keyboard/mouse disabled users
- Voice control tools

4. Importance of Utility Software
Utility software is essential because it:
- Improves system performance
- Prevents data loss
- Enhances computer security
- Simplifies file management
- Helps diagnose system issues
- Optimizes resource usage

Without utility software, systems would become slow, unprotected, and inefficient.

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5. Differences Between System Software and Utility Software

Feature	System Software	Utility Software
Purpose	Manages hardware and system operations	Maintains and optimizes system performance
Examples	OS, Drivers	Antivirus, Backup tools

Feature	System Software	Utility Software
Works	Always runs in background	Runs when needed
Dependency	Required for system operation	Enhances performance but not mandatory

6. Examples of Most Common Utility Software

- Windows Defender
- Disk Cleanup
- Recycle Bin
- WinRAR / 7-Zip
- CCleaner
- Backup and Restore
- BitLocker
- System Restore
- Device Manager
- Network Troubleshooter

1.5 Middleware Software

Introduction to Middleware Software

Middleware is a **software layer** that sits **between the operating system and application software** to enable communication, data exchange, and integration between different applications or distributed systems.

It acts as **"glue software"** that connects:

- Applications with other applications
- Applications with databases
- Applications with networks
- Applications with cloud services

Middleware is essential in **distributed computing**, **client–server architectures**, **enterprise software**, and **cloud environments**.

2. Need for Middleware

Modern applications require:

- Communication across networks
- Sharing of data between different platforms
- Integration of multiple systems
- Reliable message handling
- Transaction management

Middleware solves these challenges by:

- Enabling interoperability
- Simplifying complex communication
- Providing uniform interfaces
- Handling background connectivity

3. Characteristics of Middleware

- Supports **heterogeneous environments** (Windows, Linux, Mainframes, Cloud)
- Provides **communication abstraction**
- Enhances **scalability**
- Ensures **data consistency** in transactions
- Supports **security and authentication**
- Works **behind the scenes** for enterprise applications

4. Types of Middleware
Middleware is classified into several important categories:

A. Database Middleware (DB Middleware)
Connects applications to databases.
Examples
- ODBC (Open Database Connectivity)
- JDBC (Java Database Connectivity)
- ADO.NET
- Oracle Call Interface

Functions
- Standardized communication with different databases
- Query execution
- Data access & manipulation
- Connection pooling

B. Message-Oriented Middleware (MOM)
Supports communication between distributed applications using messaging.
Examples
- RabbitMQ
- Apache Kafka
- IBM MQ
- ActiveMQ

Functions
- Asynchronous communication
- Message queuing
- High reliability and load distribution
- Event-driven architecture support

C. Web Middleware / Web Application Servers
Enables web-based applications to communicate with server resources.
Examples
- Apache Tomcat
- IBM WebSphere
- Oracle WebLogic
- Nginx
- Microsoft IIS

Functions
- Hosting web applications
- Handling HTTP requests
- Managing sessions
- Load balancing

D. Transaction Processing Monitors
Ensure reliable processing of transactions in distributed applications.
Examples
- IBM CICS
- BEA Tuxedo
- Microsoft Transaction Server (MTS)

Functions

- Manages multi-step transactions
- Ensures ACID properties
- Fault tolerance
- Rollback in case of failure

E. Remote Procedure Call (RPC) Middleware

Allows applications to execute procedures on remote systems as if they were local.

Examples

- Java RMI
- XML-RPC
- gRPC

Functions

- Remote function calls
- Simplifies distributed computing
- Data serialization

F. Object Middleware

Supports communication between objects in distributed systems.

Examples

- CORBA (Common Object Request Broker Architecture)
- DCOM (Distributed Component Object Model)

Functions

- Object-to-object communication
- Interface definition through IDL

G. Middleware for Mobile & Cloud Computing

Enables applications to interact with cloud and mobile platforms.

Examples

- Firebase Cloud Messaging
- AWS Lambda Middleware
- Azure Service Bus
- Mobile Backend as a Service (MBaaS) tools

Functions

- Authentication
- Mobile push notifications
- Storage access
- API management

H. API Middleware / Integration Middleware

Handles API messaging, routing, and transformation.

Examples

- MuleSoft
- Dell Boomi
- Apigee API Management
- Postman (API Integration Testing)

Functions

- API calls routing
- Data transformation
- Security management
- Service orchestration

5. Features of Middleware
Middleware provides powerful capabilities:
1. Connectivity
Connects applications running on different platforms.
2. Interoperability
Allows systems developed in different languages to work together.
3. Security
Provides authentication, authorization, encryption.
4. Scalability
Supports large, enterprise-level environments.
5. Data Management
Handles data access, conversion, and transfer.
6. Reliability
Provides error handling, failover, and recovery.

6. Architecture of Middleware
Middleware generally sits between:
User Interface → Application Layer → Middleware → Database/Server Layer → Hardware/OS
It acts as a translator and coordinator across layers.

7. Real-World Examples of Middleware Use
1. E-commerce Systems
- Payment gateways
- Inventory systems
- Customer management

2. Hospital Information Systems (HIS)
- Lab, Pharmacy, Radiology, Billing modules connected via middleware

3. Banking Systems
- ATM networks communicating with banking servers

4. Airline Reservation Systems
- Real-time ticketing
- Seat allocation

5. Cloud & Mobile Apps
- Synchronization across multiple devices

8. Advantages of Middleware
- Simplifies application development
- Faster communication between systems
- Supports distributed and cloud environments
- Enables system integration
- Reduces code duplication
- Enhances performance with caching and queues

9. Disadvantages of Middleware
- Can be costly (enterprise middleware)
- Requires technical expertise
- Complexity in implementation
- Performance issues if not configured properly

1.6 Open-Source Software (OSS)

1. Introduction to Open-Source Software

Open-Source Software (OSS) refers to software whose **source code is publicly accessible**, allowing anyone to view, modify, use, and distribute it. OSS is built on transparency, collaboration, and community-driven development.

Key Principles

- **Free Redistribution:** Can be shared without restrictions.
- **Source Code Availability:** Must provide the human-readable source code.
- **Permission to Modify:** Users can enhance or adapt the software.
- **No Discrimination:** No restrictions on persons, groups, or fields of use.
- **License Integrity:** Rights are preserved even when redistributed.

2. Characteristics of Open-Source Software

1. **Transparency:** Users see how software works internally.
2. **Security:** Many developers inspect and improve code.
3. **Flexibility:** Can be customized for specific needs.
4. **Community Support:** Developers worldwide contribute.
5. **Cost-Effective:** Usually available free of cost.
6. **Platform Independent:** Many OSS tools support multiple operating systems.
7. **Frequent Updates:** Community-driven patches and improvements.

3. Advantages of Open-Source Software

A. Technical Advantages

- Enhanced reliability due to peer review.
- Scalability for small to enterprise-level applications.
- Easy integration with other systems.
- Strong documentation and community forums.

B. Business Advantages

- Reduction in licensing fees.
- No vendor lock-in.
- Freedom to modify and deploy widely.
- Long-term sustainability (supported by community).

4. Disadvantages of Open-Source Software

- **Limited official support** (compared to proprietary software).
- **Compatibility issues** with some hardware or specialized systems.
- **Security risks** if updates/patches are not managed promptly.
- **Steep learning curve** for some OSS tools.
- **No guaranteed service level agreement** (unless paid support is purchased).

5. Popular Open-Source Licenses

Open-Source Software is governed by licenses that define how software can be used and distributed. Some major licenses include:

1. GNU General Public License (GPL)

- Strong "copyleft."
- Any modifications must also be open-source.

2. MIT License
- Very permissive.
- Allows reuse, modification, and distribution even in commercial software.

3. Apache License 2.0
- Allows commercial use.
- Offers explicit patent protection.

4. BSD License
- Very flexible.
- Fewer restrictions on redistribution.

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6. Examples of Open-Source Software

Operating Systems
- Linux (Ubuntu, Fedora, Debian)
- FreeBSD

Office Suites
- LibreOffice
- Apache OpenOffice

Browsers
- Mozilla Firefox
- Chromium

Programming Languages
- Python
- PHP
- Java (OpenJDK)

Databases
- MySQL
- PostgreSQL
- MongoDB (Community Edition)

Graphic Tools
- GIMP
- Inkscape
- Blender

Server Tools
- Apache HTTP Server
- NGINX
- Docker (Community Edition)

7. Open-Source Software in Different Domains

Education
- Moodle (LMS)
- Koha (Library management)

Healthcare
- OpenMRS (Medical record system)
- OpenEMR (Electronic medical records)

Cloud & DevOps
- Kubernetes
- Terraform
- Jenkins

AI & Data Science

- TensorFlow (Open-source framework)
- Scikit-learn
- PyTorch

8. Open-Source Software Development Model

OSS development follows a community-driven approach:

1. Contributor Model

- Anyone can contribute using GitHub/GitLab.
- Maintainers review and accept contributions.

2. Version Control

- Mostly uses Git.
- Public repositories allow collaboration.

3. Release Cycle

- Frequent updates.
- "Stable" and "development" versions.

4. Community Structure

- Core maintainers
- Contributors
- Testers
- Users (feedback providers)

1.7 SUMMARY

Computer software refers to the set of programs and instructions that tell a computer how to perform tasks. It acts as an interface between the user and the hardware. Software is broadly classified into system software, such as operating systems and device drivers, and application software, such as word processors and spreadsheets. Without software, hardware cannot perform any meaningful work. Software makes computers useful by enabling users to create documents, analyze data, communicate, and manage information efficiently.

1.8 KEY WORDS

System Software – Software that manages hardware resources and controls basic computer operations.

Application Software – Programs designed to help users perform specific tasks like writing or calculations.

Operating System – The main software that controls and coordinates all activities of a computer.

Device Drivers – Specialized programs that allow the operating system to communicate with hardware devices.

Utility Software – Programs used for system maintenance such as antivirus and disk cleanup.

1.9 SELF-ASSESSMENT QUESTIONS

1. Explain the concept of computer software and its importance.
2. Describe the types of software with suitable examples.
3. Discuss the role and functions of an operating system.
4. Explain the difference between system software and application software.
5. Write an essay on the importance of utility software in computer systems.

1.10 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON- 4

COMPUTER NETWORKS

LEARNING OBJECTIVE

- Understand the concept and purpose of computer networks.
- Identify different types of networks such as LAN, MAN, and WAN.
- Explain the basic components of a network.
- Describe data communication and network architecture.
- Recognize the importance of networks in modern communication.

STRUCTURE

1.0 INTRODUCTION TO COMPUTER NETWORKS

A computer network is a collection of two or more computers and devices connected together to share resources such as data, hardware, and software.

Objectives of Networking

- Resource sharing (printers, storage, software)
- Data sharing and communication
- Cost reduction
- Reliability and availability
- Scalability

2. Components of a Computer Network

2.1 Hardware Components

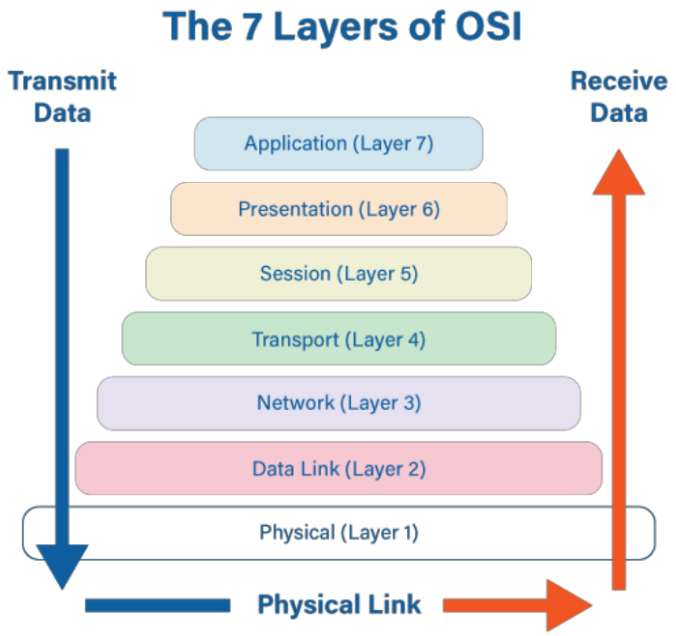
- Nodes (Computers/Servers): Devices that send/receive data
- Network Interface Card (NIC): Connects device to network
- Hub: Basic device that broadcasts data
- Switch: Smart device that forwards data to correct device
- Router: Connects different networks (LAN to WAN)
- Modem: Converts digital to analog signals and vice versa
- Access Point: Provides wireless connectivity

2.2 Transmission Media

- Guided Media (Wired):
  - Twisted Pair Cable (UTP/STP)
  - Coaxial Cable
  - Fiber Optic Cable

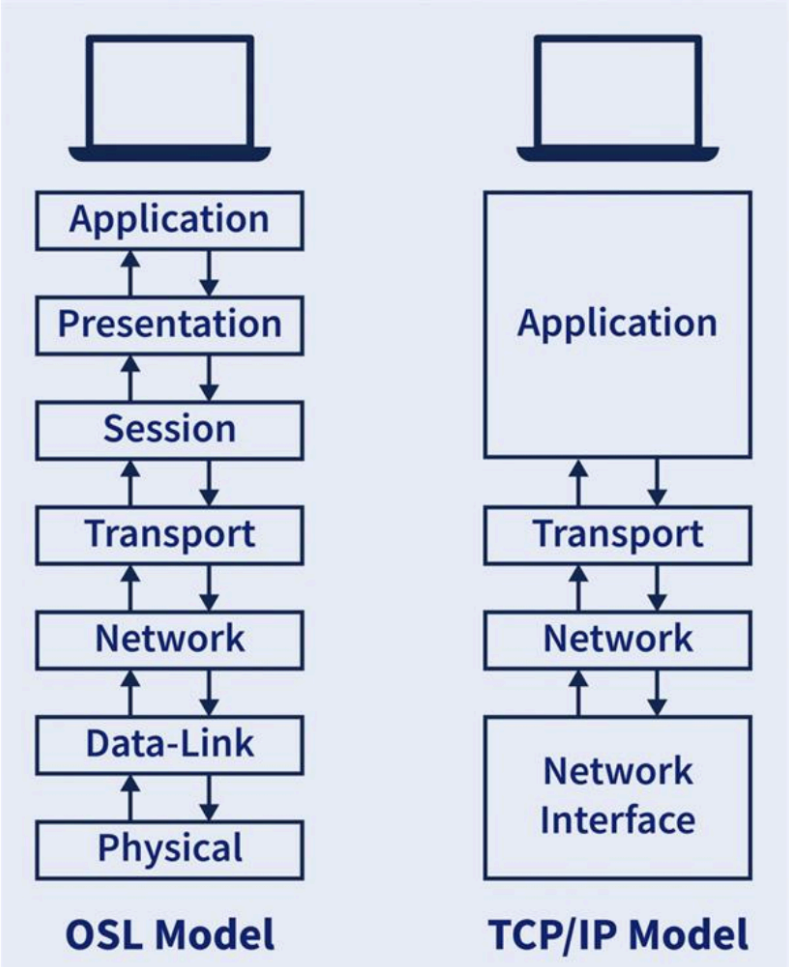
- Unguided Media (Wireless):
  - Radio Waves
  - Microwaves
  - Infrared
  - Satellite Communication

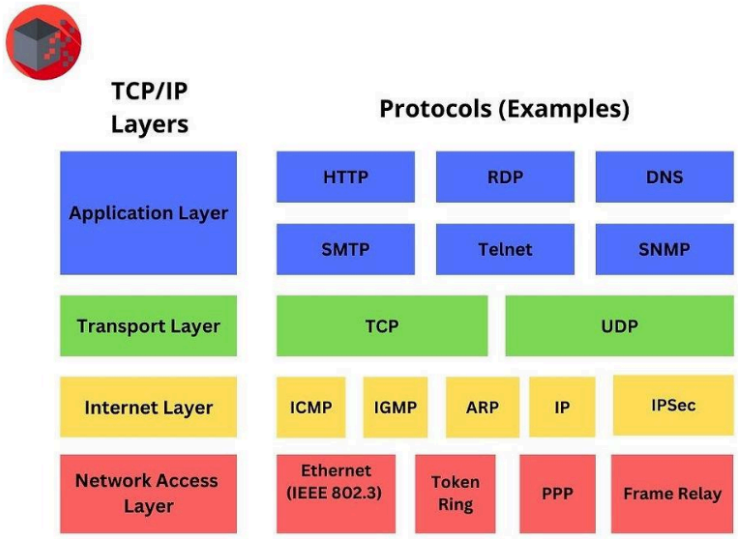
1.1 Network Models
1. OSI Model (7 Layers)



Layer	Name	Function
7	Application	User interface to network
6	Presentation	Data formatting and encryption
5	Session	Session management
4	Transport	End-to-end communication (TCP/UDP)
3	Network	Logical addressing (IP)
2	Data Link	MAC addressing and framing
1	Physical	Transmission of raw bits

2. TCP/IP Model





Layer	Function
Application	User services (HTTP, FTP, SMTP)
Transport	TCP, UDP
Internet	IP addressing and routing
Network Access	Physical transmission

3. Network Protocols

Common protocols used in networks:

- TCP (Transmission Control Protocol): Reliable, connection-oriented
- UDP (User Datagram Protocol): Fast, connectionless
- IP (Internet Protocol): Handles addressing and routing
- HTTP/HTTPS: Web communication
- FTP: File transfer
- SMTP: Sending emails
- DNS: Converts domain names to IP addresses
- DHCP: Automatically assigns IP addresses

4. IP Addressing

4.1 IPv4 Addressing

- 32-bit address (e.g., 192.168.1.1)
- Written in dotted decimal format

4.2 Classes of IP Addressing

Class	Range	Default Subnet Mask
A	1.0.0.0 – 126.0.0.0	255.0.0.0
B	128.0.0.0 – 191.255.0.0	255.255.0.0
C	192.0.0.0 – 223.255.255.0	255.255.255.0

4.3 IPv6 Addressing

- 128-bit addresses
- Example: 2001:0db8:85a3::8a2e:0370:7334

5. Switching Techniques

- Circuit Switching – Dedicated path (Example: Telephone networks)
- Packet Switching – Data sent in packets (Example: Internet)
- Message Switching – Entire message sent and stored

6. Routing and Routing Protocols

Types of Routing

- Static Routing
- Dynamic Routing

Common Routing Protocols

- RIP (Routing Information Protocol)
- OSPF (Open Shortest Path First)
- BGP (Border Gateway Protocol)
- EIGRP (Enhanced Interior Gateway Routing Protocol)

7. Network Security

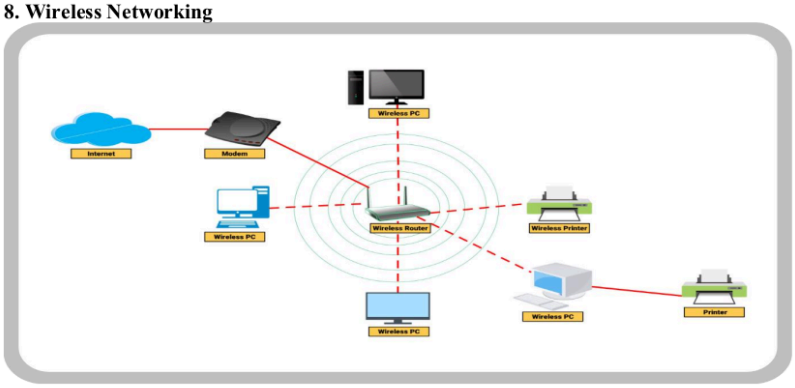
Common Network Threats

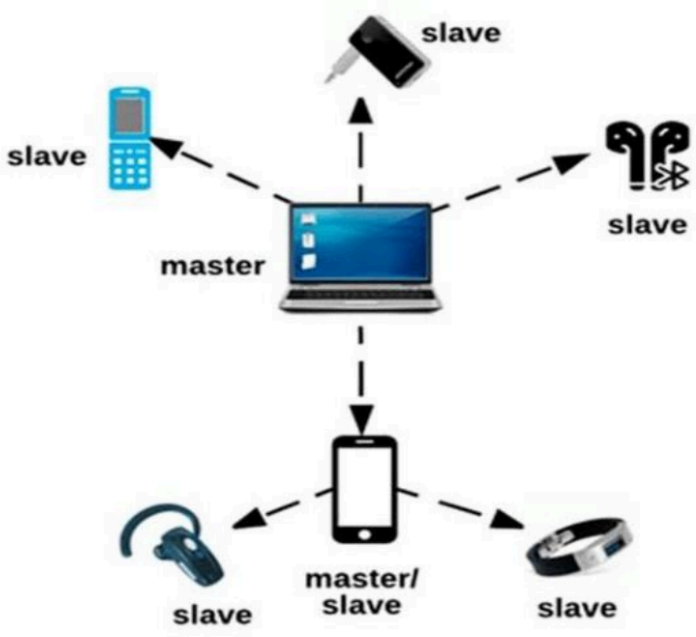
- Viruses
- Worms
- Trojans
- Phishing
- Denial of Service (DoS)

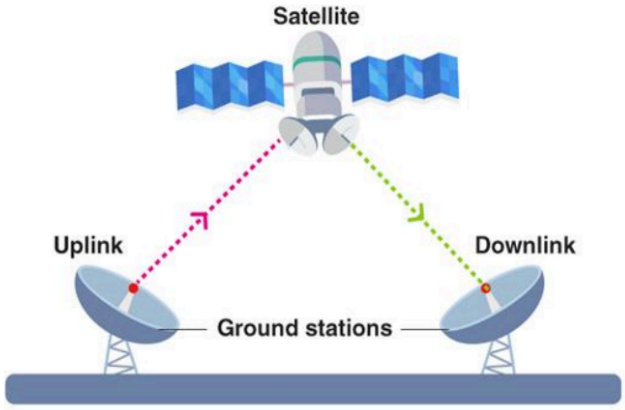
Security Mechanisms

- Firewalls
- Antivirus software
- Encryption
- VPNs (Virtual Private Networks)
- Intrusion Detection Systems (IDS)

8. Wireless Networking




slave
slave
slave
master
master/
slave
slave
slave


Satellite
Uplink
Downlink
Ground stations

9. Types of Wireless Networks

- Wi-Fi (IEEE 802.11)
- Bluetooth
- Cellular Networks (3G, 4G, 5G)
- Satellite Networks

10. Client–Server and Peer-to-Peer Models

Feature	Client–Server	Peer-to-Peer
Structure	Centralized	Decentralized
Control	Server controlled	No central control
Example	Web server	File sharing

11. Advantages and Disadvantages of Networks

Advantages

- Easy communication
- Resource sharing
- Data backup and recovery
- Centralized management

Disadvantages

- Security risks
- Setup cost
- Requires skilled management

1.2 Types of Computer Networks

Introduction

A **computer network** is a collection of interconnected computers and devices that communicate with each other to share data, hardware, and software resources. Networks are classified based on geographical coverage, purpose, ownership, and architecture.

2. Classification Based on Geographical Coverage

2.1 PAN (Personal Area Network)

Definition:

A Personal Area Network (PAN) is a very small network centered around an individual person.

Key Features:

- Range: 1–10 meters
- Uses Bluetooth, Infrared, or USB

Examples:

- Mobile phone connected to Bluetooth earphones
- Laptop connected to wireless mouse

Advantages:

- Low cost
- Easy to set up

2.2 LAN (Local Area Network)

Definition:

A Local Area Network (LAN) connects computers within a limited area such as a room, building, school, or hospital.

Key Features:

- High-speed communication
- Privately owned

Examples:
- Computer lab network in a college
- Office internal network

Advantages:
- Fast data transfer
- Easy resource sharing

Disadvantages:
- Limited geographical range

2.3 WLAN (Wireless Local Area Network)

Definition:
A Wireless LAN (WLAN) connects devices wirelessly using Wi-Fi technology.

Examples:
- Home Wi-Fi network
- Hotspots in cafes and airports

Advantages:
- No physical cables
- Mobility

Disadvantages:
- Security risks
- Signal interference

2.4 MAN (Metropolitan Area Network)

Definition:
A Metropolitan Area Network (MAN) covers an entire city or large campus.

Examples:
- City-wide cable TV network
- Metro rail communication network

Advantages:
- Larger coverage than LAN
- High-speed backbone

2.5 WAN (Wide Area Network)

Definition:
A Wide Area Network (WAN) covers a very large geographical area such as countries or continents.

Examples:
- The Internet
- Bank branch networking

Advantages:
- Global connectivity
- Access to remote resources

Disadvantages:
- Expensive infrastructure
- Slower than LAN

3. Classification Based on Purpose

3.1 SAN (Storage Area Network)

Definition:

A Storage Area Network (SAN) is a high-speed network that connects storage devices to servers.

Uses:

- Data centers
- Large organizations

3.2 CAN (Campus Area Network)

Definition:

A Campus Area Network (CAN) connects multiple LANs within a campus or organization.

Examples:

- University networks
- Corporate office campuses

3.3 VLAN (Virtual Local Area Network)

Definition:

A VLAN is a logical network that groups devices regardless of their physical location.

Advantages:

- Improved security
- Better traffic management

4. Classification Based on Network Architecture

4.1 Peer-to-Peer Network

Definition:

In this network, all computers have equal roles and can act as both client and server.

Advantages:

- Easy to set up
- Low cost

Disadvantages:

- Poor security
- Not suitable for large networks

4.2 Client–Server Network

Definition:

A central server provides services, and clients request them.

Advantages:

- Centralized control
- High security

Disadvantages:

- Server failure affects entire network
- Higher cost

5. Classification Based on Connection Method

5.1 Wired Networks

- Use cables (twisted pair, coaxial, fiber optic)
- High speed and stable

5.2 Wireless Networks

- Use radio signals (Wi-Fi, Bluetooth, cellular networks)
- More flexible but less secure

1.3 SUMMARY

A computer network is a group of interconnected computers and devices that communicate with each other to share data and resources. Networks allow users to share files, printers, internet connections, and applications efficiently. Depending on geographical coverage, networks can be classified as Local Area Network (LAN), Metropolitan Area Network (MAN), and Wide Area Network (WAN). Computer networks play a vital role in business, education, healthcare, and everyday communication through email, video calls, and cloud services.

1.4 KEYWORDS

LAN (Local Area Network) – A network that connects computers within a small geographical area like an office or school.
WAN (Wide Area Network) – A network that connects devices over large distances such as cities or countries.
Router – A device that forwards data packets between different networks.
Protocol – A set of rules that govern data communication between devices in a network.
Bandwidth – The maximum data transfer capacity of a network connection.

1.5 SELF-ASSESSMENT QUESTIONS

1. Explain the concept and advantages of computer networks.
2. Describe different types of networks with examples.
3. Discuss the major components of a computer network.
4. Explain the working of data communication in networks.
5. Write an essay on the role of computer networks in modern society.

1.6 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner*. Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-5

NETWORK TOPOLOGIES

LEARNING OBJECTIVES

- Understand the concept of network topologies.
- Identify different types of network topologies.
- Explain the structure and working of each topology.
- Compare advantages and disadvantages of various topologies.
- Select suitable topology based on network requirements.

STRUCTURE

1.0 Introduction to Network Topology

Network topology is the physical or logical arrangement of computers, cables, and other devices in a network. It defines how devices are connected and how data flows.

1.1 Bus Topology

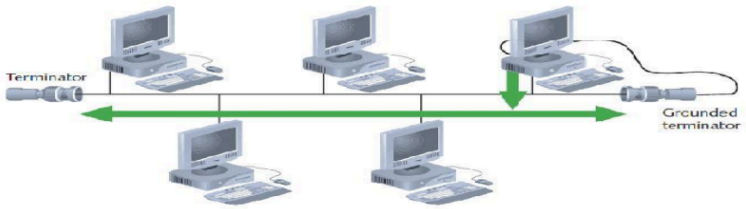


Diagram (Text Representation)

PC1 —— PC2 —— PC3 —— PC4 —— PC5

Explanation

All devices are connected to a single main cable (backbone). Data is broadcast in both directions.

Advantages

- Simple to install
- Low cost

Disadvantages

- Backbone failure stops the entire network
- Difficult troubleshooting

Uses

- Small temporary networks
- Laboratory testing

1.2 Star Topology

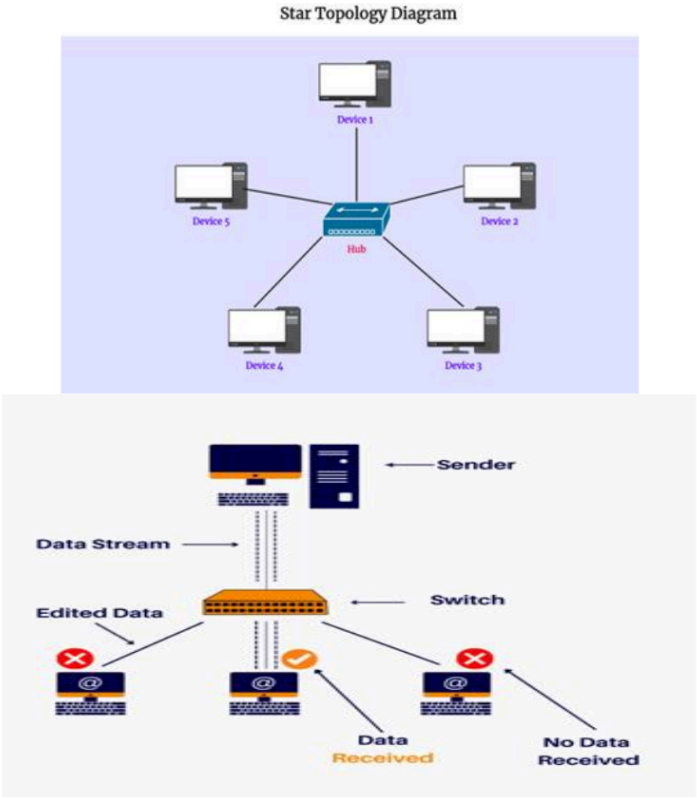


Diagram (Text Representation)

```
      PC1
       |
PC2 ── SWITCH ── PC3
       |
      PC4
```

Explanation

All devices connect to a central hub or switch. All communication passes through this central device.

Advantages

- Easy to manage and troubleshoot
- Failure of one node does not affect others

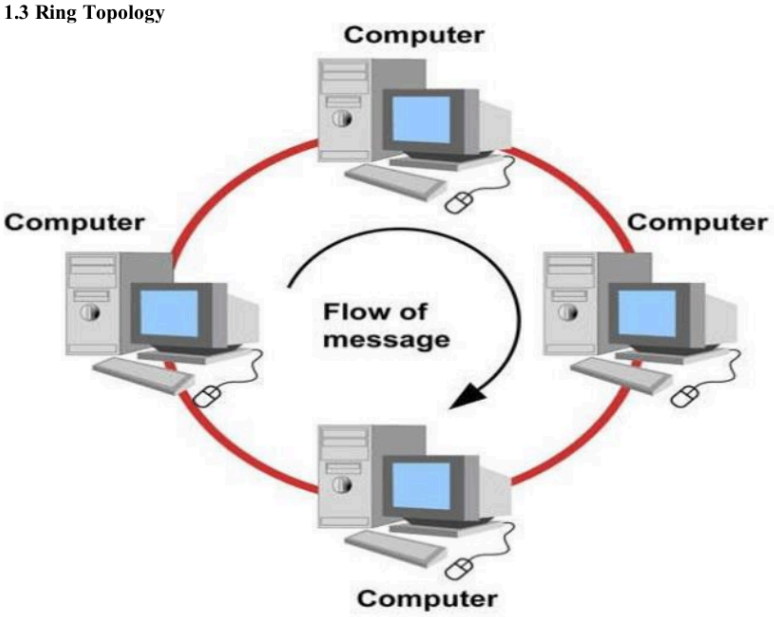
Disadvantages

- If central device fails, entire network stops
- More cables are required

Uses

- Office and school networks
- Modern LANs

1.3 Ring Topology



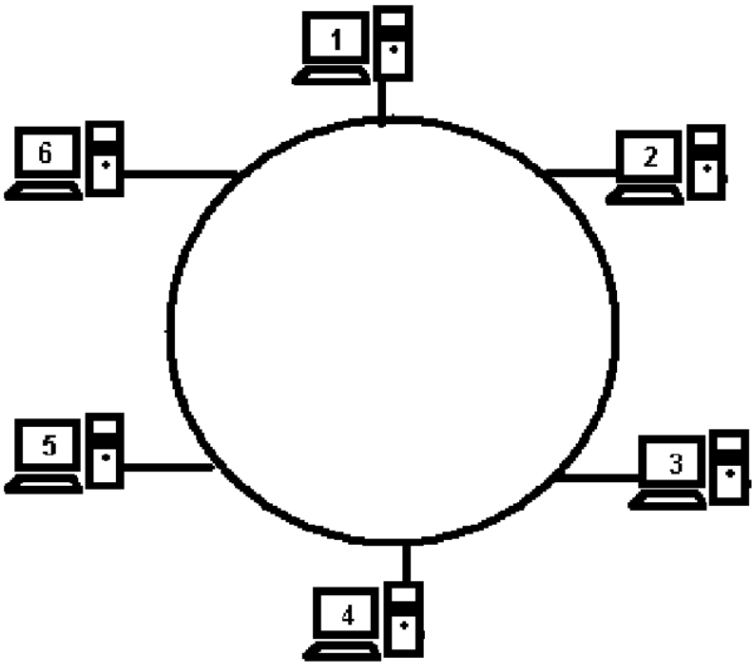


Diagram (Text Representation)

PC1 —— PC2 —— PC3 —— PC4

| |

|_____|

Explanation

Each device is connected to exactly two other devices. Data travels in a circular path.

Advantages

- No data collision
- Equal access to all devices

Disadvantages

- One break can disrupt entire network
- Difficult to reconfigure

Uses

- Token Ring networks (older systems)

1.4 Mesh Topology

Diagram (Text Representation)

```
PC1 ----- PC2
 | \     / |
 |  \   /  |
 |    X    |
 |  /   \  |
PC3 ----- PC4
```

Explanation

Each device is connected to every other device. There are two types:

- Full Mesh
- Partial Mesh

Advantages

- Very high reliability
- No single point of failure

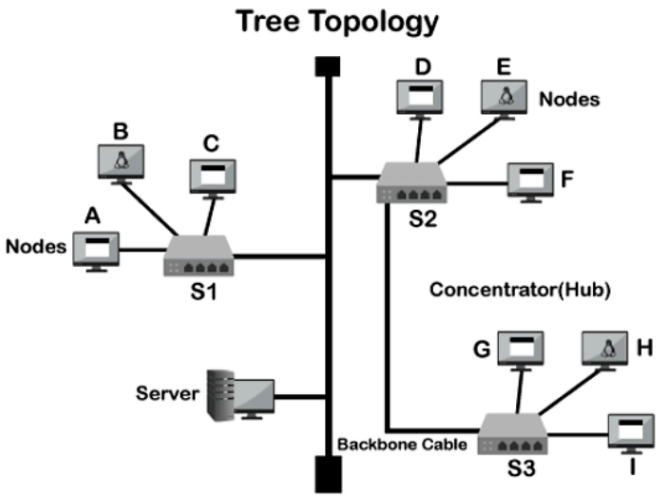
Disadvantages

- Very costly
- Complex cabling

Uses

- Military networks
- Critical communication systems

1.5 Tree Topology



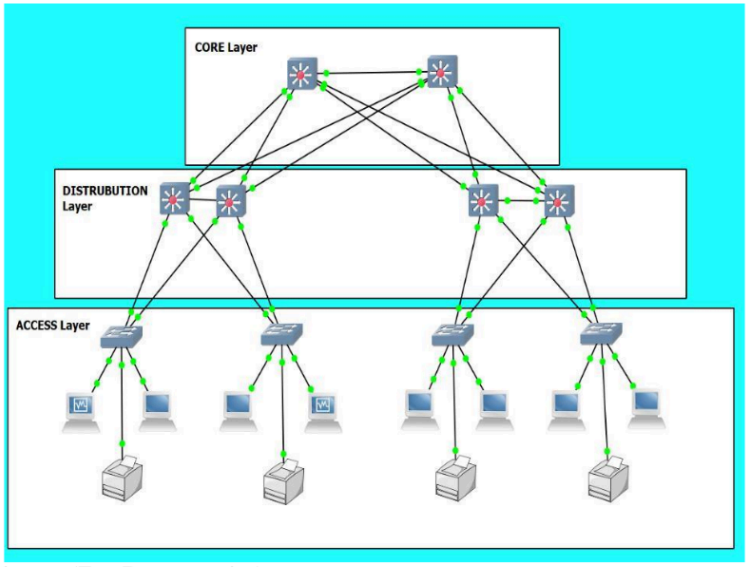


Diagram (Text Representation)

```
        MAIN HUB
      /   |   \
    HUB1  HUB2  HUB3
   / \     \
  PC1  PC2    PC3
```

Explanation

Combination of star and bus topologies. Works in hierarchical structure.

Advantages

- Easy network expansion
- Good for large organizations

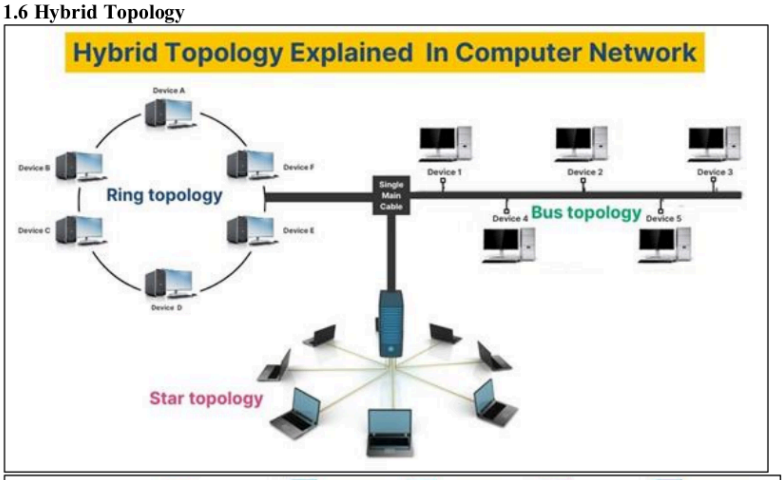
Disadvantages

- Dependency on backbone cable
- Complex setup

Uses

- Corporate networks
- Large buildings and campuses

1.6 Hybrid Topology



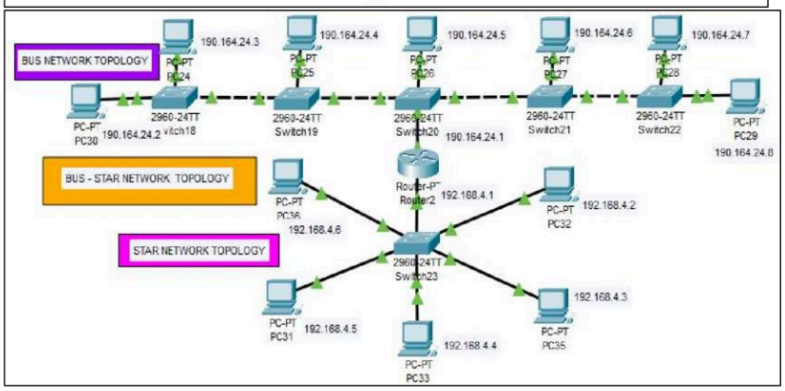


Diagram (Text Representation)

```
Star Network      Bus Network
   |                  |
— SWITCH ———————— Backbone ———— SWITCH —
   |                  |
  PCs                PCs
```

Explanation

Combination of two or more different topologies (Star + Bus, Star + Ring, etc.).

Advantages

- Flexible and scalable
- High fault tolerance

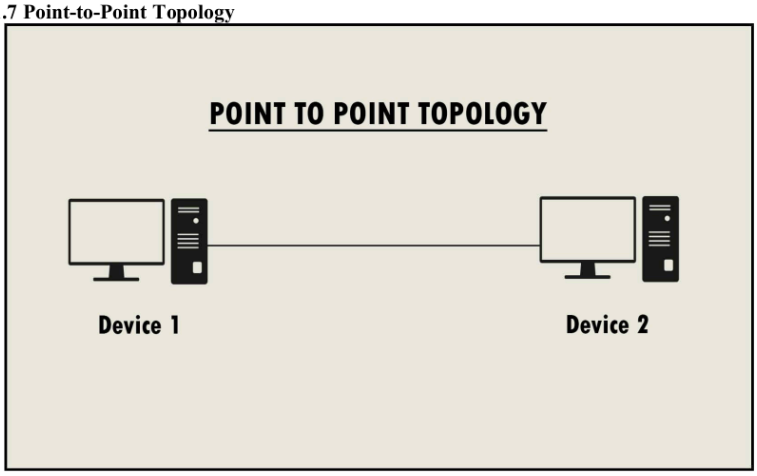
Disadvantages

- Complex design
- Expensive

Uses

- Large enterprises
- Data centers

1.7 Point-to-Point Topology



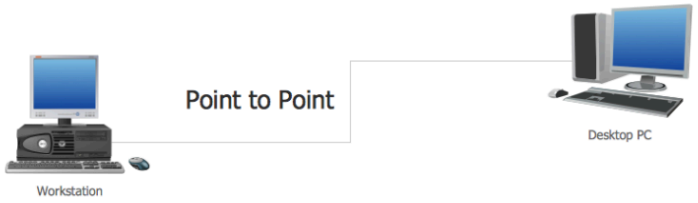


Diagram (Text Representation)
Computer A ———————— Computer B
Explanation
Direct connection between two devices.
Advantages

- Simple configuration
- High-speed communication

Disadvantages

- Not scalable for large networks

Uses

- Remote desktop connections
- Direct cable connections

1.8 SUMMARY

Network topology refers to the physical or logical arrangement of computers and devices in a network. It defines how nodes are connected and how data flows between them. Common types of topologies include bus, star, ring, mesh, and tree. Each topology has its own advantages and limitations in terms of cost, reliability, performance, and scalability. Choosing the right network topology is important for efficient communication and network management.

1.9 KEYWORDS

Bus Topology – A network structure where all devices are connected to a single central cable.
Star Topology – A network layout where all devices are connected to a central hub or switch.
Ring Topology – A configuration in which each device is connected to two other devices, forming a circular path.
Mesh Topology – A network design where devices are interconnected with multiple paths for reliable communication.
Tree Topology – A hierarchical network structure that combines characteristics of bus and star topologies

1.10 SELF-ASSESSMENT QUESTIONS

1. Explain the concept of network topology and its importance.
2. Describe different types of network topologies with their merits and demerits.
3. Compare star and bus topologies in terms of performance and reliability.
4. Explain mesh topology and its applications in real-world networking.
5. Write an essay on how to choose a suitable network topology for an organization.

1.11 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-6

INTERNET, INTRANET, EXTRANET & MIS

LEARNING OBJECTIVES

- Understand the concepts of Internet, Intranet, Extranet, and MIS.
- Differentiate between Internet, Intranet, and Extranet.
- Explain the role of MIS in organizational decision-making.
- Identify the applications of these systems in business and education.
- Recognize the importance of digital communication and information systems.

Structure

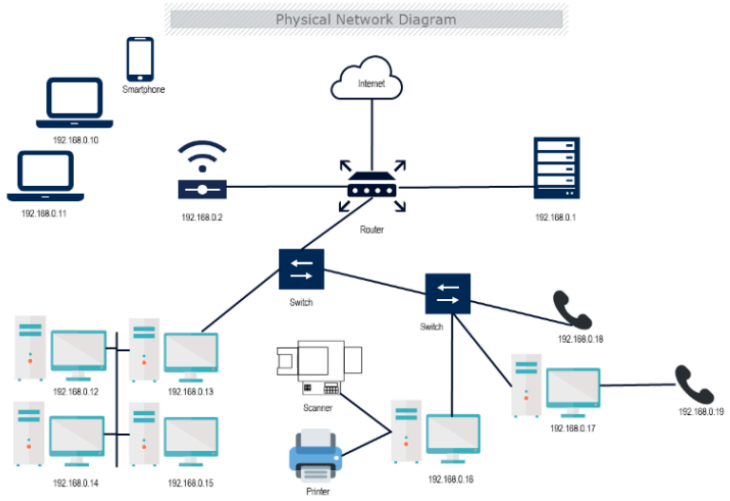
1.1 INTERNET

Definition

The **Internet** is a global network of interconnected computers and servers that allows worldwide communication and information sharing.

Key Features

- Worldwide connectivity
- Uses TCP/IP protocols
- Public access



Users
You stalk your friends on Instagram, which in turn...

Clients
...makes your computer request more data from the Internet...

Servers
...which servers fetch and return to you.

-

Services on the Internet

- Email
- World Wide Web (WWW)
- Social media
- Cloud services
- Video conferencing

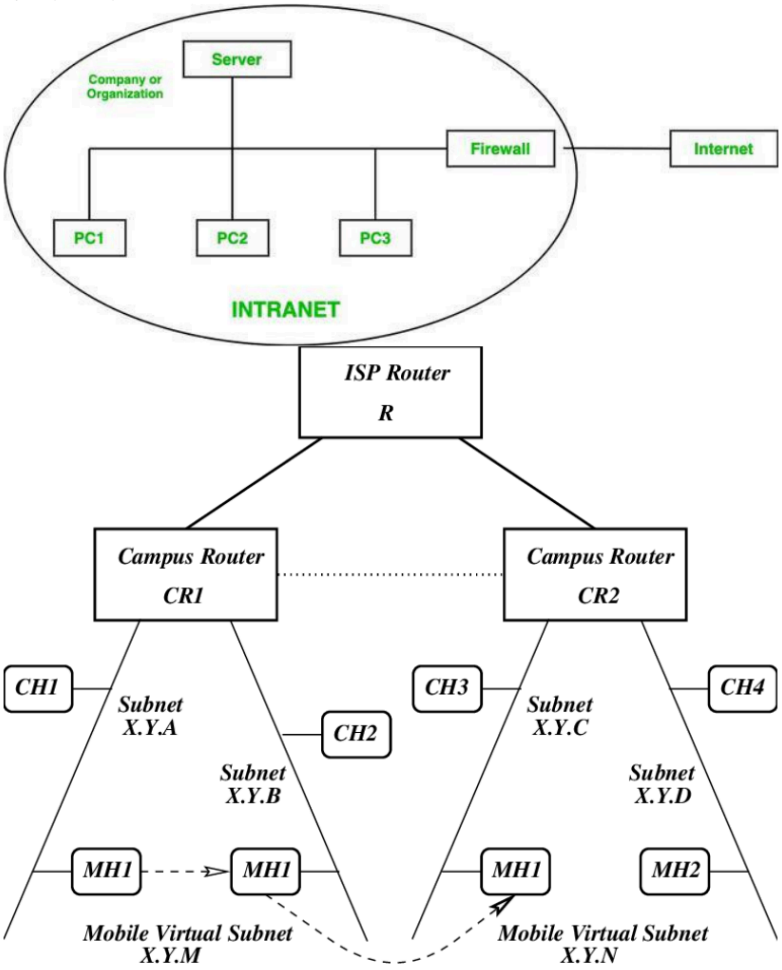
Advantages

- Global communication
- Easy access to information

Disadvantages

- Security risks
- Privacy issues

1.2 INTRANET



Definition

An **Intranet** is a **private network** used inside an organization. It uses internet technologies (web browsers and TCP/IP), but access is restricted to authorized users.

Key Features

- Internal communication
- Private and secured

Uses

- Employee portals
- Internal documents
- HR policies and manuals

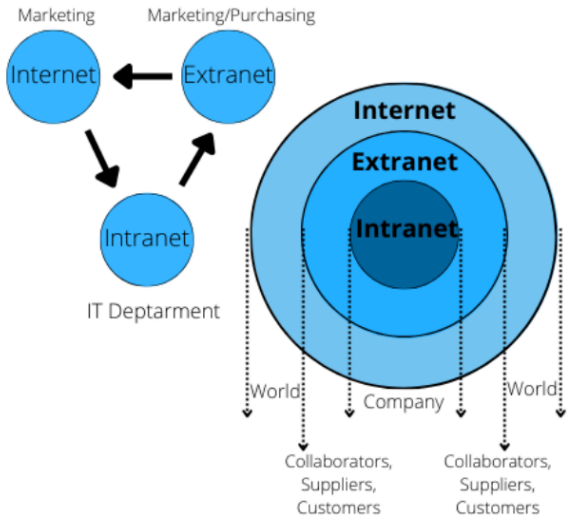
Advantages

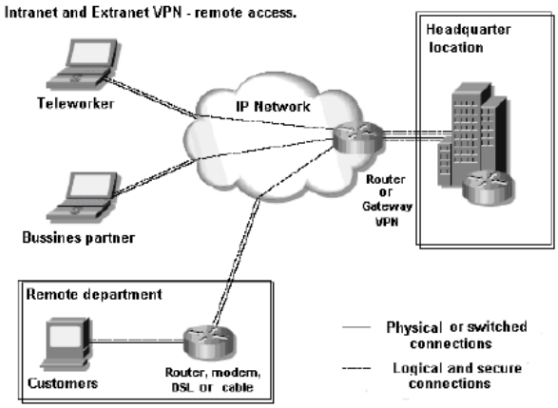
- Improved internal communication
- Secure information sharing

Disadvantages

- Limited access (inside organization only)
- Requires maintenance

1.3 EXTRANET





Definition

An **Extranet** is an **extension of an intranet** that allows controlled access to external users such as suppliers, vendors, or business partners.

Key Features

- Restricted external access
- Uses secure login and VPN

Uses

- Supplier portals
- Customer support portals
- Business partner communication

Advantages

- Improves business collaboration
- Secure data sharing with outsiders

Disadvantages

- Complex security management
- Setup cost is high

1.4 MIS (Management Information System)

Definition

MIS (Management Information System) is a computer-based system that collects, processes, stores, and distributes information to help managers make decisions.

MIS converts **raw data → useful information → reports for management**.

Components of MIS

- Hardware
- Software
- Data/Database
- People (Users)
- Procedures

Functions

- Data collection
- Data processing
- Report generation
- Decision support

Types of MIS Reports

- Periodic reports
- Summary reports
- Exception reports
- Real-time reports

Advantages

- Better decision making
- Improves planning and control
- Increases efficiency

Disadvantages

- Expensive setup
- Needs trained staff

1.5 Difference Table – Internet vs Intranet vs Extranet

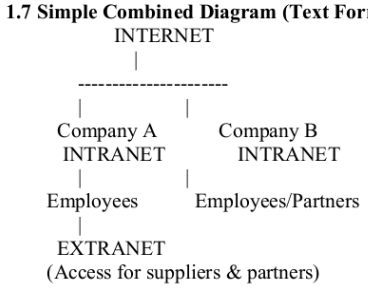
Point of difference	Internet	Intranet	Extranet
Accessibility of network	Public	Private	Private
Availability	Global system.	Specific to an organization.	To share information with suppliers and vendors it makes the use of public network.
Coverage	All over the world.	Restricted area up to an organization.	Restricted area up to an organization and some of its stakeholders or so.
Accessibility of content	It is accessible to everyone connected.	It is accessible only to the members of organization.	Accessible only to the members of organization and external members with logins.
No. of computers connected	It is largest in number of connected devices.	The minimal number of devices are connected.	The connected devices are comparable with Intranet.
Owner	No one.	Single organization.	Single/ Multiple organization.
Purpose of the network	Its purpose is to share information throughout the world.	Its purpose is to share information throughout the organization.	Its purpose is to share information between members and external, members.
Security	It is dependent on the user of the device connected to network.	It is enforced via firewall.	It is enforced via firewall that separates internet and extranet.

Users	General public.	Employees of the organization.	Employees of the organization which are connected.
Policies behind setup	There is no hard and fast rule for policies.	Policies of the organization are imposed.	Policies of the organization are imposed.
Maintenance	It is maintained by ISP.	It is maintained by CIO. HR or communication department of an organization.	It is maintained by CIO. HR or communication department of an organization.
Economical	It is more economical to use.	It is less economical.	It is also less economical.
Relation	It is the network of networks.	It is derived from Internet.	It is derived from Intranet.
Example	What we are normally using is internet.	WIPRO using internal network for its business operations.	DELL and Intel using network for its business operations.
Feature	Internet	Intranet	Extranet
Access	Public	Private (Internal)	Limited External
Users	Anyone	Organization employees	Employees + Partners
Security	Low	High	Very High
Example	Google, Email	Company portal	Supplier login portal

1.6 Difference Table – MIS vs Traditional System

Feature	Traditional System	MIS
Data Handling	Manual	Computerized
Speed	Slow	Fast
Accuracy	Low	High
Decision Making	Difficult	Easy

1.7 Simple Combined Diagram (Text Format)



1.8 SUMMARY

The Internet is a worldwide network that connects millions of computers and allows global communication and information sharing. An Intranet is a private network used within an organization to share internal information securely. An Extranet extends the intranet to trusted external users such as suppliers or partners. Management Information Systems (MIS) are

computer-based systems that collect, process, and provide information to support planning, control, and decision-making in organizations. Together, these systems improve communication, efficiency, and managerial effectiveness.

1.9 KEYWORDS

Internet – A global network that connects computers and devices worldwide.
Intranet – A private internal network used within an organization for secure communication.
Extranet – A controlled network that provides limited access to external users.
MIS (Management Information System) – A system that provides managers with information for effective decision-making.
Data Processing – The collection and manipulation of data to produce meaningful information.

1.10 SELF-ASSESSMENT QUESTIONS

1. Explain the concept and features of the Internet.
2. Differentiate between Internet, Intranet, and Extranet.
3. Discuss the role of Extranet in modern business organizations.
4. Explain the functions and importance of Management Information Systems (MIS).
5. Write an essay on how Internet technologies support MIS in organizations.

1.11 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-7

MICROSOFT WORD

LEARNING OBJECTIVES

- Understand the basic features and interface of MS Word.
- Create, edit, and format text documents.
- Use page layout and design tools effectively.
- Insert images, shapes, and symbols in documents.
- Save, print, and share documents securely.

STRUCTURE

1.0 INTRODUCTION TO MS WORD

Microsoft Word, commonly known as MS Word, is a popular word processing software used to create, edit, format, store, and print text documents. It is developed by Microsoft and is included as part of the Microsoft Office software package. MS Word allows users to prepare professional documents such as letters, reports, resumes, projects, works, books, and question papers with ease. It provides a user-friendly interface that helps both beginners and advanced users to work efficiently with text-based documents.

MS Word provides a wide range of basic and advanced features that make document creation simple and effective. Users can type text, change font styles, sizes, and colors, align paragraphs, and apply spacing to improve the visual appearance of documents. It also offers automatic spelling and grammar checking, which helps in reducing typing mistakes and improving the quality of written content. The software supports inserting pictures, tables, charts, symbols, and shapes, making documents more attractive and informative.

The MS Word window consists of several important components that help users work smoothly. The Title Bar displays the document name, while the Ribbon contains tabs such as Home, Insert, Page Layout, References, and Review, which organize tools into logical groups. The Quick Access Toolbar provides shortcuts for commonly used commands like Save, Undo, and Redo. The main working area is the document area, where users type and edit content. The Status Bar at the bottom shows information such as page number and word count, helping users track their progress.

MS Word also makes file management easy by allowing users to save documents in different formats. The default file format is .docx, while older versions use .doc. Users can save files in different locations such as computer drives, external devices, or cloud storage. MS Word also supports printing functionality, allowing users to preview documents before printing and select printing options such as page size, orientation, and number of copies.

Another important feature of MS Word is its ability to enhance productivity through tools such as templates, mail merge, and styles. Templates provide ready-made document formats for resumes, letters, and reports, saving time and effort. Mail Merge helps in creating multiple documents like invitation letters or certificates by combining a single template with a list of names and addresses. Styles allow uniform formatting throughout long documents, which is especially useful in academic and professional writing.

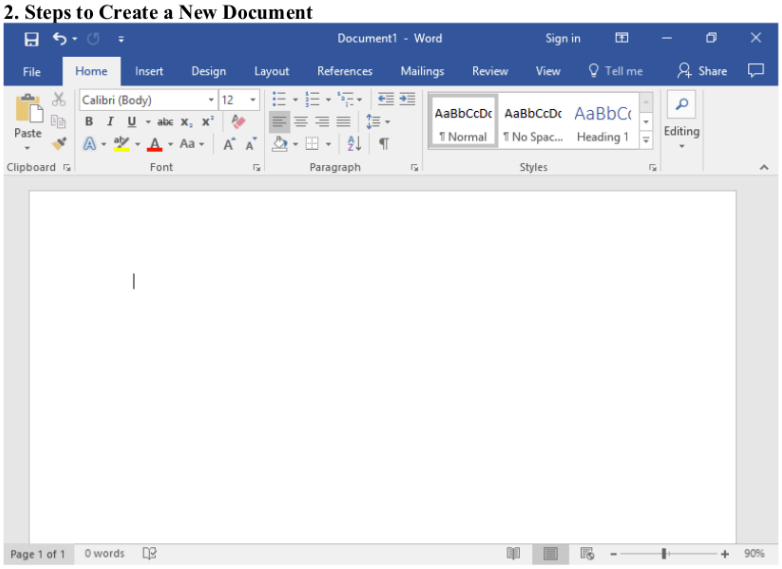
MS Word is widely used in education, business, and government organizations because it improves work efficiency and ensures professional document presentation. Its ease of use and powerful editing tools make it an essential application for students, teachers, office staff, and researchers. By learning MS Word, users can develop strong document preparation skills that are helpful in both academic and professional life.

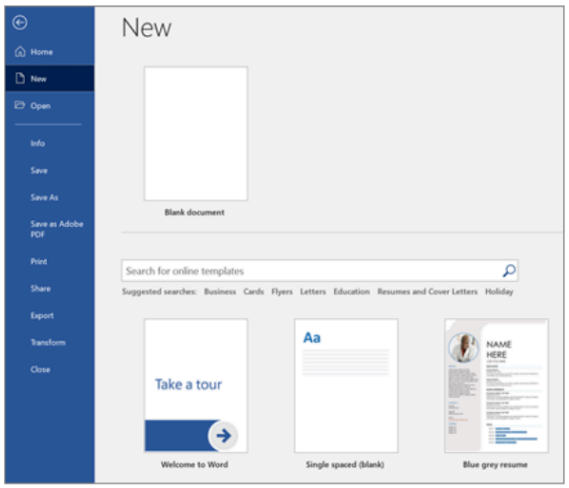
1.1 CREATION OF DOCUMENT IN MS WORD

1. What is Document Creation in MS Word?

Document creation in MS Word is the process of opening the software, starting a new file, typing content, formatting it, saving it, and preparing it for printing or sharing. It is the most basic and important skill in word processing.

2. Steps to Create a New Document





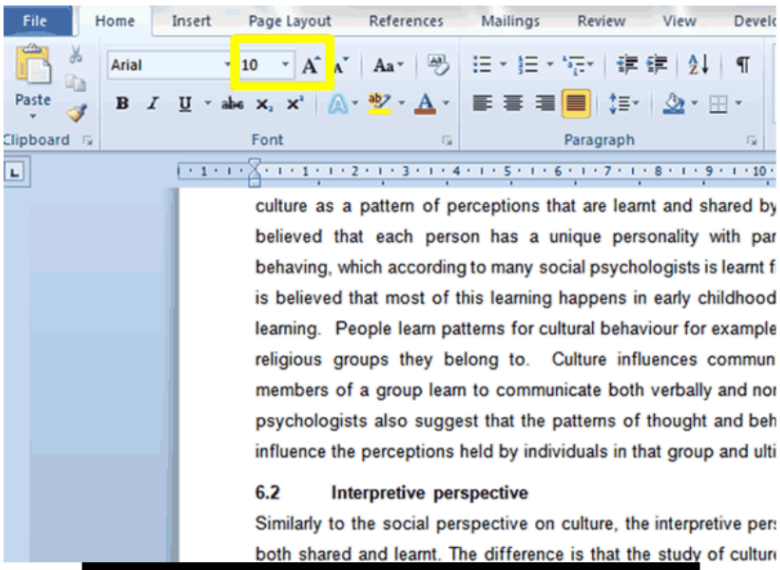
Method 1: Using Menu

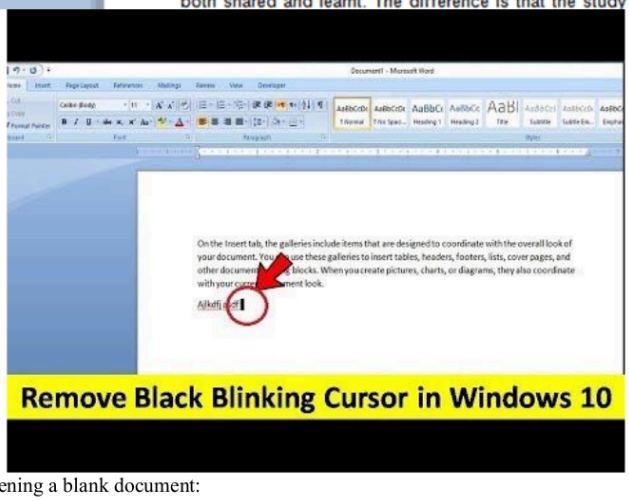
1. Open **Microsoft Word**
2. Click **File**
3. Click **New**
4. Select **Blank Document**

Method 2: Using Shortcut

Press:
Ctrl + N → New Document opens instantly

3. Typing Text in a Document

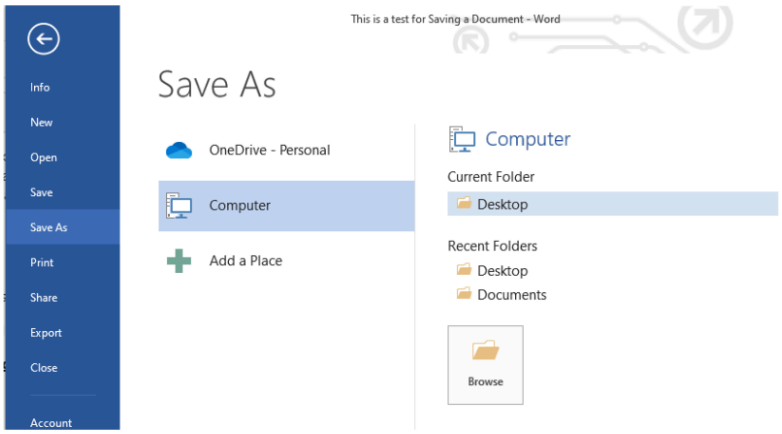




After opening a blank document:

- Place the cursor in the document area
- Start typing using the keyboard
- Use **Enter** for new paragraph
- Use **Backspace/Delete** to remove text

4. Saving a Document



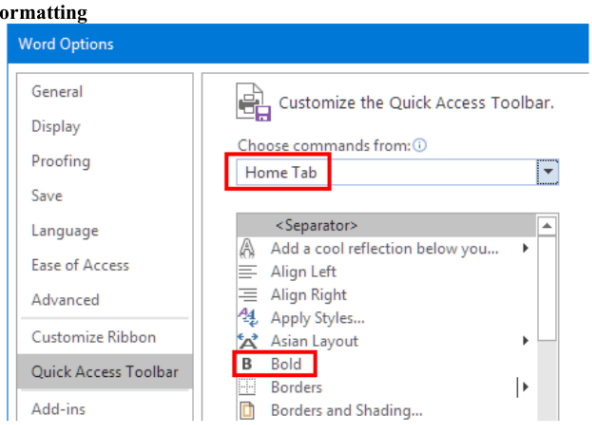
First Time Saving

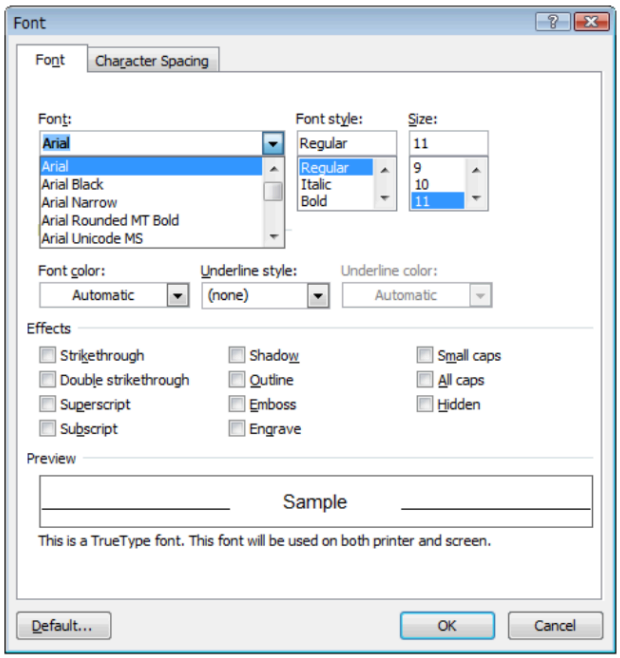
1. Click **File → Save As**
2. Choose location (This PC / Documents)
3. Type file name
4. Click **Save**

Shortcut:
Ctrl + S
File Types

- .docx → Default Word format
- .doc → Older format

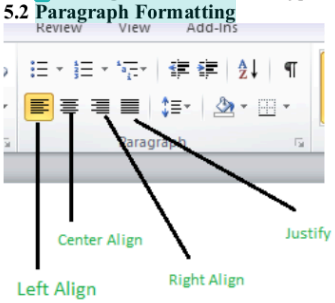
5. Basic Formatting of the Document
5.1 Text Formatting

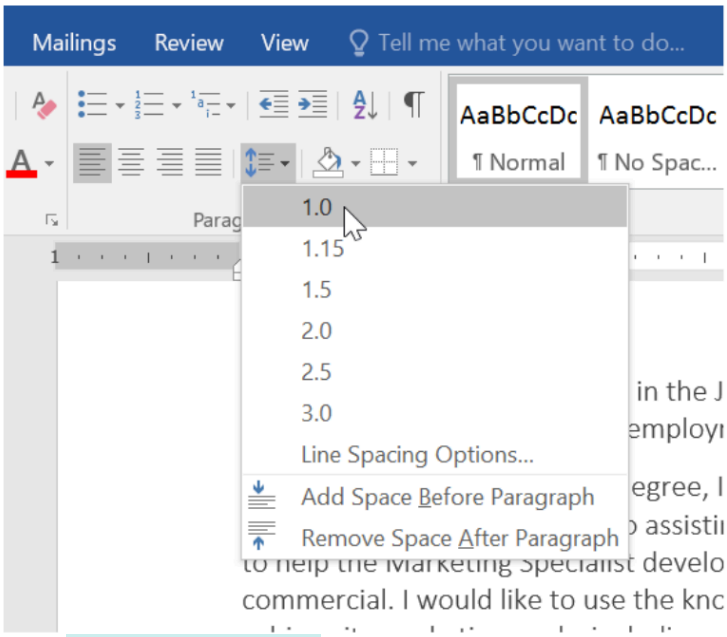




- **Bold** (Ctrl + B)
- *Italic* (Ctrl + I)
- Underline (Ctrl + U)
- Change font size and font type

5.2 Paragraph Formatting

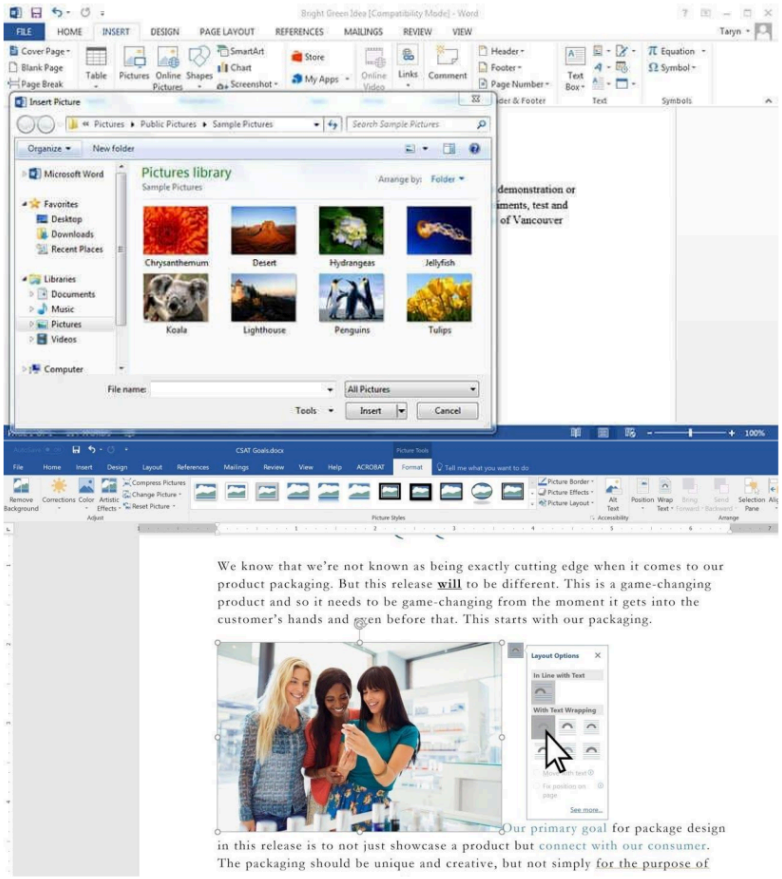




- Alignment: Left, Center, Right, Justify
- Line spacing
- Indentation

6. Inserting Elements into a Document

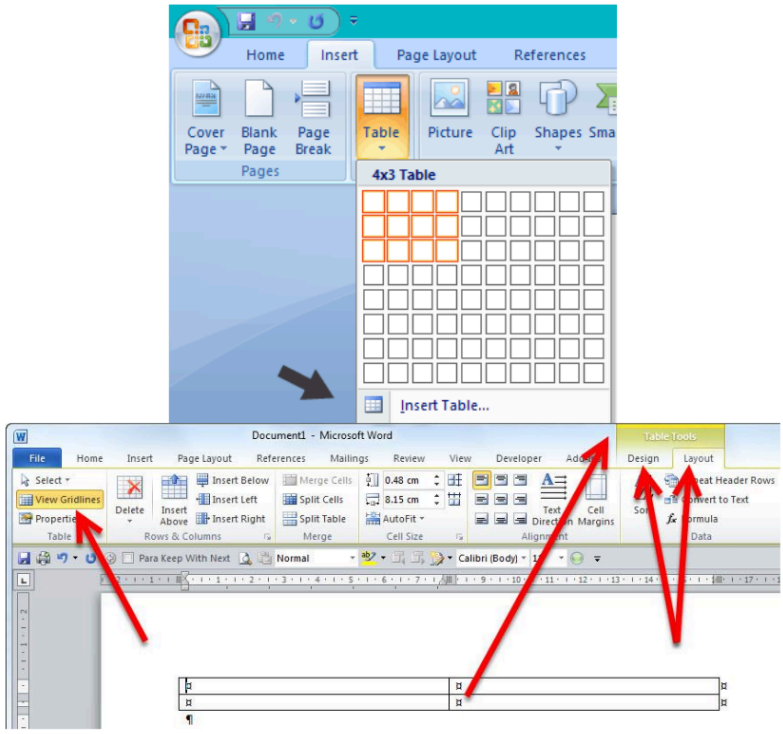
6.1 Inserting Pictures



Steps:

1. Click **Insert**
2. Click **Pictures**
3. Select image → Insert

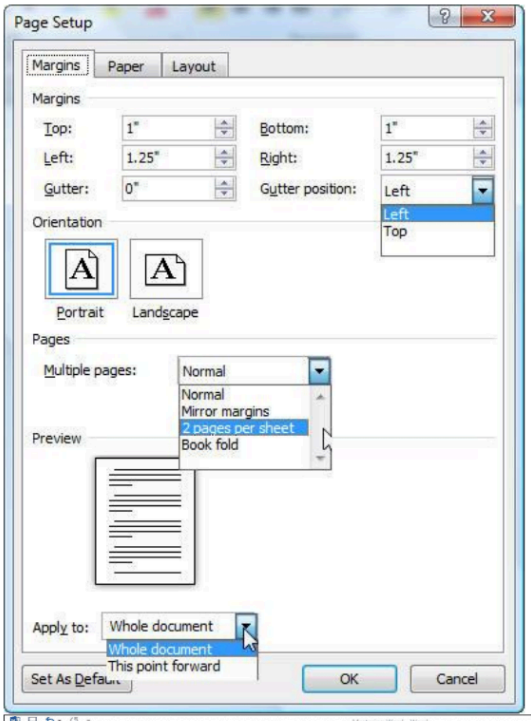
6.2 Inserting Tables

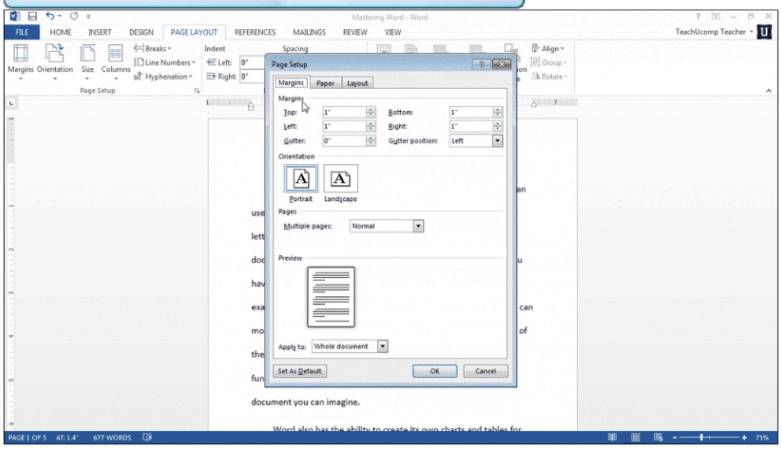


Ste[91]

1. Click **Insert**
2. Click **Table**
3. Select rows and columns

7. Page Setup of Document

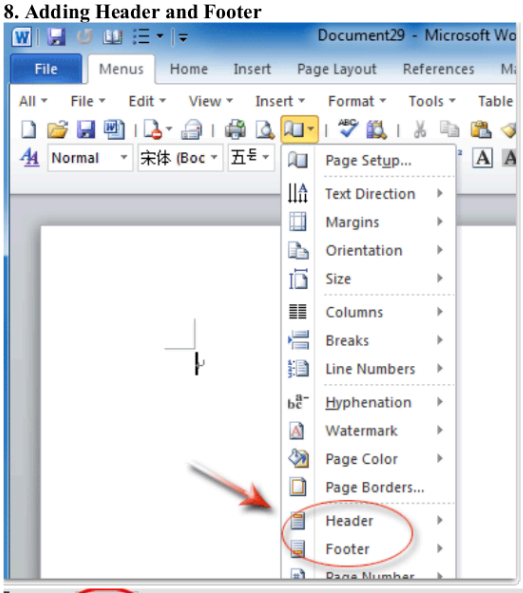

Page Setup
Margins
Paper
Layout
Margins
Top:
1"
Bottom:
1"
Left:
1.25"
Right:
1.25"
Gutter:
0"
Gutter position:
Left
Left
Top
Orientation
Portrait
Landscape
Pages
Multiple pages:
Normal
Normal
Mirror margins
2 pages per sheet
Book fold
Preview
Apply to:
Whole document
Whole document
This point forward
Set As Default
OK
Cancel

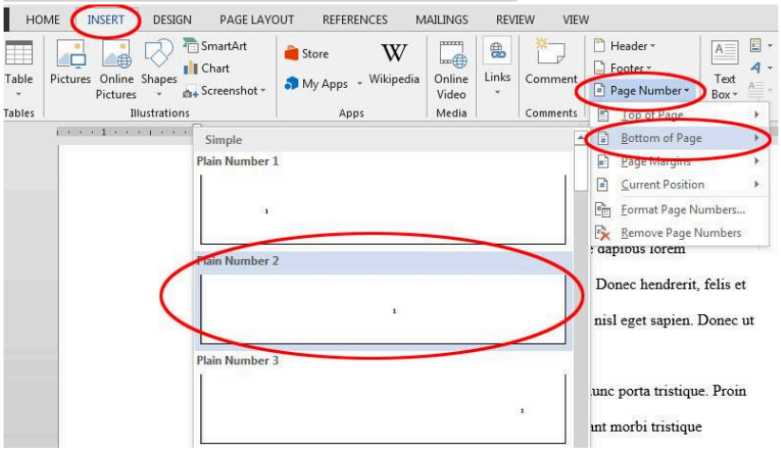


Options available:

- Margins
- Orientation (Portrait / Landscape)
- Paper size (A4, Letter)

8. Adding Header and Footer

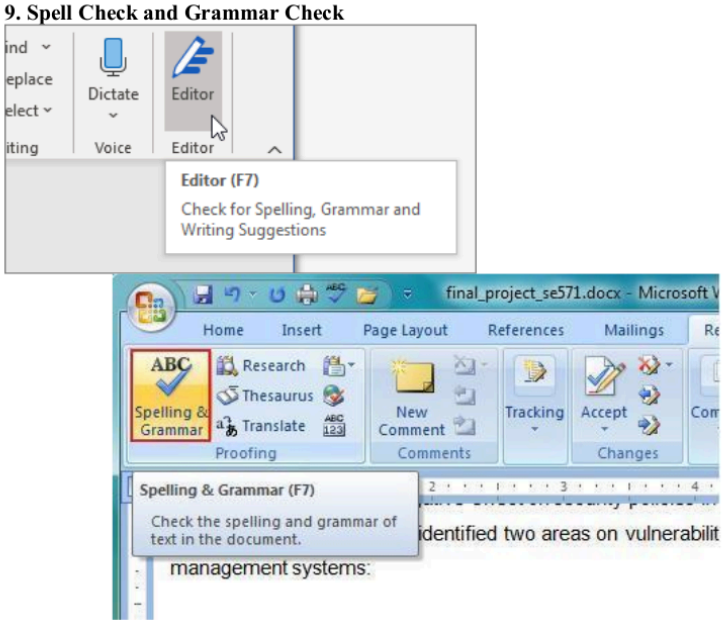




Steps:

1. Click **Insert**
2. Click **Header** or **Footer**
3. Type required content

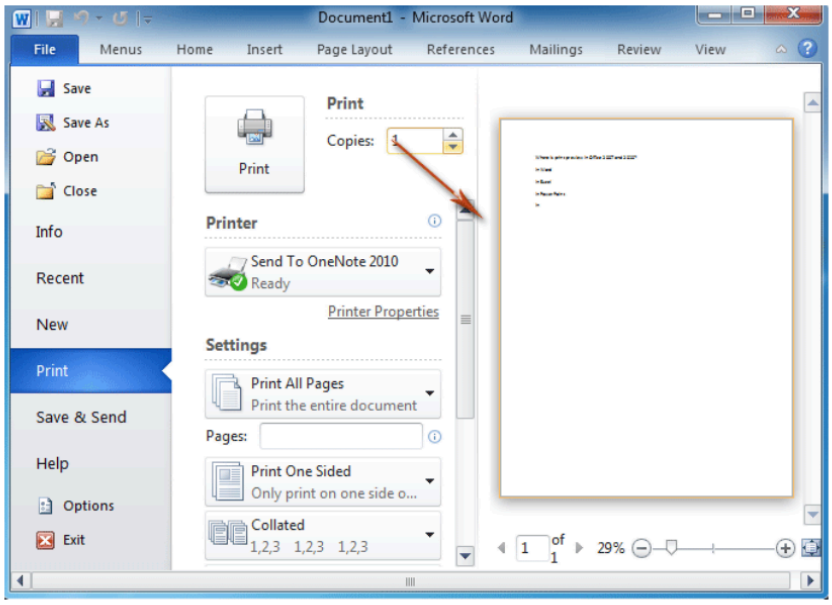
9. Spell Check and Grammar Check

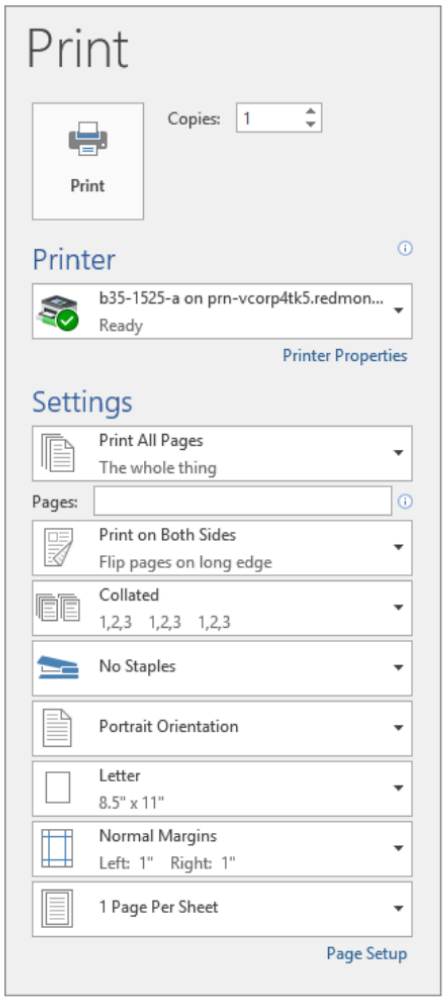


Steps:

1. Click **Review**
2. Click **Spelling & Grammar**

10. Printing the Document


Document1 - Microsoft Word
File
Menus
Home
Insert
Page Layout
References
Mailings
Review
View
Save
Save As
Open
Close
Info
Recent
New
Print
Save & Send
Help
Options
Exit
Print
Print
Copies:
Printer
Send To OneNote 2010
Ready
Printer Properties
Settings
Print All Pages
Print the entire document
Pages:
Print One Sided
Only print on one side o...
Collated
1,2,3 1,2,3 1,2,3
1
of 1
29%



Steps:

1. Click **File**
2. Click **Print**
3. Choose printer
4. Click **Print**

11. Simple Flow Diagram of Document Creation Process

Open MS Word
↓
Create New Document
↓
Type Content
↓
Format Text & Page
↓
Save Document
↓
Print / Share

1.2 SUMMARY

MS Word is a powerful word processing application used to create professional documents such as letters, reports, and resumes. It provides tools for text formatting, page layout, spelling and grammar checking, and document design. Users can insert pictures, shapes, headers, footers, and page numbers to enhance the appearance of documents. MS Word improves productivity by making document creation, editing, and sharing easy and efficient.

1.3 KEYWORDS

Word Processor – A software application used to create, edit, and print text documents.
Formatting – The process of changing the appearance of text using fonts, styles, and alignment.
Spell Check – A tool that automatically detects and corrects spelling errors.
Page Layout – The arrangement of text and images on a document page.
Templates – pre-designed document layouts used to create documents quickly.

1.4 SELF-ASSESSMENT QUESTIONS

1. Explain the features and uses of MS Word in document creation.
2. Describe various text formatting tools available in MS Word.
3. Discuss the importance of page layout settings in MS Word.
4. Explain the process of inserting and editing images in MS Word.
5. Write an essay on the advantages of using MS Word for professional documentation.

1.5 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-8
ORGANIZING INFORMATION WITH TABLES AND OUTLINES IN MS WORD

LEARNING OBJECTIVES

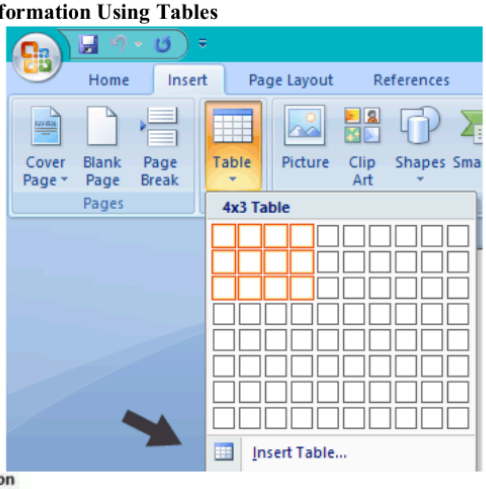
- Understand the purpose of tables and outlines in documents.
- Create and format tables in MS Word effectively.
- Use outline tools to structure long documents.
- Apply styles for better document organization.
- Improve readability and presentation of information.

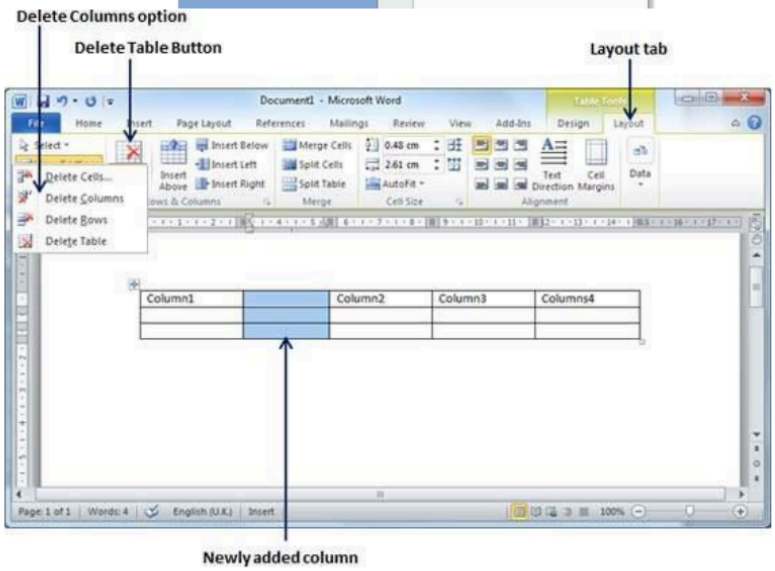
STRUCTURE

1.0 INTRODUCTION

Organizing information in **MS Word (Microsoft Word)** helps present content in a clear, structured, and professional way. Two powerful tools used for organizing data are **Tables** and **Outlines**. Tables arrange information in rows and columns, while outlines organize content using headings and hierarchical levels.

1.1 Organizing Information Using Tables





What is a Table?

A **table** is a grid that contains **rows and columns** used to organize data systematically.

How to Create a Table

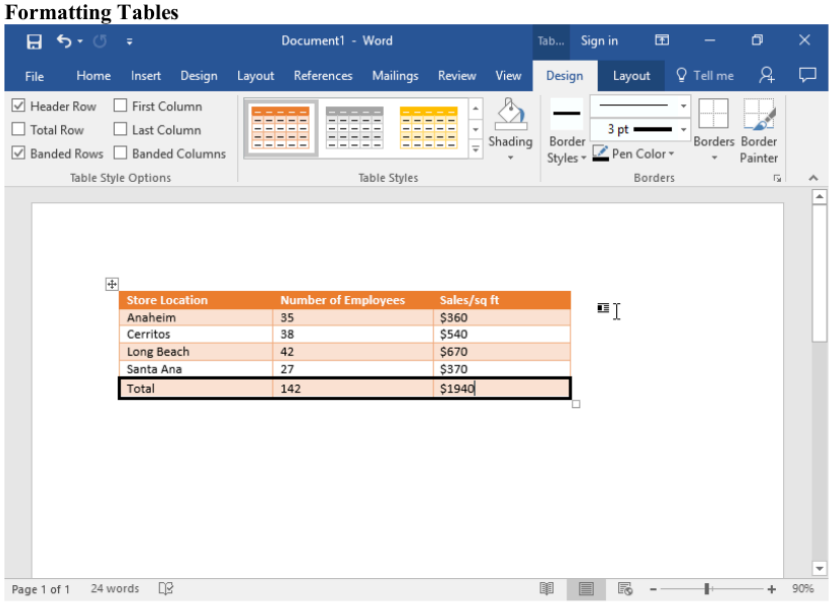
Steps:

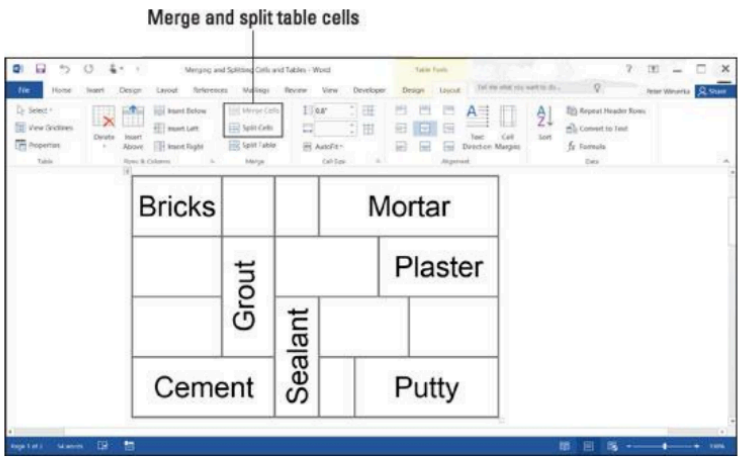
1. Click the **Insert** tab
2. Click **Table**
3. Select number of rows and columns
4. Click to insert the table

Sample Diagram (Text Representation)

```
+---------+---------+---------+
| Name    | Class   | Marks   |
+---------+---------+---------+
| Rahul   | 10th    | 85      |
| Anjali  | 10th    | 90      |
| Suresh  | 10th    | 88      |
+---------+---------+---------+
```

Formatting Tables

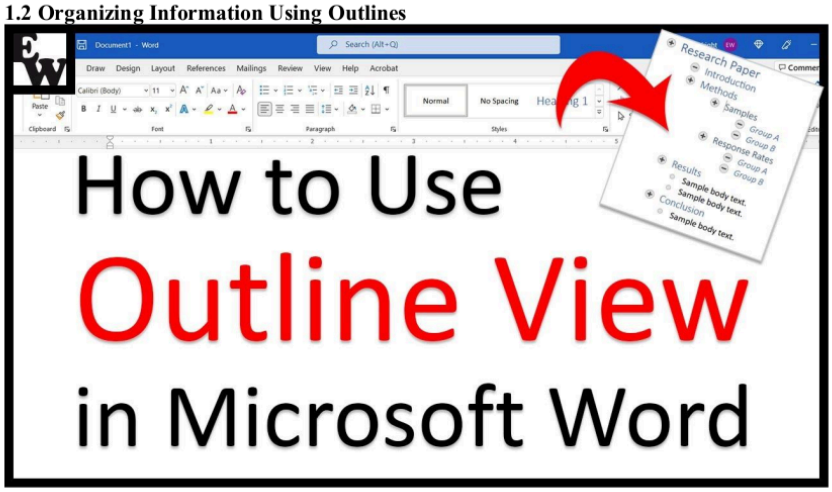


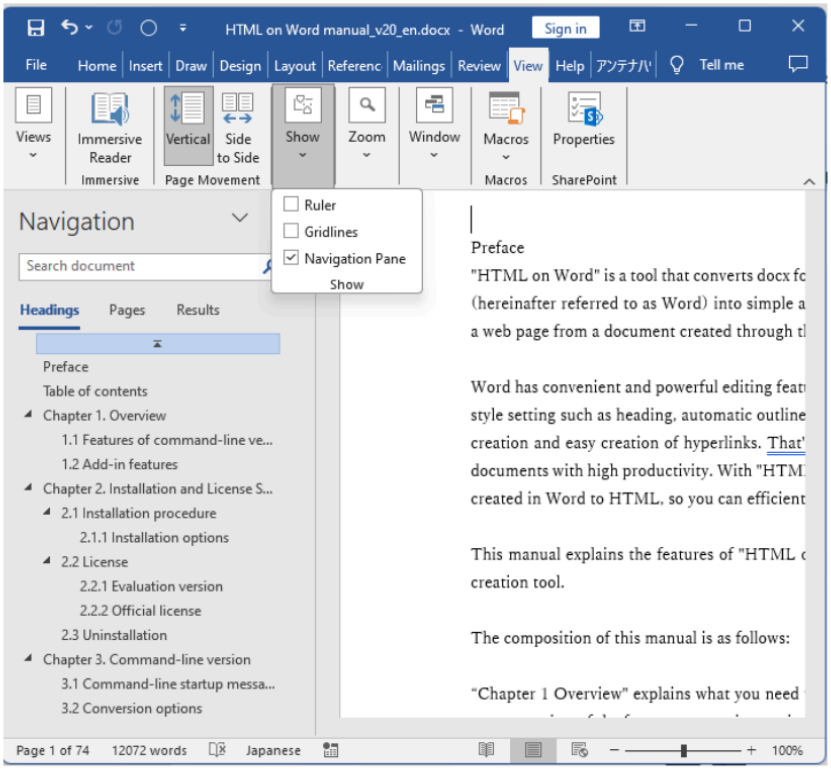


You can:

- Change border styles
- Shade cells with colors
- Merge and split cells
- Adjust row height and column width

1.2 Organizing Information Using Outlines





What is an Outline?

An **outline** arranges content in a **hierarchical structure** using headings and subheadings.

Example structure:

I. Chapter One
  A. Introduction
  B. Objectives
II. Chapter Two
  A. Methods
  B. Results

Using Outline View in MS Word

Steps to use Outline:

1. Click **View** tab
2. Select **Outline View**
3. Use **Heading Styles** (Heading 1, Heading 2, Heading 3)

Sample Outline Diagram (Text Representation)

Title: Computer Networks

```
|
├── 1. Introduction
|     ├── 1.1 Definition
|     └── 1.2 Advantages
|
├── 2. Types of Networks
|     ├── 2.1 LAN
|     └── 2.2 WAN
|
└── 3. Conclusion
```

1.3 Difference Between Tables and Outlines

Feature	Tables	Outlines
Structure	Rows and columns	Hierarchical headings
Best for	Numerical or tabular data	Large documents & chapters
View	Grid format	Tree-like format

1.4 Practical Uses

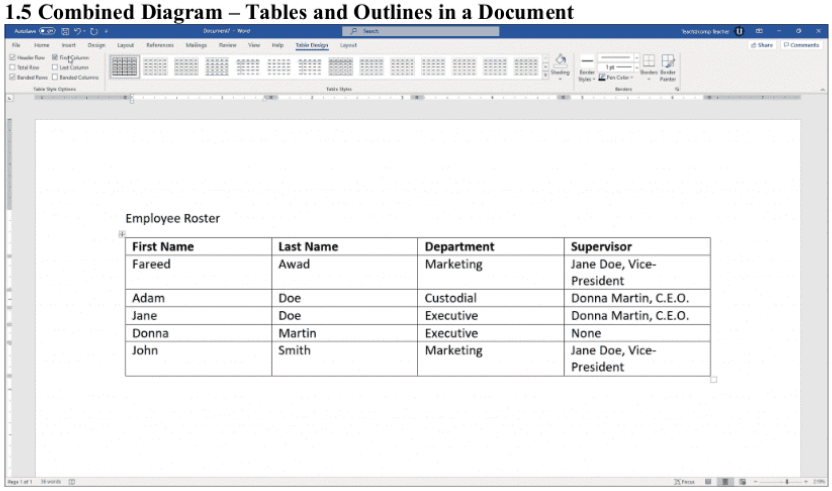
Tables are commonly used to prepare:

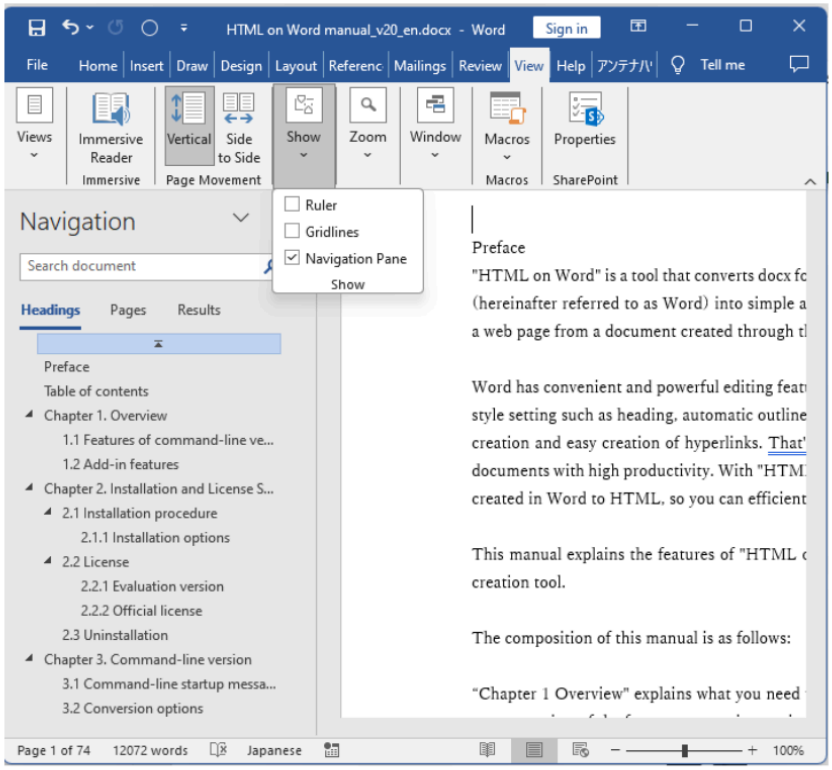
- Mark sheets
- Timetables
- Financial reports

Outlines are used for:

- Project reports
- Books and manuals
- Research documents

1.5 Combined Diagram – Tables and Outlines in a Document





1.6 Mail Merge in Ms Word

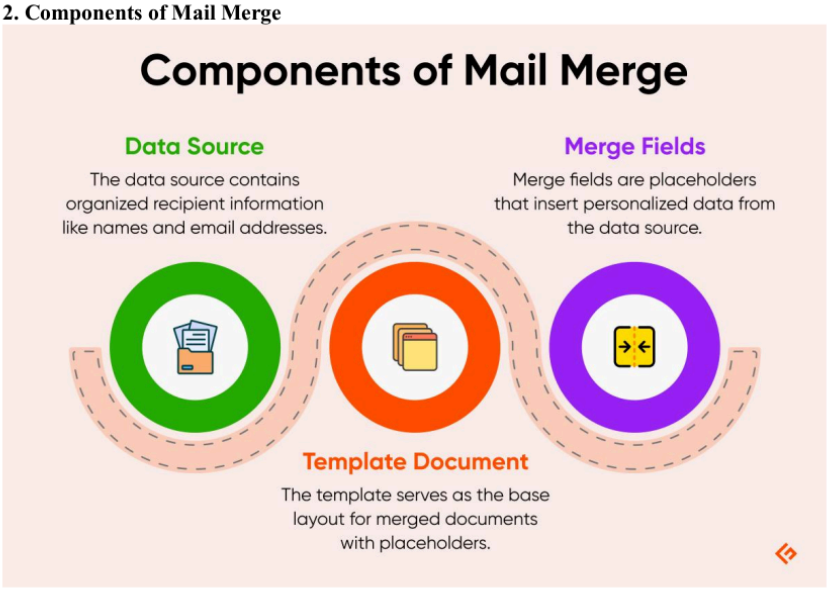
Definition

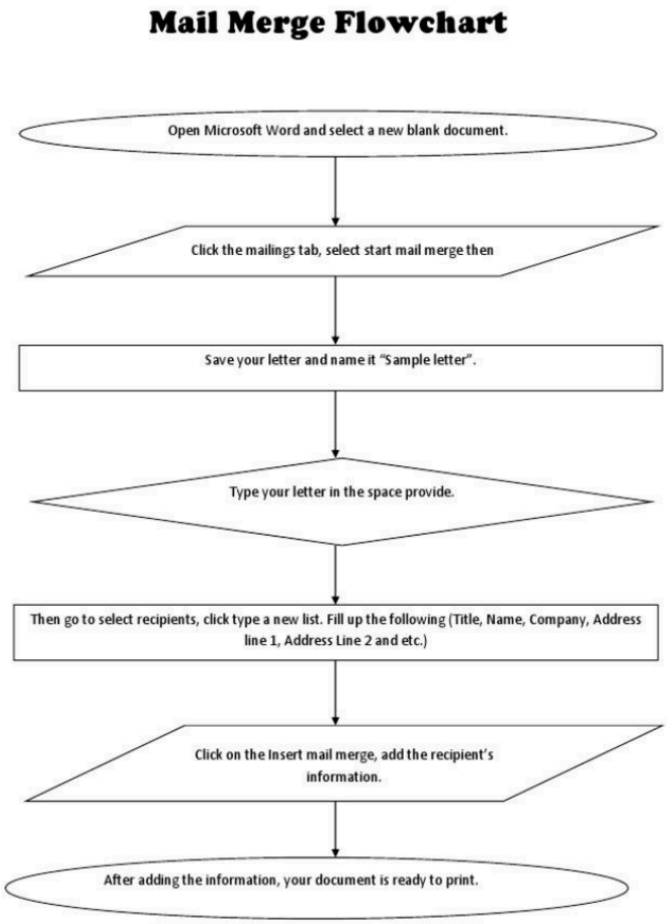
Mail Merge is a powerful feature in **Microsoft Word** that allows users to create multiple documents such as letters, certificates, envelopes, or labels by combining:

- A **main document** (template)
- A **data source** (list of names and addresses)

It is mainly used when the same document has to be sent to many people with personalized details.

2. Components of Mail Merge





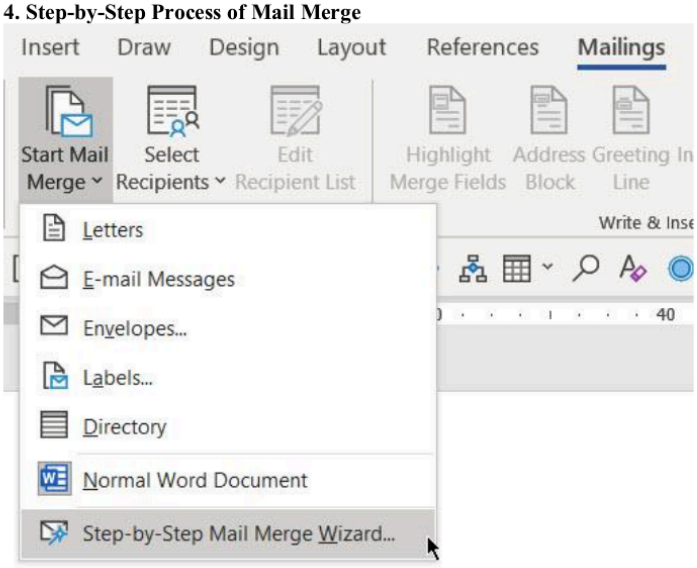
Main Components

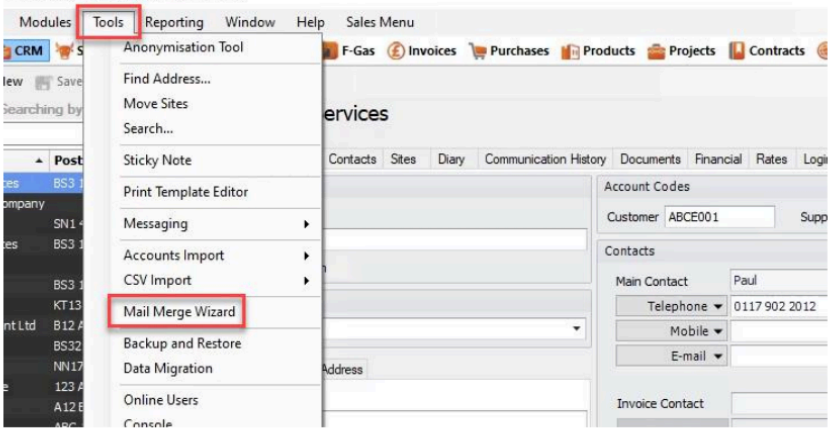
- **Main Document** – The body of the letter
- **Data Source** – Excel/Word table containing recipient information
- **Merge Fields** – Placeholders like «Name», «Address»
- **Merged Document** – Final personalized output

3. Types of Mail Merge

Type	Use
Letters	Personalized letters
Emails	Customized emails
Envelopes	Printing addresses on envelopes
Labels	Bulk labels printing
Directory	Creating catalogs/lists

4. Step-by-Step Process of Mail Merge





Step 1: Create Main Document

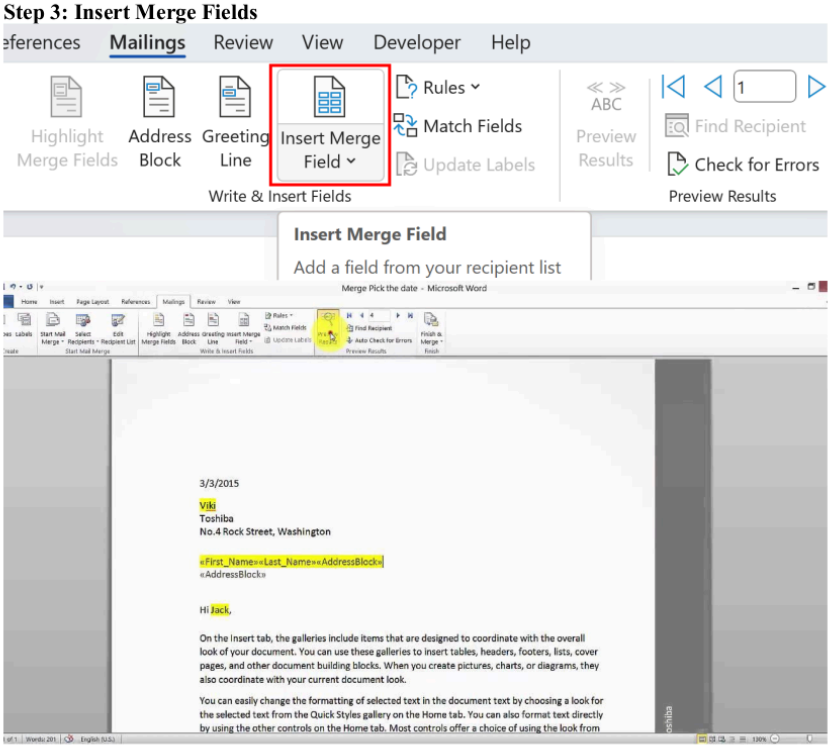
1. Open **MS Word**
2. Click **Mailings** tab
3. Click **Start Mail Merge**
4. Choose **Letters**

Step 2: Create Data Source

You can create a new list or use an existing file (Excel/Access).
Example data table:

ID	Name	Address
1	Rahul	Chennai, Tamil Nadu
2	Anjali	Hyderabad, Telangana
3	Suresh	Bengaluru, Karnataka

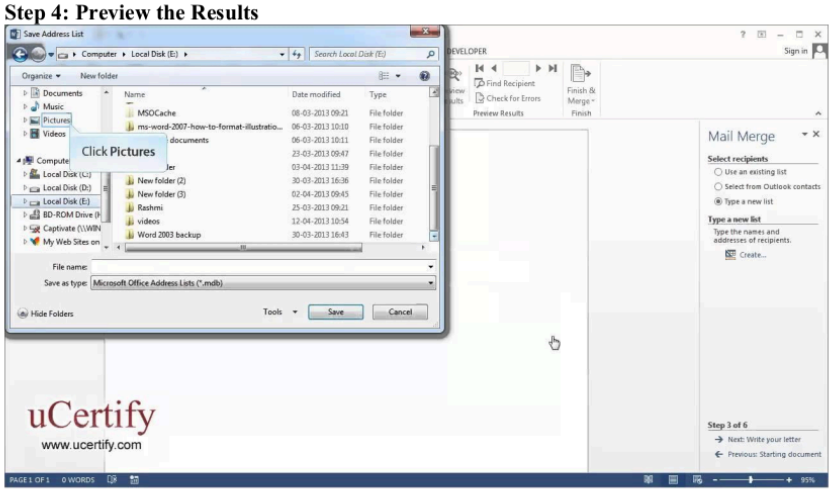
Step 3: Insert Merge Fields

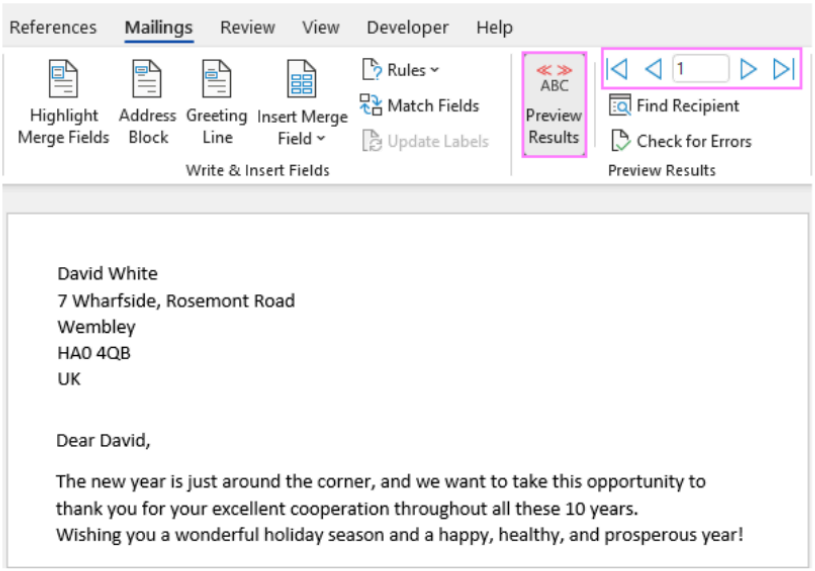


1. Click **Insert Merge Field**
2. Select fields like:
    - «Name»
    - «Address»

Example inside document:
Dear «Name»,
You are invited to attend the annual function.
Your address is: «Address»
Thank you.

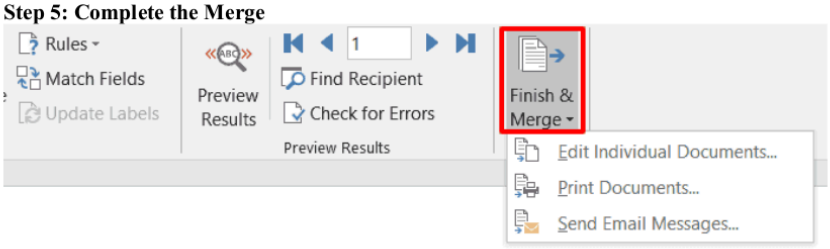
Step 4: Preview the Results



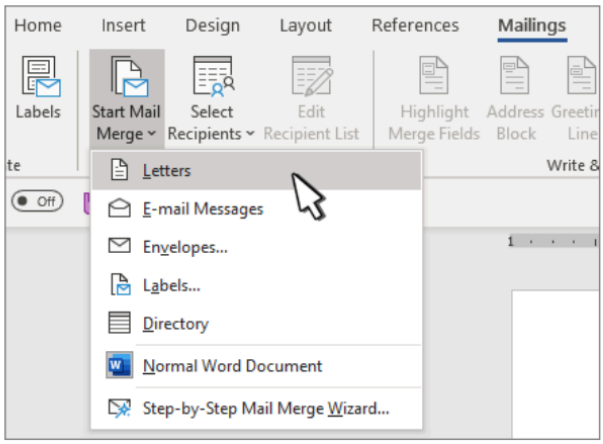


1. Click **Preview Results**
2. Use next/previous buttons to view different recipients

Step 5: Complete the Merge



nce that we're opening a brand-new Ted's Tadpole Tanks store in Downtown



1. Click **Finish & Merge**
2. Choose:
    - Edit individual documents
    - Print documents
    - Send email messages

6. Flow Diagram of Mail Merge Process

Create Main Document
↓
Create/Select Data Source
↓
Insert Merge Fields
↓
Preview Results
↓
Finish & Merge

7. Advantages of Mail Merge

- Saves time and effort
- Avoids repetitive typing
- Increases accuracy
- Professional communication

8. Limitations of Mail Merge

- Requires basic computer knowledge
- Data must be accurate
- Formatting can be complex for beginners

9. Practical Uses of Mail Merge

- Certificates for students
- Salary slips
- Invitation letters
- Mark sheets
- Fee reminders

1.7 Index in Ms Word

1. Definition

An **Index** in **Microsoft Word** is an alphabetical list of important words, topics, or names along with the **page numbers** where they appear in a document. It is usually placed at the **end of a document** and helps readers quickly locate information.

An index is mostly used in:

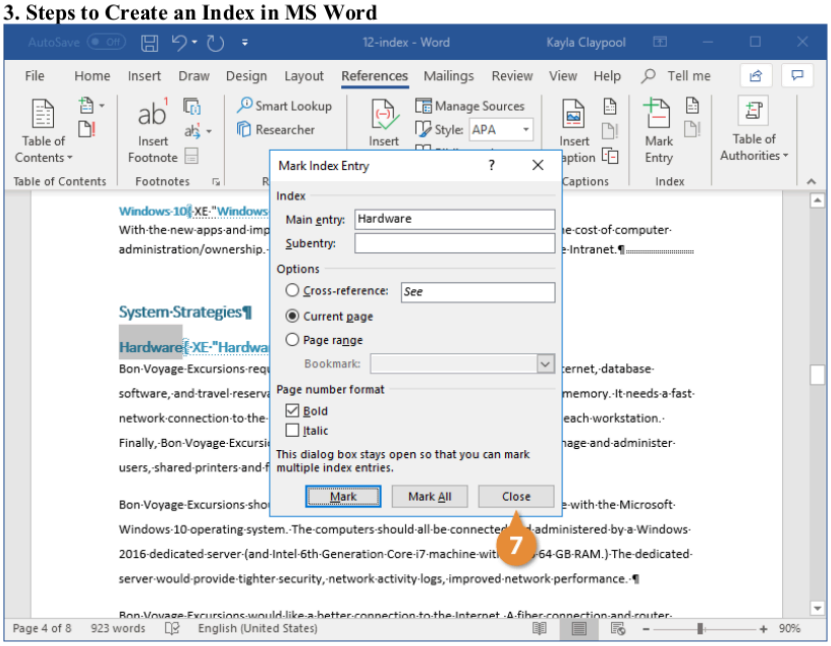
- Books
- Research reports
- Project reports
- Manuals

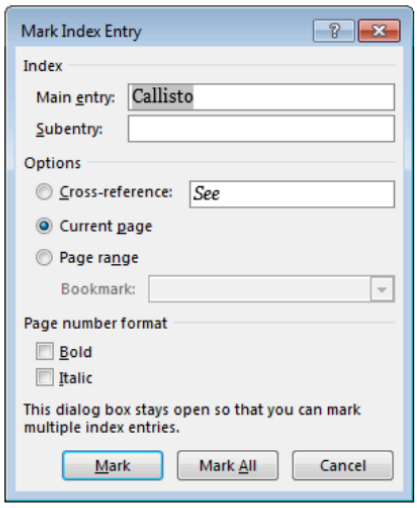
2. Why is Index Important?

An index improves:

- Ease of navigation
- Professional appearance of documents
- Reader experience

3. Steps to Create an Index in MS Word





Step 1: Select Text for Index Entry

Highlight the word or phrase you want to include in the index.

Step 2: Mark the Entry

1. Go to **References** tab
2. Click **Mark Entry**
3. Click **Mark** or **Mark All**

This adds hidden field codes like:

{ XE "Computer" }

4. Inserting the Index

Steps:

1. Place the cursor where you want the index
2. Click **References → Insert Index**
3. Choose format and columns
4. Click **OK**

5. Sample Index Diagram (Text Representation)

Index

Computer 1, 3, 7
Internet 2, 5
Mail Merge 4
MS Word 1, 6
Network 3, 9

6. Updating the Index

Steps:

1. Right-click on the index
2. Click **Update Field**
3. Select **Update entire index**

7. Marking Subentries in an Index

You can create main entries and subentries.

Example in **Mark Entry** box:

- Main entry: Computer
- Subentry: Networks

Displayed index result:

Computer
Networks 3
Hardware 5

8. Difference Between Index and Table of Contents

Feature	Index	Table of Contents
Basis	Keywords	Headings
Order	Alphabetical	Sequential
Location	End of document	Beginning of document

9. Advantages of Using Index

- Saves reader's time
- Works automatically with page numbers
- Easy to update

10. Flow Diagram of Creating an Index

Select Word/Phrase
↓
Mark Index Entry
↓
Insert Index
↓
Update Index

1.8 Printing in Ms Word

1. Introduction

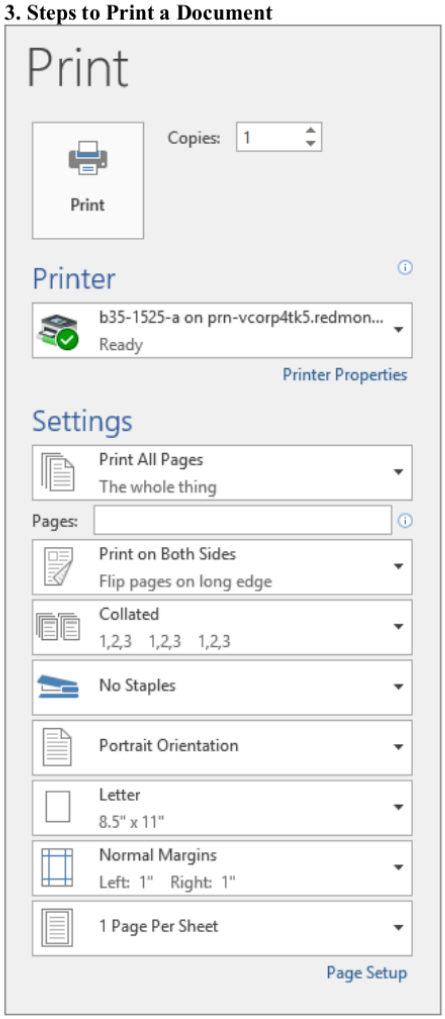
Printing in **Microsoft Word** is the process of transferring a document from the computer to paper using a **printer**. It helps create physical copies of letters, reports, question papers, and other documents.

2. Print Preview in MS Word

Purpose of Print Preview

Print Preview shows how the document will appear on paper before printing. It helps to avoid mistakes like page breaks or wrong margins.

3. Steps to Print a Document

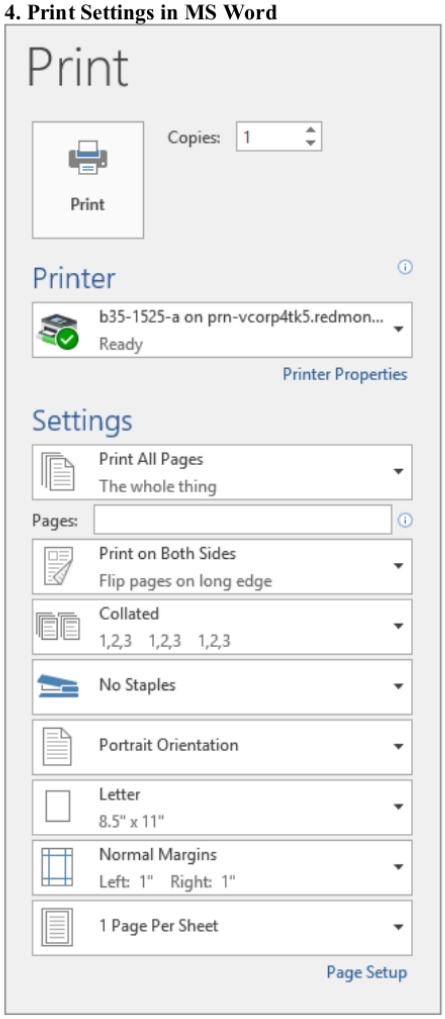


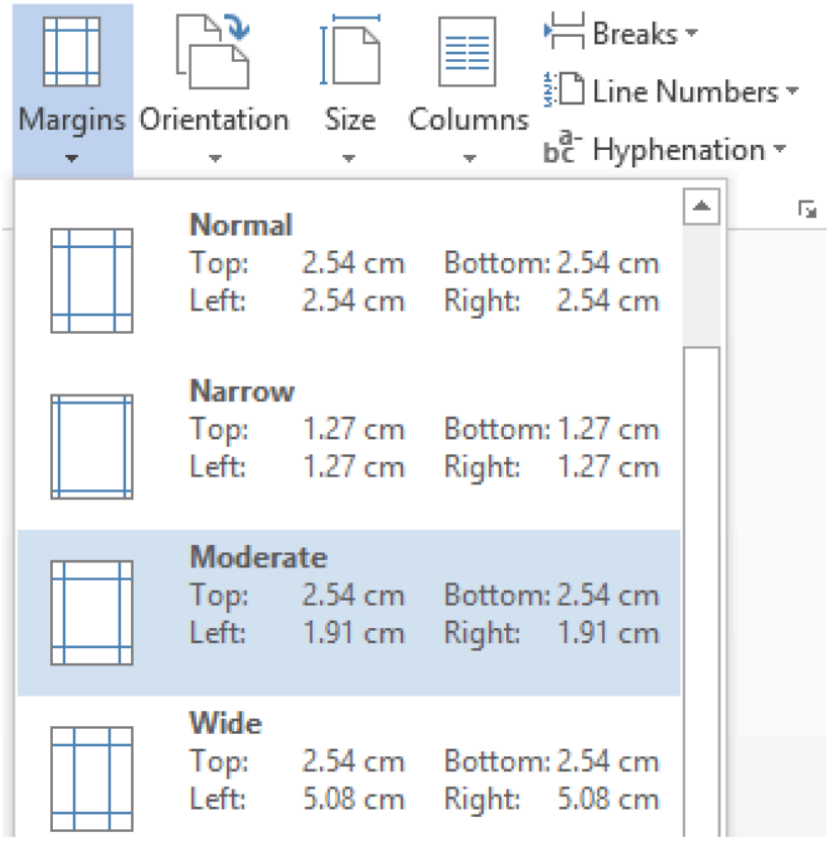
Step-by-Step Procedure

1. Open the document in MS Word
2. Click **File** menu
3. Click **Print**
4. Select the **Printer**
5. Set **Number of copies**
6. Click **Print** button

Shortcut key:
Ctrl + P

4. Print Settings in MS Word

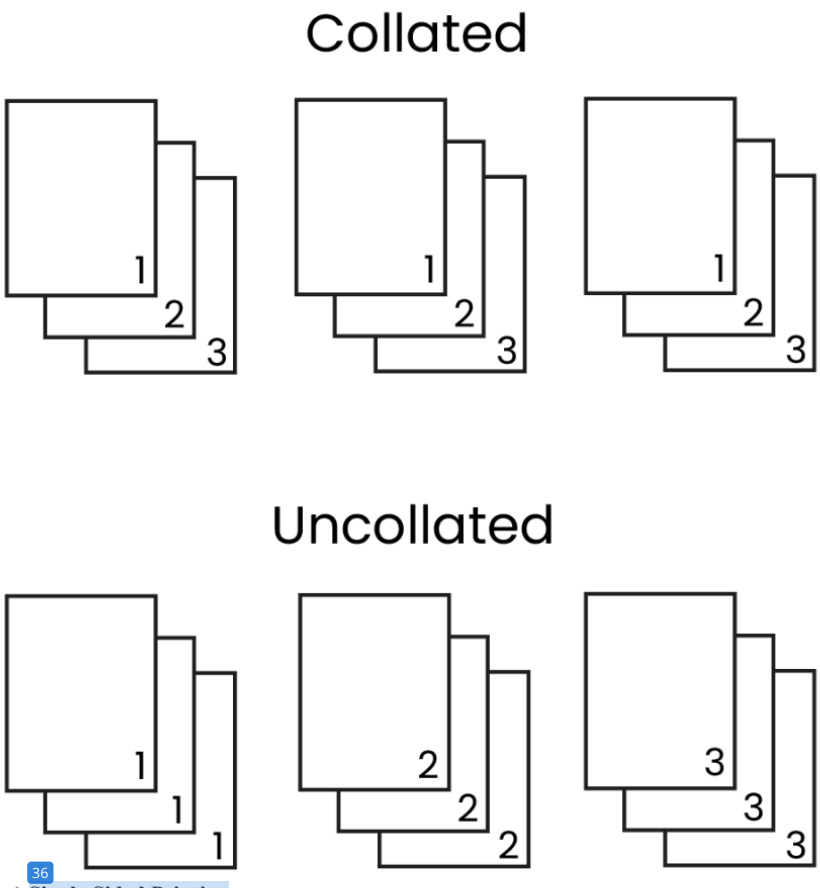




Common Print Options

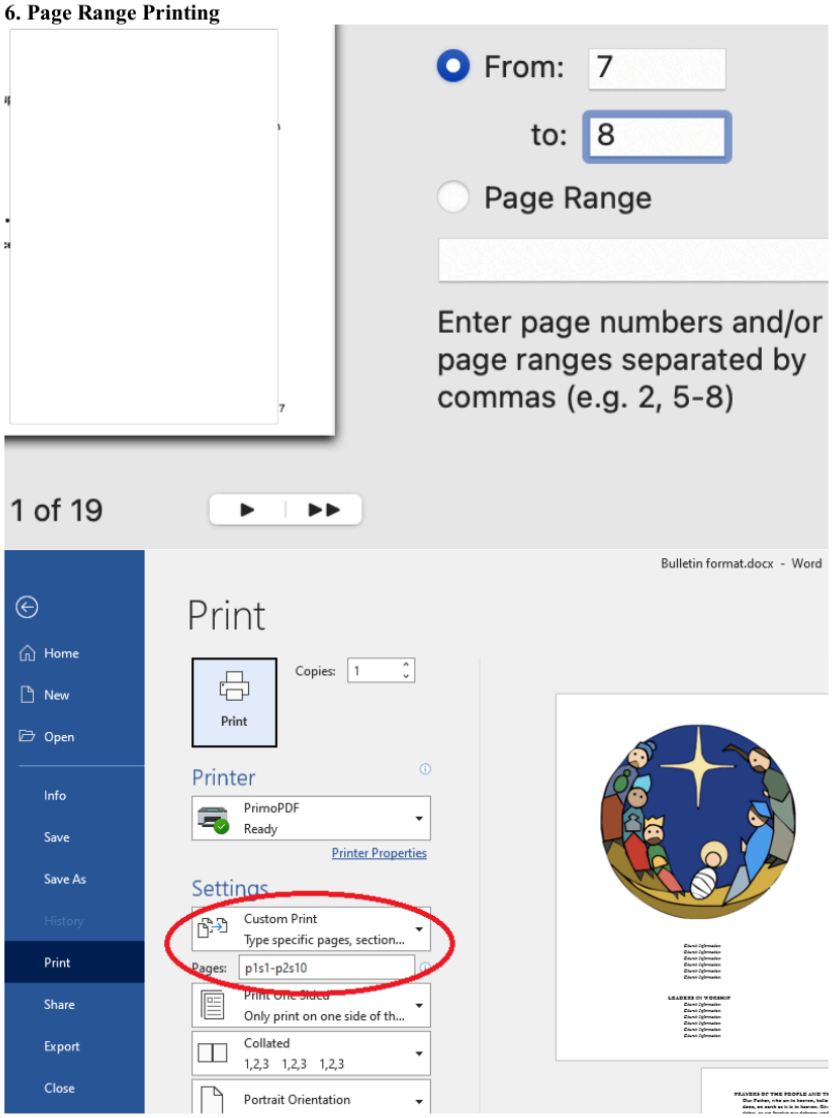
Option	Description
Copies	Number of pages to print
Printer	Select available printer
Orientation	Portrait / Landscape
Paper Size	A4, Letter, Legal
Margins	Top, Bottom, Left, Right
Page Range	Print all or selected pages

5. Types of Printing



a) Single-Sided Printing
Prints on one side of the paper.
b) Double-Sided Printing
Prints on both sides of the paper (also called duplex printing).
c) Collated Printing
Prints complete sets in proper order.
d) Uncollated Printing
Prints multiple copies of the same page together.

6. Page Range Printing



You can print:

- All pages
- Current page
- Specific pages like 1–3, 5, 7

7. Simple Flow Diagram of Printing Process

Open Document
↓
Click File → Print
↓
Select Printer
↓
Set Print Options
↓
Click Print

8. Common Printing Problems and Solutions

Problem	Solution
Printer not responding	Check power and cable/Wi-Fi
Paper jam	Remove stuck paper
Blank pages	Check ink/toner
Wrong layout	Check print preview

9. Advantages of Printing

- Creates hard copies
- Useful for official records
- Easy sharing of information

1.9 SUMMARY

Organizing information with tables and outlines in MS Word helps present data in a clear and structured way. Tables are used to arrange information into rows and columns, making comparisons and data interpretation easier. Outlines help organize headings and subheadings in a logical order, which is useful for creating reports, research papers, and lengthy documents. These features improve document clarity, consistency, and professional presentation.

1.10 KEYWORDS

Table – A grid of rows and columns used to organize information neatly.
Outline View – A special view in MS Word used to arrange headings and subheadings hierarchically.
Styles – Predefined formatting settings used to create consistent headings and text.
Row and Column – Horizontal (row) and vertical (column) divisions in a table for data entry.
Heading Levels – Different levels of headings used to structure document sections.

1.11 SELF-ASSESSMENT QUESTIONS

1. Explain the importance of using tables to organize information in MS Word.
2. Describe the steps and benefits of using Outline View in MS Word.
3. Discuss how styles and heading levels improve document organization.
4. Explain the methods to create and format tables in MS Word.
5. Write an essay on the role of tables and outlines in preparing professional documents.

1.12 SUGGESTED READINGS

1. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner*. Hardback.
2. Schwartz, Steve (2011). *Microsoft Office 2011 for Mac: Visual QuickStart Guide*. Paperback.
3. Johnson, Yvonne (2011). *Using Microsoft Office for Mac 2011*. eBook / Book.
4. Newby, Timothy J.; Lewandowski, Judith Oates (2012). *Teaching and learning with Microsoft Office 2010 and Office 2011 for Mac*. Paperback.
5. Hart-Davis, Guy (2011). *Learn Excel 2011 for Mac*. Softcover / eBook.

LESSON-9

MICROSOFT EXCEL

LEARNING OBJECTIVES

- Understand the basic features and interface of MS Excel.
- Enter, edit, and format data in worksheets.
- Use formulas and functions for calculations.
- Create charts and graphs for data visualization.
- Manage and analyze data efficiently using Excel tools.

STRUCTURE

1.0 INTRODUCTION TO MS EXCEL

MS Excel (Microsoft Excel) is a powerful spreadsheet software used for storing, organizing, calculating, and analyzing data in the form of rows and columns. It is developed by Microsoft and is part of the Microsoft Office package. MS Excel is widely used in education, business, finance, healthcare, and research because it helps users perform complex calculations accurately and quickly. It works on the concept of a worksheet, where data is entered into individual cells arranged in a grid structure.

In MS Excel, a document is called a workbook, which contains one or more worksheets. Each worksheet consists of horizontal rows and vertical columns, and the intersection of a row and a column is called a cell. Each cell has a unique address, such as A1, B2, or C5, which makes

it easy to locate and use data in formulas and functions. This organized structure allows users to handle large volumes of information efficiently and systematically.

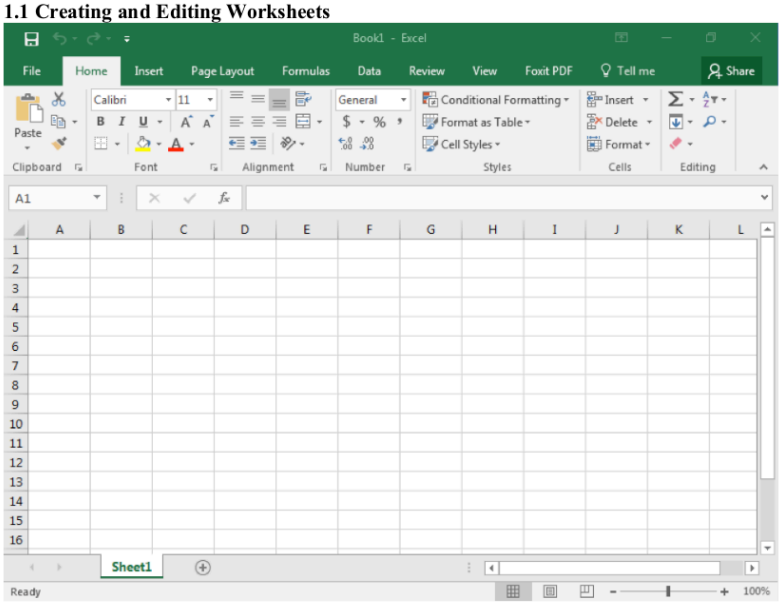
One of the most important features of MS Excel is its ability to perform calculations using formulas and built-in functions. Users can add, subtract, multiply, and divide numbers and use advanced functions such as SUM, AVERAGE, COUNT, MAX, and MIN. Excel automatically recalculates results whenever the data changes, which reduces manual effort and minimizes errors. This makes it highly useful for tasks like preparing budgets, financial statements, marks sheets, and performance reports.

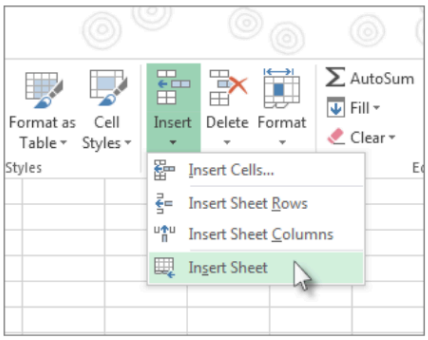
MS Excel also provides rich formatting options that help in improving the visual appearance of data. Users can change font styles, apply colors, adjust column widths and row heights, and use borders to make data more readable. It also supports charts and graphs, which transform numerical data into visual presentations like bar charts, pie charts, and line graphs. These visual tools make it easier to understand trends, comparisons, and patterns in data.

Another key feature of MS Excel is data management and analysis. Users can sort data in ascending or descending order, filter records to view specific information, and use tools like PivotTables to summarize large datasets. Excel also supports data validation, conditional formatting, and protection options to maintain data accuracy and security. These advanced features make Excel a highly effective tool for decision-making and reporting.

MS Excel is easy to learn and widely used across different fields because it improves productivity and accuracy in handling data. Students use it for academic projects, teachers use it to maintain student records, businesses use it for accounting and inventory management, and researchers use it for data analysis. By learning MS Excel, users acquire essential digital skills that are valuable in both academic and professional environments.

1.1 Creating and Editing Worksheets





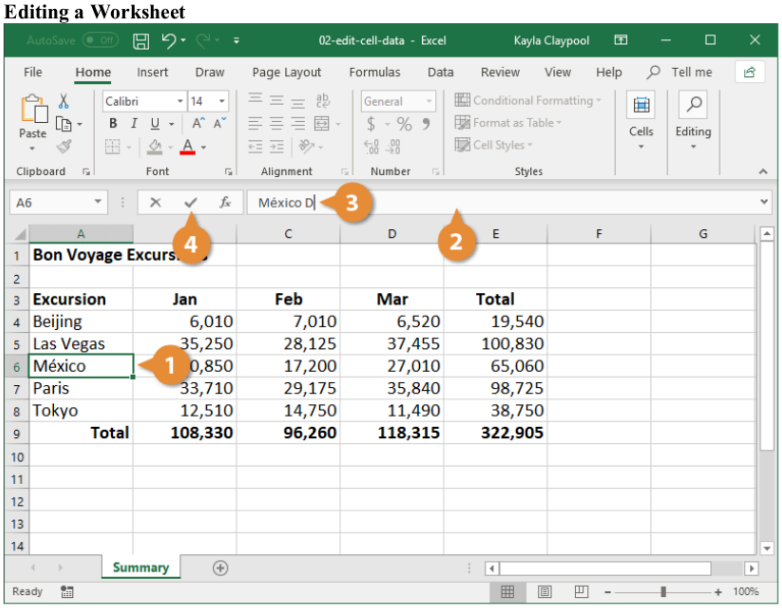
Creating a New Worksheet

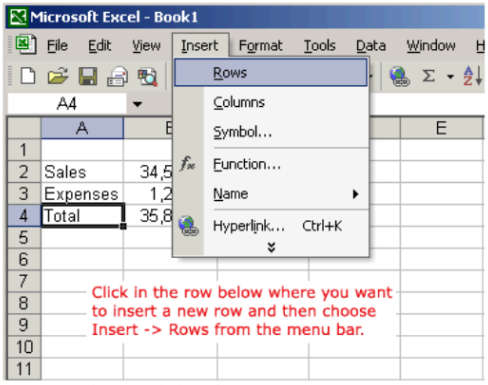
A **worksheet** is a single page in an Excel workbook where data is entered.

Steps:

1. Open **MS Excel**
2. Click **File → New → Blank Workbook**
3. To add a worksheet, click the + button near sheet tabs

Editing a Worksheet

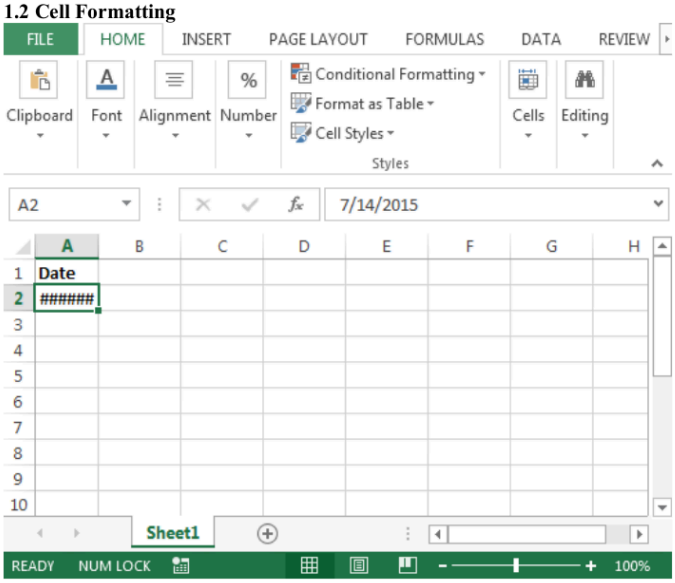


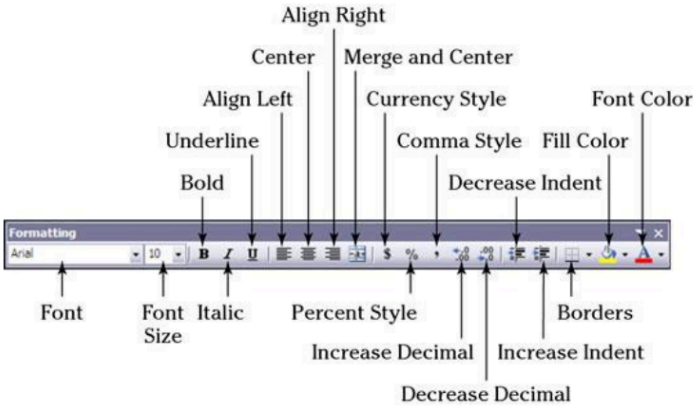


You can edit a worksheet by:

- Changing cell contents
- Inserting and deleting rows/columns
- Renaming sheets (Right-click → Rename)
- Moving or copying sheets

1.2 Cell Formatting





What is Cell Formatting?

Cell formatting means changing the **appearance of cells** to improve readability.

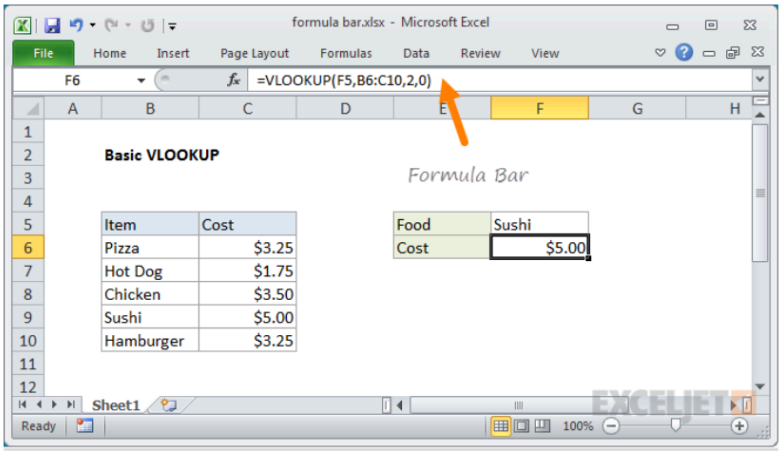
Types of Formatting

Formatting Type	Use
Font Formatting	Change font, size, color
Alignment	Left, Center, Right
Borders	Add lines around cells
Number Format	Currency, Date, Percentage
Fill Color	Background shading

Sample Cell Formatting Diagram (Text)

```
+---------------------------+
|  STUDENT MARKS REPORT     |
+---------------------------+
| Name   | Marks | Result   |
+--------+-------+----------+
| Ravi   | 85    | Pass     |
| Anu    | 92    | Pass     |
+--------+-------+----------+
```

1.3 Creating and Using Formulas



D12 =SUM(D2:D10)

	A	B	C	D	E
1	**Name**	**Type 1**	**Type 2**	**Total stats**	
2	Mankey	Fighting		305	
3	Magneton	Electric	Steel	465	
4	Onix	Rock	Ground	385	
5	Dragonair	Dragon		420	
6	Pidgeotto	Normal	Flying	349	
7	Rattata	Normal		253	
8	Charmeleon	Fire		405	
9	Gastly	Ghost	Poison	310	
10	Magikarp	Water		200	
11					
12				3092	
13					
14					
15					

What is a Formula?

A **formula** is an expression used to perform calculations. All formulas in Excel start with an **equal sign (=)**.

Example Formulas

Formula Meaning

=A1+B1 Addition

Formula Meaning

=A1-B1 Subtraction

=A1*B1 Multiplication

=A1/B1 Division

Diagram (Text Representation)

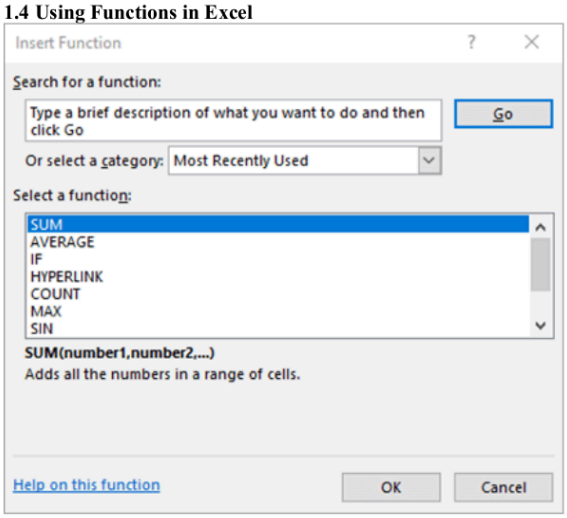
A B C

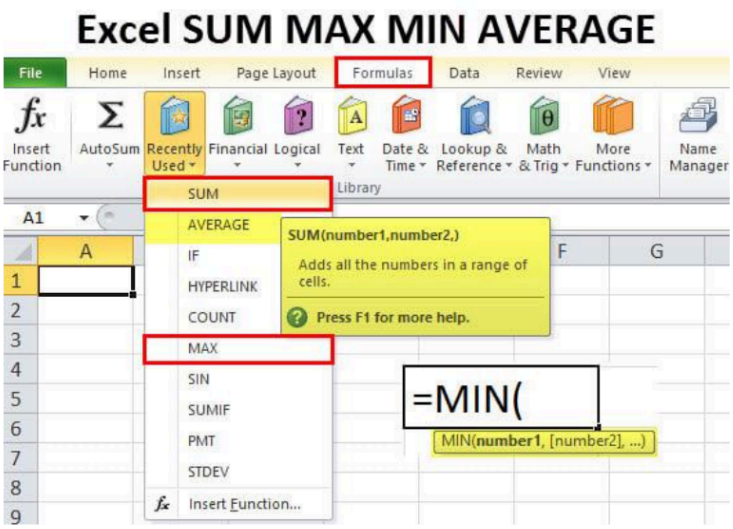
---

10 20 =A1+B1

Result in cell C1 → **30**

1.4 Using Functions in Excel





What is a Function?

A **function** is a predefined formula that makes complex calculations easy.

Common Functions

Function	Purpose	Example
SUM	Adds values	=SUM(A1:A5)
AVERAGE	Finds average	=AVERAGE(A1:A5)
COUNT	Counts numbers	=COUNT(A1:A5)
MAX	Highest value	=MAX(A1:A5)
MIN	Lowest value	=MIN(A1:A5)

Example Function Diagram

A

10
20
30
40
50

Formula: =SUM(A1:A5)
Result: 150

1.5 Difference Between Formula and Function

Feature	Formula	Function
Definition	User-created expression	Predefined calculation
Example	=A1+B1	=SUM(A1:A5)

Feature	Formula	Function
Complexity	Simple	Can be complex

1.6 Combined Flow Diagram

Create Worksheet
↓
Enter Data
↓
Format Cells
↓
Apply Formulas
↓
Use Functions

1.7 Practical Uses

- Mark sheets
- Salary calculations
- Budget preparation
- Inventory management

1.8 Use of Macros in MS Excel

What is a Macro?

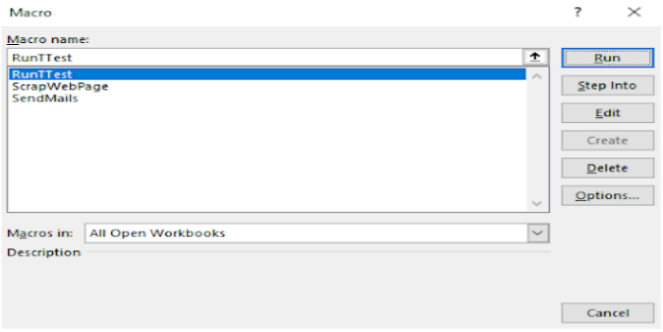
A **macro** is a set of recorded actions that can be played back to **automate repetitive tasks** in **Microsoft Excel**. Macros are written in **VBA (Visual Basic for Applications)**.

How to Create a Macro

Steps:

1. Go to **Developer** tab
2. Click **Record Macro**
3. Give macro name
4. Perform actions (formatting, calculations)
5. Click **Stop Recording**

How to Run a Macro

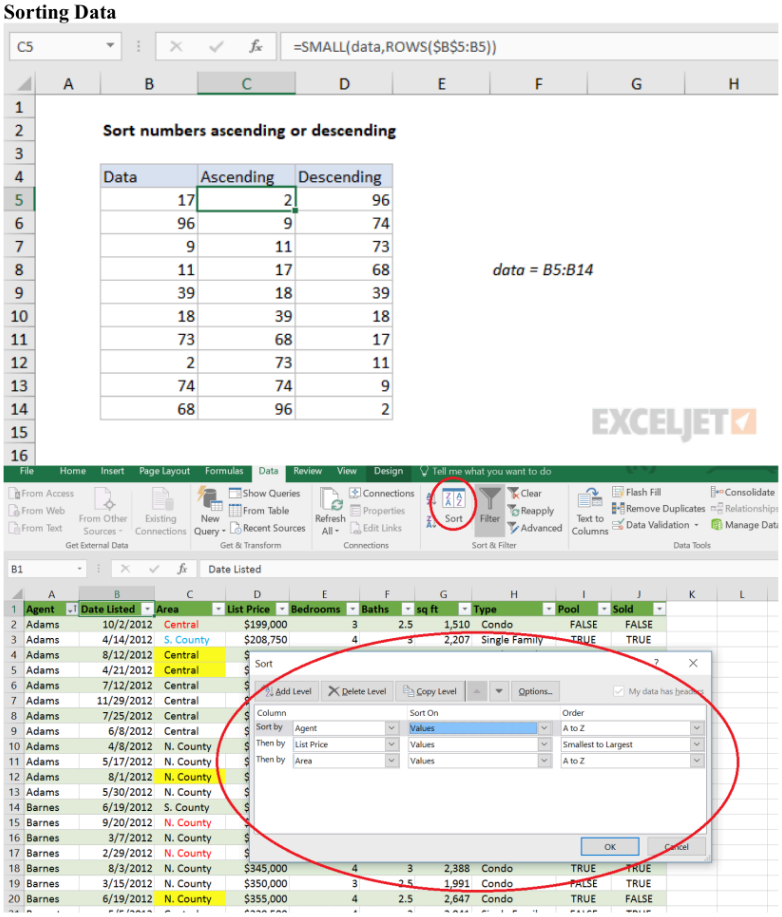


Steps:

1. Click **Macros**
2. Select macro name
3. Click **Run**

1.9 Sorting and Querying Data

Sorting Data



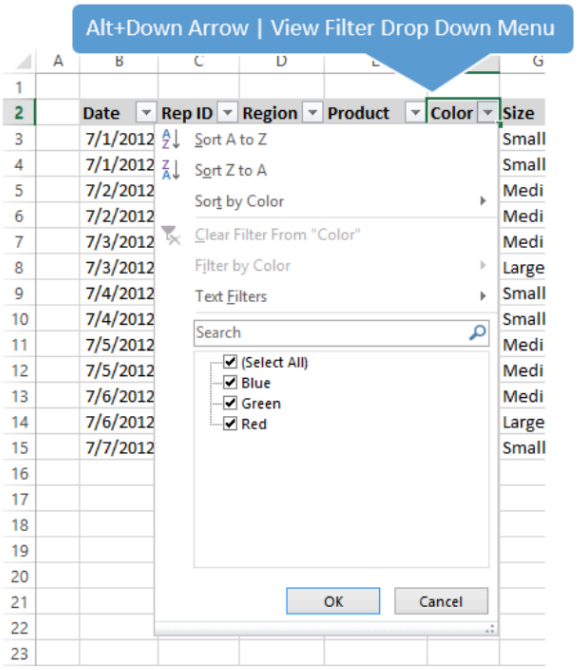
What is Sorting?

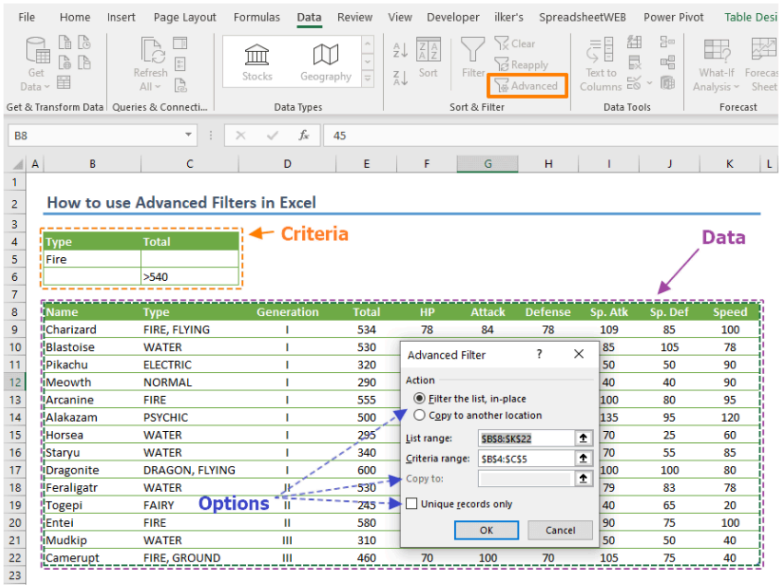
Sorting arranges data in a specific order such as **ascending** or **descending**.

Types of Sorting

- A → Z / Z → A (Text)
- Smallest → Largest (Numbers)
- Oldest → Newest (Dates)

Querying (Filtering) Data





What is Querying?

Querying means **searching and extracting specific data** using **filters and conditions**.

Steps:

1. Select data
2. Click **Data → Filter**
3. Use dropdown arrows to select conditions

Sample Diagram of Sorting and Filtering

Before Sorting:

Name Marks
Ravi 65
Anu 90
Kumar 75

After Sorting (Ascending):

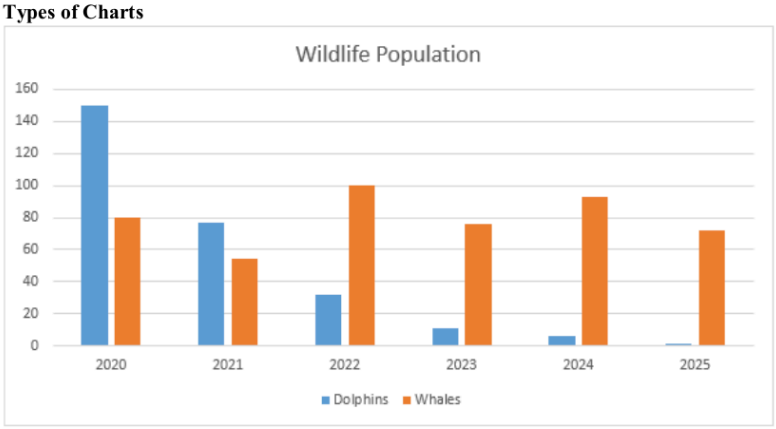
Name Marks
Ravi 65
Kumar 75
Anu 90

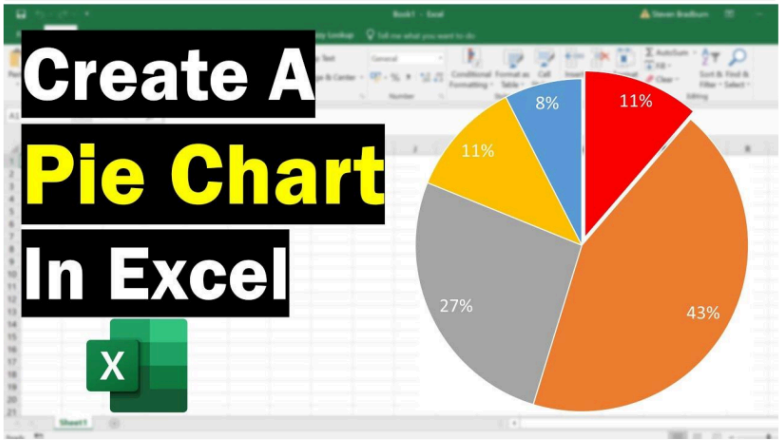
1.10 Working with Graphs and Charts

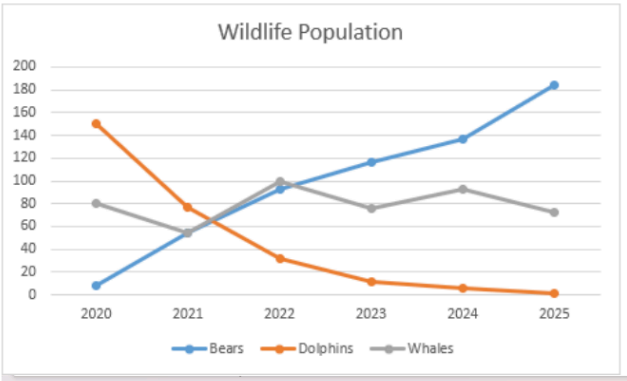
What are Charts?

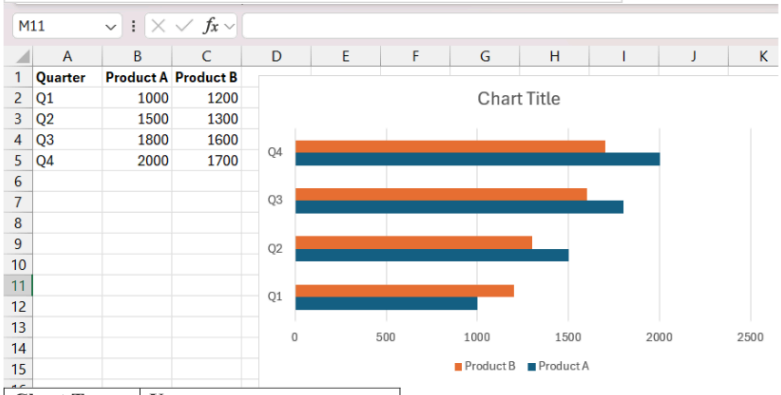
Charts are **graphical representations of data** that help in visual analysis.

Types of Charts





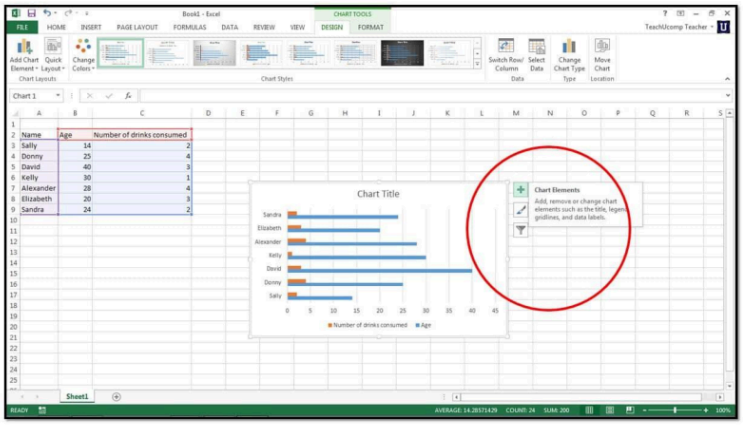


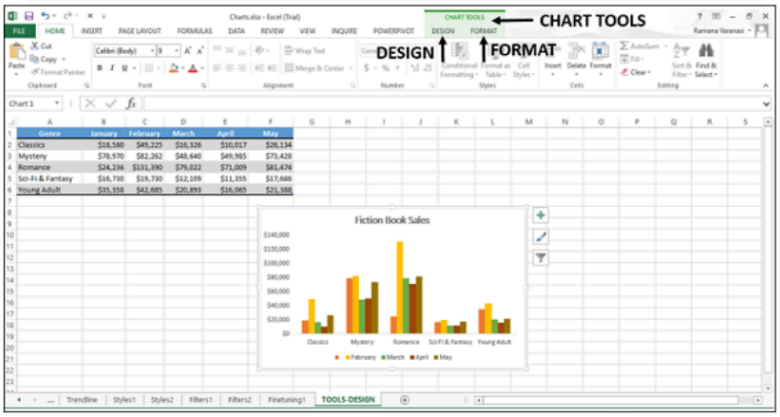


Quarter	Product A	Product B
Q1	1000	1200
Q2	1500	1300
Q3	1800	1600
Q4	2000	1700

Chart Type	Use
Column Chart	Compare values
Bar Chart	Horizontal comparison
Line Chart	Show trends over time
Pie Chart	Show percentage distribution

Creating a Chart in Excel





Steps:

1. Select data
2. Click **Insert**
3. Choose chart type
4. Chart appears in worksheet

Sample Text Diagram of a Bar Chart

Marks

Ravi |
Anu |
Kumar |

Difference Table

Feature	Sorting	Querying	Charts
Purpose	Arrange data	Extract specific data	Visual representation
Tools Used	Sort command	Filter/Search	Chart tools

Flow Diagram

Raw Data
↓
Sort Data
↓
Query/Filter Data
↓
Create Charts
↓
Visual Analysis

Practical Uses

- Sales reports
- Student performance analysis
- Financial data analysis
- Trend prediction

1.11 SUMMARY

MS Excel is a powerful spreadsheet application used to store, organize, and analyze data. It allows users to perform calculations using formulas and built-in functions. Excel supports sorting, filtering, and chart creation to help users understand data patterns and trends. It is widely used in business, education, finance, and research for budgeting, reporting, and data analysis.

1.12 KEYWORDS

Worksheet – A single spreadsheet page where data is entered in rows and columns.
Formula – An expression used to perform calculations in Excel using cell references.
Function – A predefined formula that performs specific calculations automatically.
Cell – The intersection of a row and a column where data is entered.
Chart – A graphical representation of worksheet data.

1.13 SELF-ASSESSMENT QUESTIONS

1. Explain the features and applications of MS Excel.
2. Describe the role of formulas and functions in MS Excel.
3. Discuss the importance of charts and graphs in data analysis.
4. Explain how data can be managed and organized in MS Excel.
5. Write an essay on the use of MS Excel in business and education.

1.14 SUGGESTED READINGS

1. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams.* Paperback.
2. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365).* Paperback / eBook.
3. Curtis Frye & Joan Lambert (2022). *Microsoft Excel Step by Step (Office 2021 and Microsoft 365).* Paperback.
4. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook.* Paperback / eBook.
5. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.

LESSON-10

MICROSOFT POWER POINT

LEARNING OBJECTIVES

- Understand the basic interface and features of MS PowerPoint.
- Create and manage simple presentations.
- Insert and edit text, shapes, and images in slides.
- Use slide views and navigation options effectively.
- Save, print, and share presentations properly.

STRUCTURE

1.0 INTRODUCTION TO MS POWERPOINT

MS PowerPoint (Microsoft PowerPoint) is a presentation software used to create visually attractive slide-based presentations. It is developed by Microsoft and is a part of the Microsoft Office suite. MS PowerPoint allows users to combine text, images, charts, audio, video, and animations to communicate ideas clearly and effectively. It is widely used in education, business, healthcare, marketing, and training programs for delivering structured and professional presentations.

A presentation in MS PowerPoint is made up of a series of individual pages called slides. Each slide can contain different types of content such as titles, bullet points, pictures, tables, diagrams, and multimedia elements. PowerPoint provides various pre-designed templates and themes, which help users create professional-looking presentations quickly without the need for advanced design skills. The slide layout options allow users to arrange content in a well-organized manner.

The PowerPoint interface consists of several important components that make it easy to work with presentations. The Title Bar displays the presentation name, the Ribbon contains tabs such as Home, Insert, Design, Transitions, and Animations, and the Slides Pane shows thumbnail views of all slides. The Slide Area is the main workspace where content is created and edited, while the Status Bar displays information such as slide number and zoom level. These components help users navigate and manage presentations efficiently.

MS PowerPoint supports adding visual effects that make presentations more engaging. Users can apply slide transitions to control how slides change during the slideshow and animations to add movement to text and objects. It also allows inserting charts and graphs to represent data

visually, helping the audience understand trends and comparisons more easily. Multimedia elements such as audio narration and video clips can also be added to enhance the quality of a presentation.

PowerPoint is an essential tool for effective communication because it helps presenters organize information logically and present it in an attractive format. It is widely used by students for seminars and projects, teachers for classroom teaching, and professionals for meetings and conferences. Learning MS PowerPoint improves presentation skills and boosts confidence in public speaking, making it a valuable skill in both academic and professional environments.

1.1 Features of MS PowerPoint

MS PowerPoint (Microsoft PowerPoint) is a powerful presentation tool developed by Microsoft and included in the Microsoft Office package. It provides a wide range of features that help users create professional, attractive, and interactive presentations. One of the key features is the availability of themes and templates, which allow users to apply consistent designs, colors, and fonts across all slides. This helps maintain a uniform and professional appearance throughout the presentation.

Another important feature of PowerPoint is its support for multimedia integration. Users can easily insert images, audio files, video clips, tables, charts, and SmartArt graphics into slides. The software also supports animations and transitions, which add movement effects to text and objects and control how one slide changes to the next. These features help make presentations more engaging and easier to understand for the audience.

PowerPoint also offers editing and formatting tools that allow users to change font styles, sizes, colors, alignment, and spacing. It provides slide layout options such as title slide, content slide, comparison slide, and blank slide. With the slide master feature, users can control the overall formatting and design of all slides from a single place, saving time and ensuring design consistency.

Another valuable feature is collaboration and sharing. Multiple users can work on the same presentation using cloud services, and features like comments and real-time editing make teamwork easier. PowerPoint also supports presenter tools, such as Presenter View, which shows notes and upcoming slides only to the presenter during a slideshow. These features make MS PowerPoint suitable for both individual and group presentations.

1.3 Creation of Slides with Graphs and Charts

Creating slides with graphs and charts in **Microsoft PowerPoint** helps convert numerical data into visual form, making information easy to understand. Charts are especially useful for comparing values, showing trends over time, and presenting percentage shares. PowerPoint provides several chart types such as column charts, bar charts, line charts, pie charts, and area charts that can be inserted directly into slides.

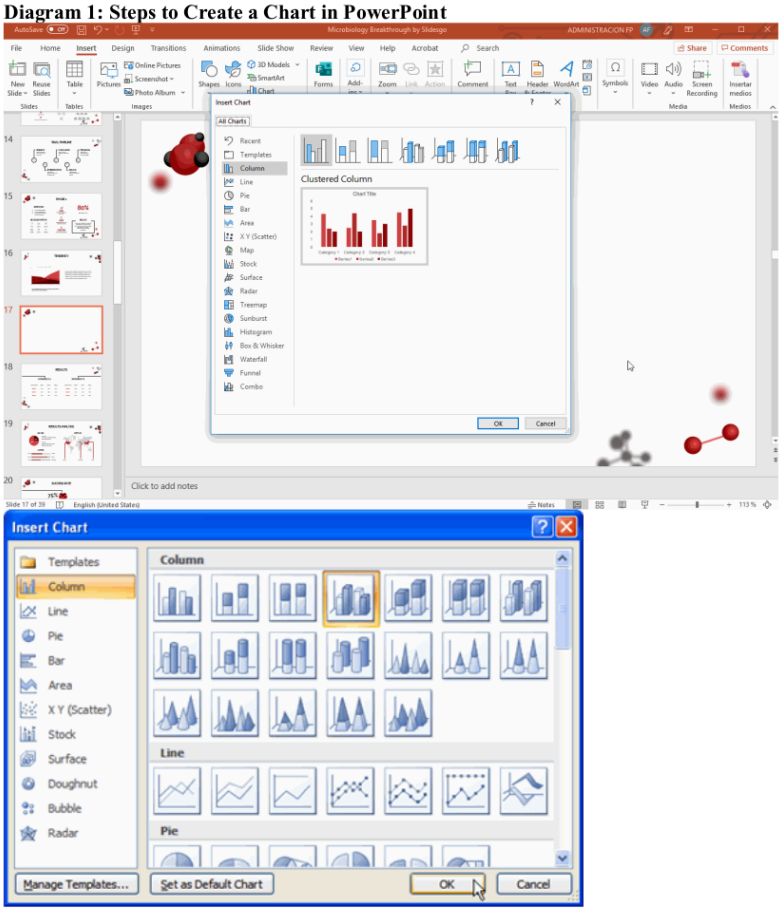
To create a slide with a chart, the user first selects a new slide layout such as "Title and Content." After clicking the **Insert** tab and choosing **Chart**, a dialog box appears allowing the user to select the type of chart. Once a chart type is selected, a small spreadsheet window opens where users can enter or edit the data. As soon as data is entered, the chart automatically updates in the slide. The chart can then be resized, repositioned, and formatted using chart tools.

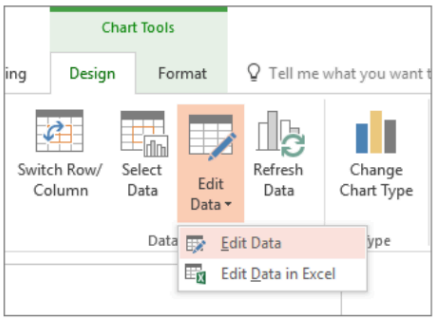
Graphs and charts can be customized using different colors, styles, titles, legends, and data labels. Users can add a **chart title** to explain what the data represents and use **axis labels** to make the chart easier to read. Gridlines can be added or removed to improve clarity. These formatting options help make the chart more attractive and meaningful to the audience.

Using graphs and charts in PowerPoint improves the quality of presentations by making them more interactive and data-driven. Instead of reading long tables of numbers, the audience can quickly understand patterns and comparisons through visual representation. This makes PowerPoint an effective tool for business reports, academic presentations, project reviews, and training sessions.

1.4 Diagrams – Creation of Slides with Graphs and Charts

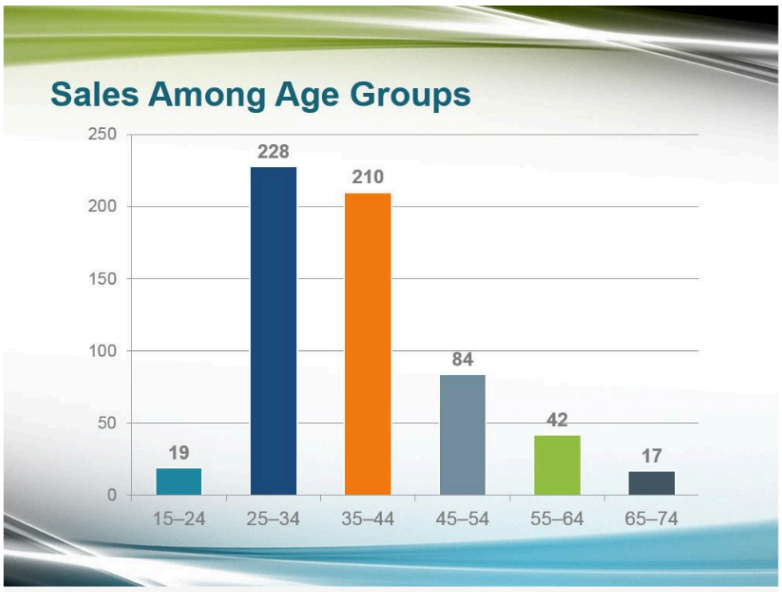
Diagram 1: Steps to Create a Chart in PowerPoint

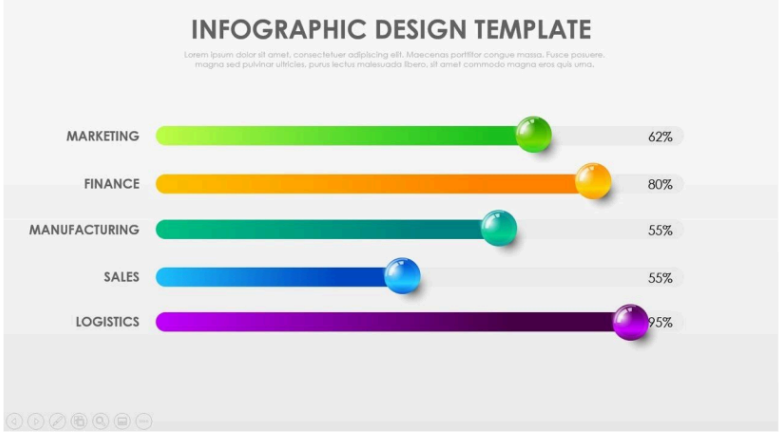




Open PowerPoint
↓
Insert New Slide
↓
Click Insert Tab
↓
Select Chart
↓
Enter Data
↓
Chart Appears on Slide

Diagram 2: Types of Charts


Sales Among Age Groups
250
200
150
100
50
0
228
210
84
42
19
17
15–24
25–34
35–44
45–54
55–64
65–74


INFOGRAPHIC DESIGN TEMPLATE
Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna.
MARKETING
62%
FINANCE
80%
MANUFACTURING
55%
SALES
55%
LOGISTICS
95%

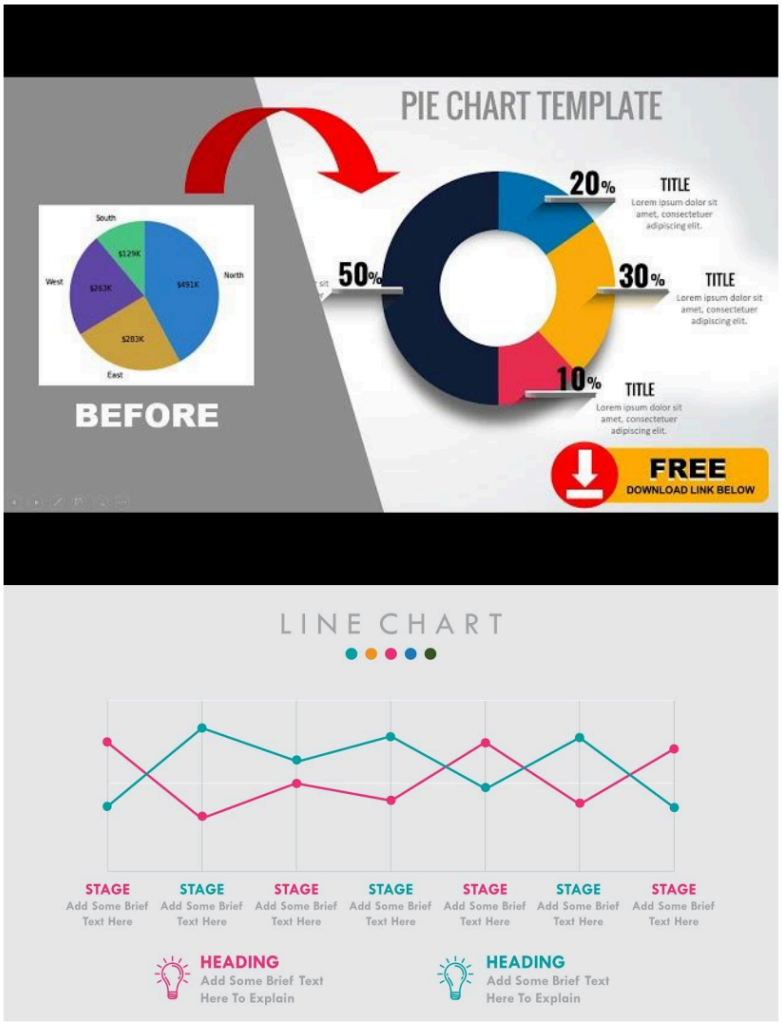


Diagram 3: Sample Text Graph
Sales Graph

Q1
Q2
Q3

Q4 [redacted]

1.5 SUMMARY

MS PowerPoint is a presentation software used to create slide-based presentations for teaching, training, meetings, and seminars. It allows users to add text, pictures, shapes, charts, and tables to slides. Users can organize slides using different views like Normal View and Slide Sorter View. PowerPoint helps present information in a clear and structured way and is widely used in education and business.

1.6 KEYWORDS

Slide – A single page or screen in a PowerPoint presentation.
Slide Sorter View – A view that displays all slides as thumbnails for easy arrangement.
Text Box – A container used to insert and format text on a slide.
Insert Tab – The toolbar option used to add pictures, charts, tables, and shapes.
Presentation – A collection of slides created to communicate information visually.

1.7 SELF-ASSESSMENT QUESTIONS

1. Explain the basic features and interface of MS PowerPoint.
2. Describe the steps involved in creating a new presentation.
3. Discuss the importance of Slide Sorter View in managing presentations.
4. Explain how to insert and format text and images in PowerPoint.
5. Write an essay on the advantages of using PowerPoint for academic and business presentations.

1.8 SUGGESTED READINGS

1. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams*. Paperback.
2. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365)*. Paperback / eBook.
3. Curtis Frye & Joan Lambert (2022). *Microsoft Excel Step by Step (Office 2021 and Microsoft 365)*. Paperback.
4. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook*. Paperback / eBook.
5. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner*. Hardback.

LESSON-11

MICROSOFT POWER POINT TEMPLATES AND SLIDE DESIGN

LEARNING OBJECTIVES

- Understand the concept of templates in MS PowerPoint.
- Identify different types of slide designs.
- Apply suitable templates for various types of presentations.
- Customize slide layouts for better visual appeal.
- Create professional-looking presentations using design tools.

STRUCTURE

1.0 INTRODUCTION

MS PowerPoint (Microsoft PowerPoint) is a widely used presentation application developed by **Microsoft** and included in the **Microsoft Office** package. Templates play an important role in creating professional and visually consistent presentations. A template is a pre-designed set of slide layouts, background designs, fonts, and color schemes that helps the user create attractive presentations quickly and easily without starting from scratch.

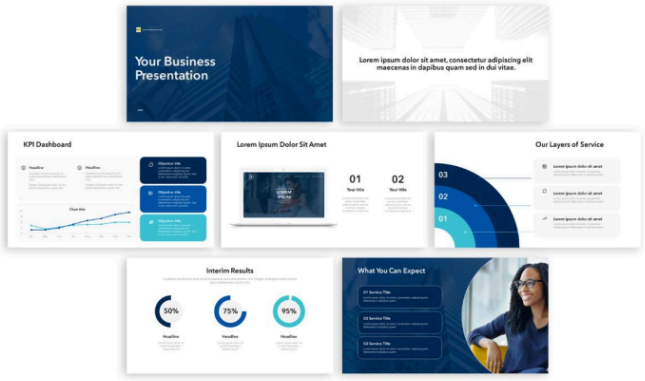
1.1 Use of Different Templates in MS PowerPoint

What is a Template in PowerPoint?

A **template** is a ready-made presentation format that contains a set of predefined slide designs. It includes background styles, font types, color combinations, and layout structures. By selecting a suitable template, users can focus more on the content rather than on designing the visual appearance. Templates are especially useful for business meetings, classroom teaching, marketing pitches, research presentations, and seminars.

Types of Templates in MS PowerPoint

1. Business Templates

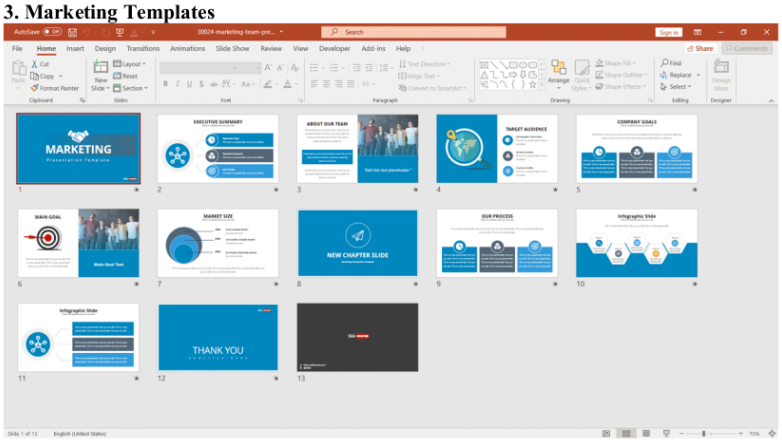


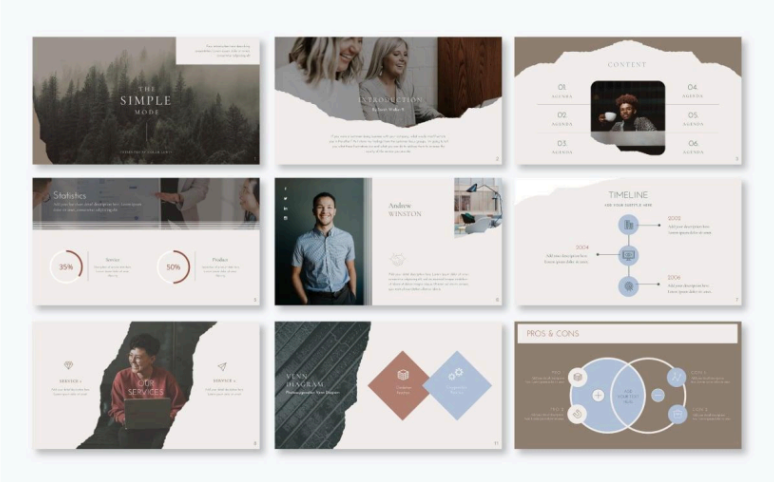
Business templates are used for corporate meetings, annual reports, project reviews, and sales presentations. They usually contain professional color schemes like blue, grey, and white with clean layouts. These templates include slides such as agenda, project overview, financial charts, and conclusion slides.

2. Education Templates

Education templates are designed for teaching and learning purposes. They use simple layouts, readable fonts, and sometimes include icons and diagrams suitable for explaining topics. Teachers and students use these templates for lectures, seminars, and academic projects.

3. Marketing Templates



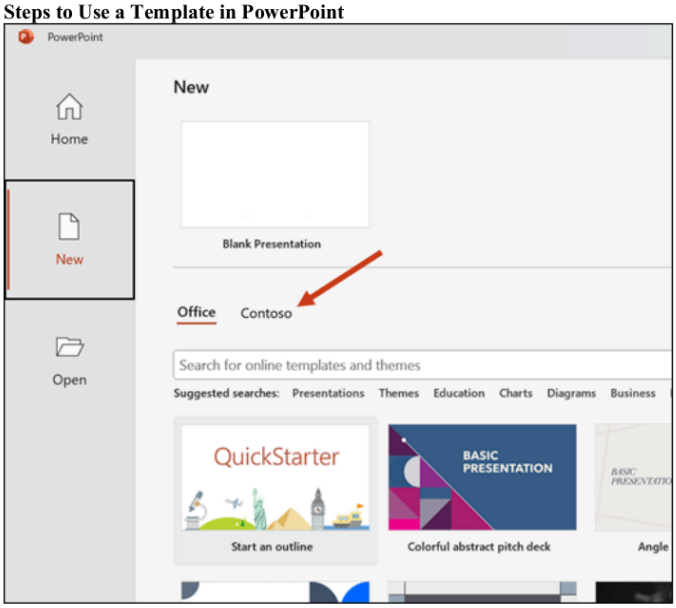


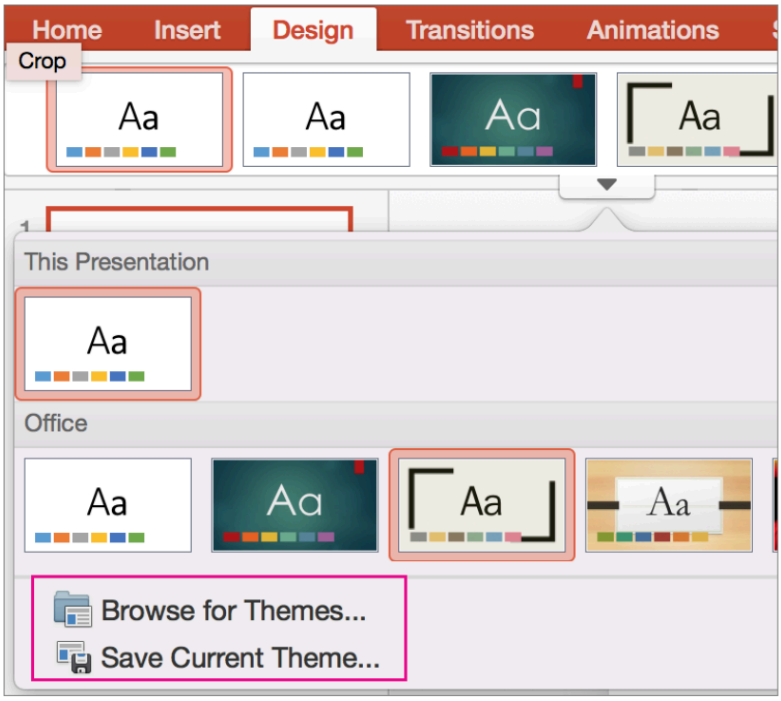
Marketing templates are used for product launches, advertisements, and promotional presentations. They often use bright colors, large images, and creative layouts to attract audience attention and highlight product features.

4. Portfolio Templates

Portfolio templates are used to showcase personal skills, work samples, achievements, and resumes. These templates help individuals present their profiles in a professional and visually appealing way.

Steps to Use a Template in PowerPoint





Steps:

1. Open **Microsoft PowerPoint**
2. Click **File → New**
3. Browse the available templates
4. Select the required template
5. Click **Create**
6. Add your content to the slides

Examples of Using Templates

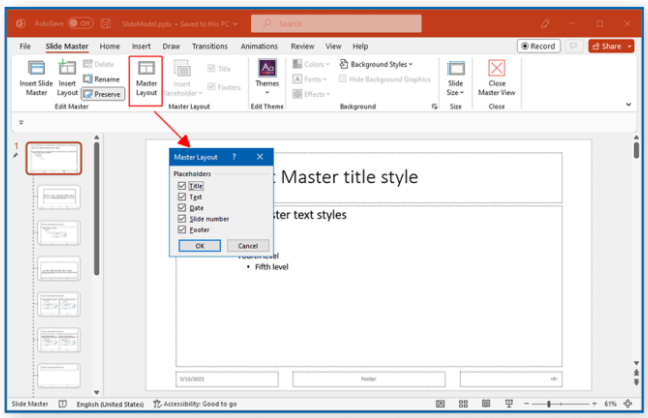
Example 1: Business Presentation Structure

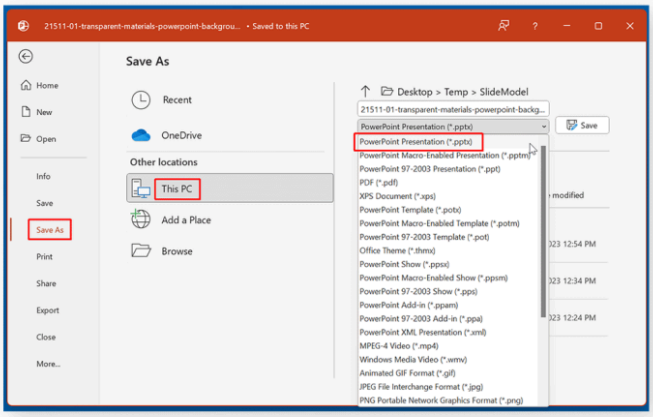
Slide 1 – Title Slide (Company Name)
Slide 2 – Agenda
Slide 3 – Company Overview
Slide 4 – Sales Chart
Slide 5 – Conclusion

Example 2: Education Presentation Structure

Slide 1 – Topic Title
Slide 2 – Definition
Slide 3 – Diagram
Slide 4 – Key Points
Slide 5 – Summary

Diagram – Workflow of Template Usage





Open PowerPoint
↓
Choose Template
↓
Apply Slide Layouts
↓
Insert Text & Images
↓

Finalize Presentation

Advantages of Using Different Templates

- Saves time and effort
- Ensures professional look
- Maintains design consistency
- Easy to edit and customize
- Suitable for different purposes

1.2 Use of Different Slide Designs in MS PowerPoint

Introduction

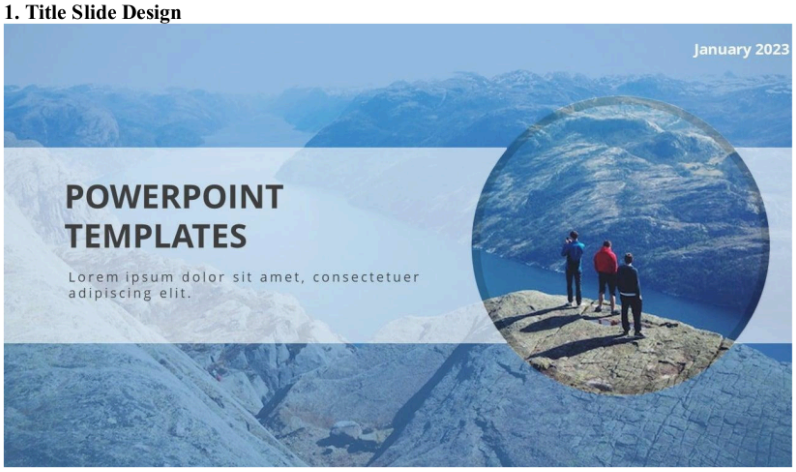
MS PowerPoint (Microsoft PowerPoint) is a powerful presentation software developed by **Microsoft** and part of the **Microsoft Office** package. Slide design refers to the overall layout and visual appearance of slides, including background, color schemes, fonts, placeholders, and arrangement of text and objects. Proper use of slide designs helps make presentations more attractive, professional, and easy to understand.

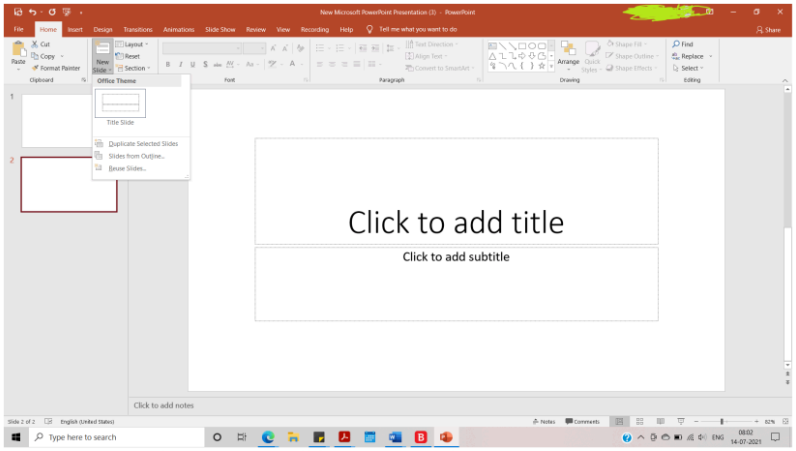
What is Slide Design?

Slide design is the predefined structure and visual format used to organize content on a slide. It includes title position, content boxes, image placeholders, and visual styles. Slide designs ensure consistency across all slides and help in maintaining a uniform look throughout the presentation.

Types of Slide Designs with Examples

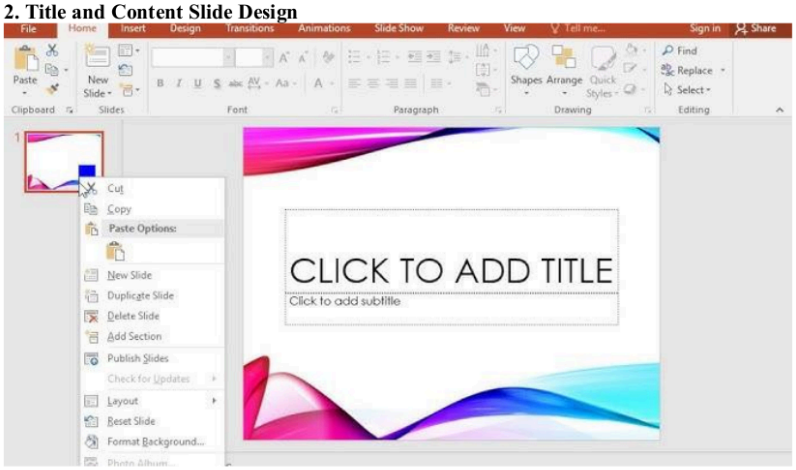
1. Title Slide Design





Use: First slide of the presentation
Contains: Presentation title, subtitle, name, date
Example:
INTRODUCTION TO COMPUTER NETWORKS
By: John Smith

2. Title and Content Slide Design

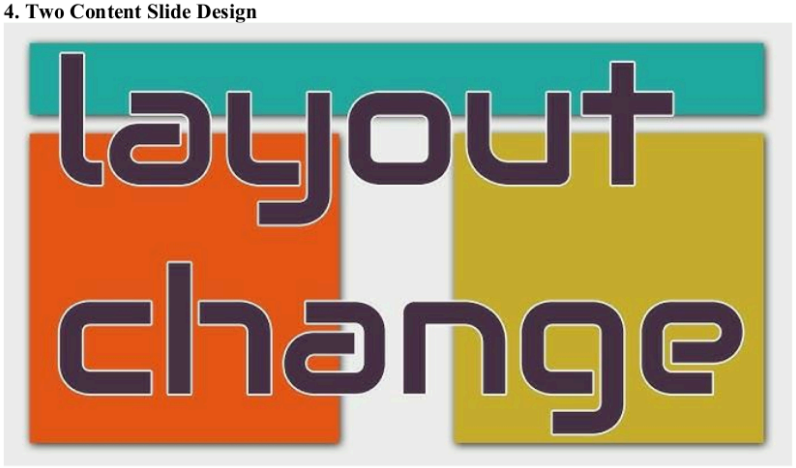


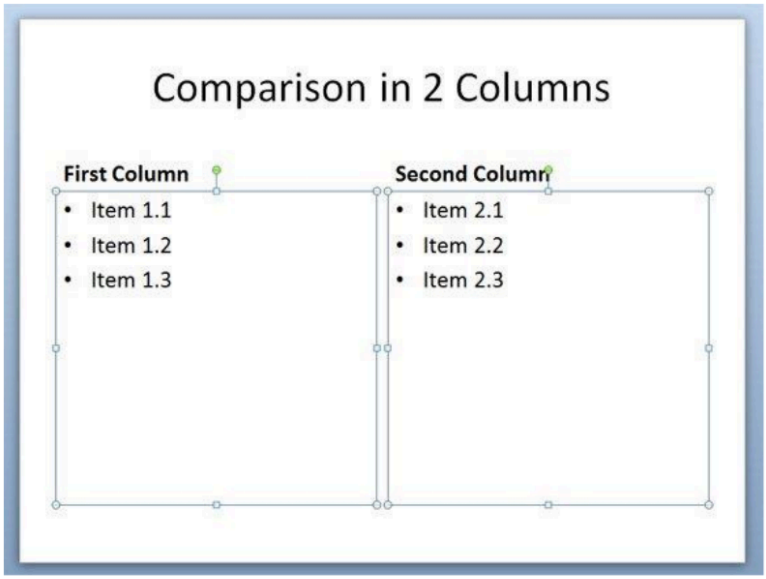
Use: To display text, bullet points, and small images
Example:
Types of Networks
• LAN
• MAN
• WAN

3. Section Header Slide Design

Use: To divide presentation into sections
Example:
CHAPTER 1: BASICS OF NETWORKING

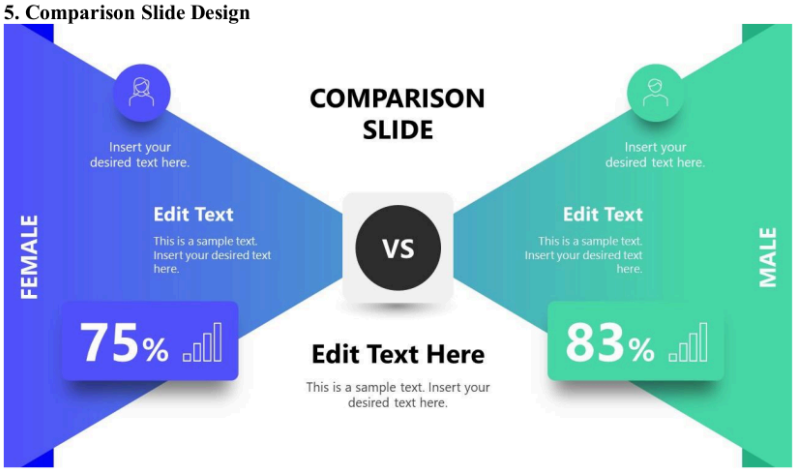
4. Two Content Slide Design





Use: To display text and image/diagram side by side
Example:
Left Side: Definition
Right Side: Diagram/Image

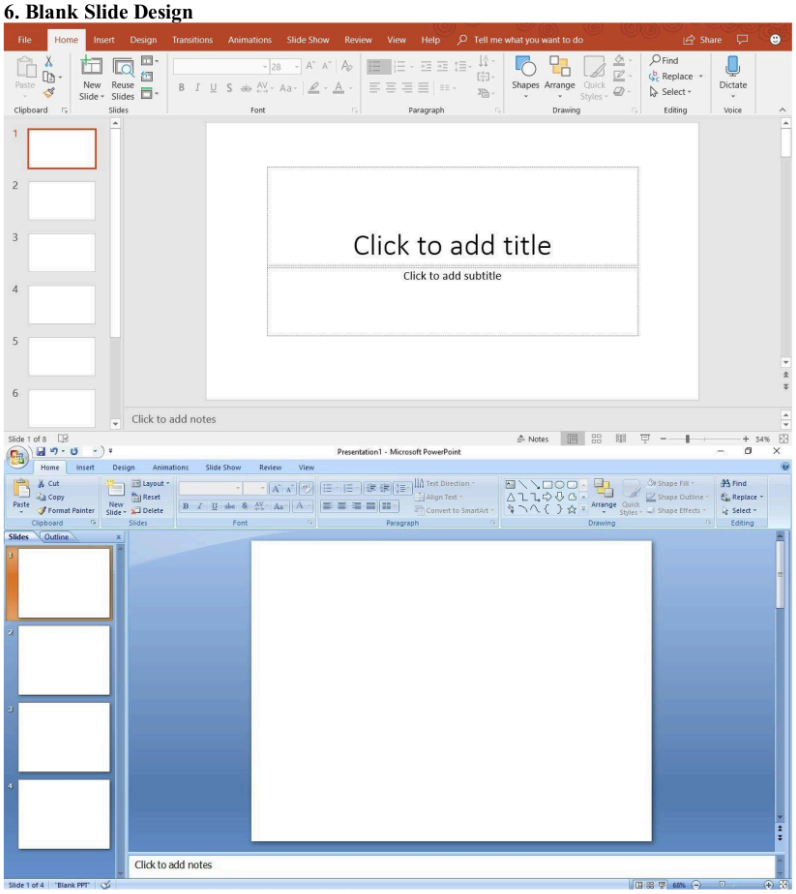
5. Comparison Slide Design



Use: To compare two topics
Example:

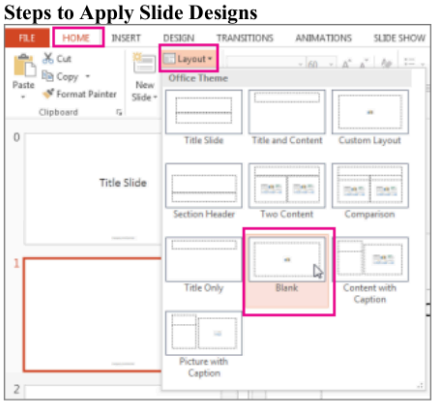
LAN	WAN
High speed	Low speed
Small area	Large area
Low cost	High cost

6. Blank Slide Design



Use: When full custom design is required
Example: Custom diagram or large image

Steps to Apply Slide Designs



Steps:

1. Select the slide
2. Click **Home → Layout**
3. Choose the required slide design

Diagram – Workflow of Slide Design Application

Create New Slide
↓
Select Slide
↓
Choose Layout
↓
Apply Design
↓
Insert Content

Advantages of Using Slide Designs

- Improves visual appearance
- Organizes content clearly
- Saves time in designing
- Enhances audience understanding

1.3 SUMMARY

Templates and slide designs in MS PowerPoint help users create visually consistent and attractive presentations. Templates provide pre-designed themes with coordinated colors, fonts, and backgrounds, which save time and improve presentation quality. Different slide designs or layouts help organize content such as titles, text, images, and charts in a structured way. Using appropriate templates and slide designs makes presentations more engaging and easier to understand.

1.4 KEYWORDS

Template – A pre-designed PowerPoint file that includes fixed formats, colors, and styles.
Theme – A combination of colors, fonts, and effects applied to slides for a uniform look.
Slide Layout – The arrangement of text and content placeholders on a slide.
Design Tab – The PowerPoint menu used to apply themes and slide designs.
Placeholder – A predefined area in a slide used to insert text, images, or content.

1.5 SELF-ASSESSMENT QUESTIONS

1. Explain the concept and importance of templates in MS PowerPoint.
2. Describe the different types of slide layouts available in PowerPoint.
3. Discuss how templates help in maintaining consistency in presentations.
4. Explain the steps to apply and change slide designs in PowerPoint.
5. Write an essay on best practices for choosing templates and slide designs for effective presentations.

1.6 SUGGESTED READINGS

2. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams.* Paperback.
3. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365).* Paperback / eBook.
4. Curtis Frye & Joan Lambert (2022). *Microsoft Excel Step by Step (Office 2021 and Microsoft 365).* Paperback.
5. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook.* Paperback / eBook.
6. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.

LESSON-12

MICROSOFT POWER POINT SLIDE MASTER, ANIMATIONS, TIMINGS, AUDIO & VIDEO

LEARNING OBJECTIVES

- Understand the purpose of Slide Master in PowerPoint.
- Apply animations to slide text and objects.
- Use slide timings to control slide transitions.
- Insert and manage audio and video in presentations.
- Create interactive and multimedia presentations.

STRUCTURE

1.1 Uses of Slide Master in MS PowerPoint

1. Why Slide Master matters (uses & benefits)

Slide Master is essential for any presentation that must look consistent, professional, and maintainable. Its main uses:

- **Global formatting control:** set a single font family, size, color scheme, and it applies to every slide.
- **Consistent logo/header/footer placement:** place a logo, footer text or page number once so it appears uniformly on all slides.
- **Create and manage layouts:** define custom layouts (title slide, two-content, comparison, blank, etc.) so every new slide follows the template.
- **Uniform placeholders:** control positions and sizes of title/content/placeholders so content aligns perfectly across slides.
- **Efficient updates:** change the master once (for example, update the company logo or color) and every slide updates automatically.
- **Brand compliance:** enforce corporate colors, fonts and slide elements for all presenters.
- **Faster slide creation:** predesigned masters speed up building new presentations — ideal for recurring reports, lectures, marketing decks.
- **Presenter consistency:** keep notes, slide number and date format consistent for printing and presenter view.

Practical scenarios: corporate templates, lecture series, training material, research theses, standardized reports.

2. Slide Master components (what you'll see)

- **Slide Master (topmost thumbnail):** controls theme and default styles for all layouts beneath it.
- **Layout masters (below the Slide Master):** Title Slide, Title & Content, Two Content, Comparison, Blank, etc. Each layout inherits from the Slide Master but can have exceptions.
- **Placeholders:** areas for title, subtitle, text, picture, chart, date, footer, slide number.
- **Theme elements:** background, color palette, fonts, effects and slide size.

3. Step-by-step procedure — Create & use Slide Master (with diagrams)

Below is a clear, repeatable procedure. Each step is followed by a compact ASCII diagram to reinforce the visual idea.

Step A — Open Slide Master view

1. Open your presentation in PowerPoint.
2. Click **View → Slide Master**.
3. The left pane now shows the master slide at the top and layout slides under it.

Diagram (before / after):

Normal View:
[Slide thumbnails]
-> Slide 1
-> Slide 2
-> ...

After: View → Slide Master
[Master Pane]
-> Slide Master (top)
-> Title Slide Layout
-> Content Layout
-> Two Content Layout
-> ...

Step B — Edit the Slide Master (global changes)

1. Select the **Slide Master** (top thumbnail).
2. Make global edits: change background (Format Background), set theme fonts (Home → Font or Design → Fonts), choose theme colors (Design → Colors), and insert logo/image or watermark (Insert → Picture).
3. Add or edit placeholders for footer, date, slide number: **Insert Placeholder** → choose type and place it.

Diagram (logo + footer applied to master):

```
[Slide Master] ----------------------
| LOGO (top-right)                 |
|                                  |
| Title placeholder                |
| Content placeholder              |
|                                  |
| Footer: "Company Confidential"   |
| Slide #   Date                   |
------------------------------------
```

Step C — Customize specific layout masters

1. Click any layout under the master (e.g., Title Slide, Two Content).
2. Rearrange placeholders, change alignment, or hide a placeholder (select → Delete).
3. If a specific layout needs a different background or font, change it here — it overrides the Slide Master for that layout only.

Diagram (two-content layout change):

[Two Content Layout]
| Title |
| Left placeholder | Right placeholder |
| Footer + Slide # |

Step D — Create new custom layouts (optional, advanced)

1. In Slide Master view, click **Insert Layout**.
2. Add placeholders (text, picture, chart) and name the layout (right-click → Rename Layout).
3. This layout appears as an option when you add a new slide in Normal view.

Diagram (custom layout with image and caption):

[Custom Layout: Image + Caption]
| Title |
| [Large Picture Placeholder] |
| [Caption / Text Placeholder] |
| Footer / Slide # |

Step E — Set Slide Master defaults (fonts & colors)

1. Use **Slide Master → Fonts** to pick heading/body fonts.
2. Use **Colors** to pick or create a color palette that matches branding.
3. Use **Effects** if you want consistent shadow/3D effects.

Tip: use accessible font sizes and high-contrast colors for readability.

Step F — Close Master View and use layouts

1. Click **Slide Master → Close Master View** (or View → Normal).
2. Insert new slides using **Home → New Slide** and choose the layout you customized. All new slides follow the master.

Flow diagram (compact):

Open PPT → View → Slide Master
↓
Edit Slide Master (logo, fonts, background)
↓
Customize Layouts (Title, Content, Custom)
↓
Close Master View → Insert slides using chosen layouts

Step G — Update master later (propagates automatically)

1. Reopen Slide Master to edit.
2. Any change to the master (e.g., update logo) automatically updates all slides that use that master/layout.
3. If a slide has manual overrides (direct edits), you may need to reset (Home → Reset) to reapply master formatting.

4. Practical examples & scenarios (with mini-diagrams)

Example 1 — Add company logo & footer to all slides

- In Slide Master: Insert logo image in top-right, Insert Placeholder → Footer at bottom → type "Company Confidential".
  Result: every slide displays logo + footer without editing each slide.

Mini view:

Slide Master: [Logo] [Title]
[content....]
Footer: Company Confidential

Example 2 — Two different slide masters (for sections)

- Create two masters: Master A (blue theme) for business section; Master B (green theme) for training section.
- Apply Master B to slides 10–20 (Design → Variants → Browse for Themes or use Slide Layouts).
  Benefit: different sections have distinct visual identity while keeping consistency within sections.

Mini view:

Master A (Blue) -> Slides 1-9
Master B (Green) -> Slides 10-20

Example 3 — Force consistent title position (lecture slides)

- Edit Title placeholder position in Slide Master so every lecture slide has title at the same X/Y coordinates.
  Result: diagrams and tables align vertically on sequential slides — better for handouts.

5. Tips, best practices & troubleshooting

- **Use Slide Master early:** design master before creating content to avoid rework.
- **Keep masters simple:** avoid overcrowding; minimal and clear is more professional.
- **Use placeholders, not fixed text boxes:** placeholders remain editable per slide; fixed text in master is global.
- **Name custom layouts:** right-click → Rename Layout to make them easy to find.
- **Avoid local manual formatting:** excessive manual changes on slides may prevent master updates from appearing; use **Reset** on slides to reapply master.
- **Save master as template (.potx):** File → Save As → PowerPoint Template to reuse across presentations.
- **Check slide size and aspect ratio:** Design → Slide Size before finalizing master (16:9 vs 4:3).
- **Accessibility:** choose high contrast colors, readable fonts (≥24 pt for body in presentation).
- **Logos and images:** use high-resolution images but optimized size to avoid large file sizes.
- **Protect corporate template:** consider saving a locked read-only copy for users to avoid unauthorized changes.

Troubleshooting:

- If a slide doesn't reflect master changes, it might use a different layout or have direct formatting — use **Layout** (Home → Layout) to reapply the correct layout, or **Reset** to revert manual changes.
- If fonts look wrong when opened on another computer, embed fonts (File → Options → Save → Embed fonts in the file) or use common system fonts.

6. Quick classroom exercise (5–10 minutes)

1. Open a blank presentation.
2. View → Slide Master. Insert a sample logo top-right and type "Faculty: [Your Name]" in footer placeholder.
3. Create one custom layout named "Two-picture + Caption". Add two picture placeholders and one small text placeholder beneath each. Close master view.
4. Insert a new slide → choose your "Two-picture + Caption" layout. Insert sample pictures. Observe footer and logo appear automatically.

Expected learning: students see how master changes propagate and how custom layouts make slide creation faster.

1.2 Uses of Animations, Timings, Audio & Video in MS PowerPoint

1. Why use animations, timings, audio and video?

Animations let you reveal content progressively (avoid overwhelming the audience), emphasize key points, and illustrate processes. Timings automate slide flow for rehearsed or kiosk presentations. Audio (narration, background music, sound effects) improves clarity and accessibility; video embeds demonstrations, interviews, and dynamic visuals that explain complex ideas more effectively than text or images alone.

Practical classroom/corporate uses:

- Step-by-step process build (animations)
- Auto-advance slides for unattended kiosks (timings)
- Voiceover lecture or spoken instructions (audio)
- Product demo, experiment footage, or guest talk (video)

2. PowerPoint components you'll use

- **Animations Pane** (View → Animations → Animation Pane) — control order & timing.
- **Animation Gallery** (Animations tab) — Entrance, Emphasis, Exit, and Motion Paths.
- **Transitions tab** — slide-to-slide visual effects and basic timings.
- **Insert → Audio / Video** — embed or link multimedia.
- **Playback tab** (appears when media selected) — play options, trimming, volume.
- **Rehearse Timings** (Slide Show tab) — record slide durations and narration.
- **Record Slide Show** — record narration, ink, and timings.

3. Step-by-step: Adding and controlling animations (with diagrams)

Step A — Apply an animation

1. Select object (text box, shape, picture).
2. Go to **Animations** → pick an animation (Entrance/Emphasis/Exit/Motion Path).
3. The slide shows a small numbered tag (order index).

Diagram (before/after applying animation):

[Slide]
Title
[1] Bullet 1
[2] Bullet 2

After Animations tab selection:
Bullet 1 ← Entrance Fade (1)
Bullet 2 ← Entrance Fly In (2)

Step B — Open Animation Pane & adjust order

1. Click **Animations → Animation Pane**.
2. In the pane: drag items to reorder, click the drop-down for options.

Diagram (Animation Pane simplified):
Animation Pane
1. Bullet 1 | Start: On Click | Duration: 0.50s
2. Bullet 2 | Start: With Previous | Delay: 0.30s

Step C — Set Start / Duration / Delay

- **Start**: On Click / With Previous / After Previous
- **Duration**: How long the animation takes (seconds)
- **Delay**: Wait before starting (seconds)

Example: Make bullet 2 start *After Previous* with 0.3s delay to create a smooth stagger.

4. Step-by-step: Using Timings and Rehearse Timings

Slide-level transition timing

1. Select slide → **Transitions** tab.
2. Under **Timing**, uncheck "On Mouse Click" and set **After** X:XX to auto-advance.

Rehearse Timings (recorded slide durations)

1. Slide Show → **Rehearse Timings**.
2. Advance through slides while speaking or practicing; PowerPoint records time on each slide.
3. Save timings at the end.

Diagram (Auto-advance):
Transition: Fade
Advance slide → After: 00:08 (slide auto moves after 8 seconds)

5. Step-by-step: Inserting and controlling audio

Insert audio (narration / music)

1. Insert → **Audio → Audio on My PC** (or Record Audio).
2. Select audio icon placed on slide (speaker icon).

Playback settings (Playback tab)

- **Start**: On Click / Automatically / Play Across Slides
- **Play Across Slides**: good for background music across presentation
- **Loop until Stopped**: for kiosk mode
- **Hide During Show**: hides icon while presenting
- **Trim Audio**: remove unwanted start/end portions
- **Volume**: adjust playback loudness

Diagram (audio options):
[Audio icon]
Playback: Start = Automatically | Play across slides = checked | Loop = unchecked

Record narration for entire show

1. Slide Show → **Record Slide Show**.
2. Choose to record **slide and animation timings** and **narration**.
3. Speak per slide; stop to move to next. Timings and audio attached to slides.

Tip: Use a good microphone and quiet room; use Script or bullet notes for smooth narration.

6. Step-by-step: Inserting and editing video

Insert video

1. Insert → **Video → This Device** (or Online Video).
2. Video placeholder appears on slide.

Playback & Format controls

- **Playback tab**: Start (On Click / Automatically), Play Full Screen, Trim Video, Fade In/Out, Volume, Loop until Stopped.
- **Format tab**: Picture Frame, Corrections, Poster Frame (choose thumbnail), Crop, Size.

Diagram (video workflow):
Insert → Video placed on slide
→ Playback: Start = On Click (or Auto)
→ Format: Poster Frame = choose thumbnail
→ Trim: Cut lead/trailing silence

Tips for embedded vs linked video

- **Embedded** stores video in .pptx — file grows.
- **Linked** keeps file external — reduces .pptx size but must keep video file with presentation.
  Recommendation: embed short clips; use linked for very large videos if you'll always present from the same folder.

7. Synchronizing animations with audio/video

Use the Animation Pane to add animation to objects and to the audio/video object itself. You can set audio/video to start **With Previous** and then chain subsequent animations **After Previous** with delays to sync actions.
Example: Start video (animation entry) → after 5s, animate overlay text to appear.
Animation Pane:
1. Video Play Start: On Click (or Automatically)
2. Overlay Text Start: After Previous | Delay: 5.00s

8. Best practices & accessibility

- **Less is more:** use subtle animations—avoid distracting audiences.
- **Purposeful animations:** use to teach sequence or emphasize, not for decoration.
- **Consistent timing:** maintain uniform durations across similar animations.
- **Readable text durations:** don't auto-advance slides too fast; typical reading time = 6–10 seconds per slide for dense content.
- **Use high-quality audio:** check levels and avoid clipping; normalize voice levels.
- **Provide captions/transcripts:** for accessibility and non-native speakers. PowerPoint supports closed captions when recording narration.
- **Test on target machine:** fonts, video codecs, and hardware vary—always test on presenting device.
- **Embed fonts or use standard fonts** to avoid substitution on other machines.
- **Compress media** (File → Info → Compress Media) to reduce file size while preserving quality.

9. Common troubleshooting

- **Video won't play:** ensure codecs installed or use MP4 (H.264 + AAC) which is widely compatible.
- **Audio cuts off when moving slides:** set audio playback to **Play across slides**.
- **Animations out of order after editing:** open Animation Pane and reorder manually.
- **Large file size:** compress media or link large files.
- **Timing not matching rehearsal:** re-record timings or fine-tune delays in Animation Pane.

10. Classroom exercise (15–20 minutes)

1. Create a 5-slide deck: Title, 3 content slides, Thank you.
2. On each content slide: add three bullet points. Animate bullets to appear one-by-one using **Fade** with **With Previous** for a cascading effect (Delay 0.3s).
3. Insert a short (10–20s) video on slide 3; set Poster Frame and **Start = Automatically**. Trim to 15s.
4. Insert background music on slide 2 → Playback: **Play across slides** and Loop until Stopped. Set volume low. Hide icon.
5. Rehearse Timings and save. Run Slide Show to test audio/video sync and automatic advance.

1.3 SUMMARY

Slide Master in PowerPoint allows users to control the overall design and layout of slides from one central place, ensuring consistency throughout a presentation. Animations help add movement to text and objects to make content more engaging. Timings control the duration of slides and automate the slide show. Audio and video features allow users to embed sound and visual clips, making presentations more interactive and effective for learning and communication.

1.4 KEYWORDS

Slide Master – A tool that controls the overall design and formatting of all slides in a presentation.
Animations – Visual effects applied to text or objects to add movement.
Slide Timings – The control of how long a slide is displayed during a slideshow.
Audio – Sound files added to slides to enhance presentation delivery.
Video – Moving visual files embedded in slides for better explanation of concepts.

1.6 SELF-ASSESSMENT QUESTIONS

1. Explain the role and advantages of using Slide Master in PowerPoint.
2. Describe the different types and uses of animations in PowerPoint.
3. Discuss how slide timings improve automated presentations.
4. Explain the steps and importance of inserting audio and video in PowerPoint.
5. Write an essay on how multimedia features enhance the effectiveness of PowerPoint presentations.

1.6 SUGGESTED READINGS

1. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams*. Paperback.
2. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365).* Paperback / eBook.
3. Curtis Frye & Joan Lambert (2022). *Microsoft Excel Step by Step (Office 2021 and Microsoft 365).* Paperback.
4. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook.* Paperback / eBook.
5. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.

LESSON-13

MICROSOFT ACCESS

LEARNING OBJECTIVES

- Understand the basic features and purpose of MS Access.
- Create and manage databases, tables, and relationships.
- Define fields, data types, and primary keys in tables.
- Use forms to enter and view data efficiently.
- Ensure data integrity and proper database organization.

STRUCTURE

1.1 PLANNING: ENTITY IDENTIFICATION & ER SKETCH (BEFORE YOU OPEN ACCESS)

Scenario (example): Student–Course system. Entities: Student, Course, Enrollment (junction).
Key attributes:

- Student(StudentID PK, FirstName, LastName, DOB, Email)
- Course(CourseID PK, CourseName, Credits)
- Enrollment(EnrollmentID PK, StudentID FK, CourseID FK, Grade, EnrollDate)

Simple ER sketch (text diagram):
[Student] 1 ----< [Enrollment] >---- 1 [Course]
Student(StudentID PK, ...) Course(CourseID PK, ...)
Enrollment(EnrollmentID PK, StudentID FK, CourseID FK, Grade)
Design note: Enrollment models the many-to-many relationship between Student and Course.

1.2 Create a new Access database (step by step)

1. Open **Microsoft Access**.
2. On start screen choose **Blank desktop database**.
3. In the right pane type **CollegeDB.accdb** (or your preferred name).
4. Click **Create**. Access opens with a default table named **Table1**.

Diagram (startup):
Access Start → Blank desktop database → Name file → Create

1.3 Create tables — Method A: Design View

Create Student table

1. In the left Navigation Pane right-click → **New** → choose **Table Design** (or Home → View → Design View).
2. In design grid add fields:

Field Name	Data Type	Description / Properties
StudentID	AutoNumber	Set **Primary Key** (right-click row → Primary Key)
FirstName	Short Text	Field Size 50, Required = Yes
LastName	Short Text	Field Size 50, Required = Yes
DOB	Date/Time	Format = Short Date
Email	Short Text	Field Size 100, Indexed = Yes (No Duplicates)

3. Save → name **Student**.

Diagram (Student table design):

```
Student (Table)
+-----------+-----------+---------------------+
| Field     | Type      | Key/Props           |
+-----------+-----------+---------------------+
| StudentID | AutoNum   | PK                  |
| FirstName | ShortText | Required            |
| LastName  | ShortText | Required            |
| DOB       | Date/Time |                     |
| Email     | ShortText | Indexed (No Dups)   |
+-----------+-----------+---------------------+
```

Create Course table

Fields:

- CourseID — AutoNumber — PK
- CourseName — Short Text (100) — Required
- Credits — Number (Integer) — Default Value 3

Save as **Course**.

Create Enrollment table (junction)

Fields:

- EnrollmentID — AutoNumber — PK
- StudentID — Number (Long Integer) — will be FK to Student.StudentID
- CourseID — Number (Long Integer) — will be FK to Course.CourseID
- EnrollDate — Date/Time — Default Value = Date()
- Grade — Short Text (5) or Number depending on grading scheme

Save as **Enrollment**.

Important: Use the same numeric type for FK fields as PK fields (AutoNumber PKs are referenced as Number Long Integer in Access when building FKs manually).

Set Primary Keys & Indexing

- In **Table Design** view select the StudentID row → click **Primary Key** on the toolbar. Do this for CourseID and EnrollmentID.
- To speed lookups, set **Indexed = Yes (No Duplicates)** on fields like Email or unique codes.

1.4 Define Relationships and enforce Referential Integrity (step by step)
Open Relationships window

1. Click **Database Tools → Relationships**.
2. If prompted to add tables, add **Student**, **Course**, **Enrollment**.

Create Student → Enrollment relationship

1. Drag **Student.StudentID** onto **Enrollment.StudentID**.
2. The Edit Relationships dialog appears.
3. Check **Enforce Referential Integrity**. Optionally check **Cascade Update Related Fields** and **Cascade Delete Related Records** (use with caution).
4. Click **Create**.

Create Course → Enrollment relationship

1. Drag **Course.CourseID** onto **Enrollment.CourseID**.
2. Enforce Referential Integrity and Create.

Relationship diagram (Access Relationships window simplified):
[Student] 1 ----< [Enrollment] >---- 1 [Course]
Student.StudentID PK Enrollment.StudentID FK
Course.CourseID PK Enrollment.CourseID FK
(Referential Integrity enforced)
Cardinality: Student 1 → * Enrollment; Course 1 → * Enrollment.

Additional Access conveniences
Lookup fields (not always recommended for normalization)
You can create a Lookup in the Enrollment table design so StudentID displays student names:

- In **Enrollment Design View**, set StudentID Data Type to **Lookup Wizard** → choose "I want the lookup field to get values from another table" → Student table → display FirstName + LastName.
  Note: While convenient, lookup fields hide the FK numeric value and can complicate SQL; prefer joins in queries for learning.

Input Masks and Validation Rules

- For Email you can set a **Validation Rule** or use event code in forms.
- For Phone numbers use **Input Mask** (e.g., (999) 000-0000).

Default Values and Required fields

- Set **Default Value** for EnrollDate to Date().
- Set **Required = Yes** for fields that must have values.

Enter sample data (Datasheet View)

- Double-click table to open in Datasheet View and enter sample rows for Student and Course first, then insert Enrollment rows referencing existing StudentID and CourseID.
- If referential integrity is enabled, Access will prevent inserting an Enrollment that references a non-existent StudentID or CourseID.

Sample data (text table):
Student
ID | FirstName | LastName
1 | Rahul | Sharma
2 | Anjali | Rao

Course
ID | CourseName | Credits
1 | Database 101 | 3
2 | Networks | 4

Enrollment

ID	StudentID	CourseID	Grade
1	1	1	A
2	2	2	B

Test referential integrity & cascade behavior

- Try deleting Student with ID 1. If **Cascade Delete** was checked, related Enrollment rows will be deleted automatically. If not, Access blocks deletion until child records removed — protecting data integrity.

Run queries to join tables (using Query Design or SQL)

Query Design (GUI)

1. Create → Query Design → add Student, Enrollment, Course.
2. Drag fields: Student.FirstName, Student.LastName, Course.CourseName, Enrollment.Grade.
3. Run → shows joined results.

SQL example (Access SQL dialect)

```
SELECT s.FirstName, s.LastName, c.CourseName, e.EnrollDate, e.Grade
FROM (Student AS s
    INNER JOIN Enrollment AS e ON s.StudentID = e.StudentID)
    INNER JOIN Course AS c ON e.CourseID = c.CourseID;
```

Normalization & design checks (short)

- Ensure atomic fields (no multiple values in one field).
- Avoid storing derived or repeating groups (use separate tables).
- Student–Course–Enrollment is normalized: student info stored only once, relationships stored in Enrollment.

Creating Forms & Reports (brief)

- **Forms**: Create → Form Wizard or Blank Form. Use forms for data entry, hide the raw table structure, and enforce validation.
- **Reports**: Create → Report Wizard for printable output (e.g., class lists, grade reports).

Best practices & tips

- Use **AutoNumber** surrogate keys for simplicity and stable PKs.
- Enforce **Referential Integrity** to prevent orphan records.
- Avoid overusing Lookup fields in table design; use them on forms for friendly display.
- Keep consistent data types between PK and FK fields.
- Back up the .accdb before big changes (compact & repair via File → Info).
- Name objects clearly: tblStudent, tblCourse, tblEnrollment, qryStudentEnrollments, frmStudent.

Troubleshooting common issues

- **FK insert fails** → you're referencing a non-existent PK or referential integrity blocks it. Insert parent first.
- **Lookup shows blank** → check the Row Source of lookup and that related table contains data.
- **Cascade delete removed too much** → undo and reconsider cascade settings.
- **Performance sluggish with many records** → Access is best for small/medium datasets; consider SQL Server for large scale.

Classroom exercise (lab)
Task: Build LibraryDB with Book, Member, Borrow tables.
Steps students should follow:

1. Create new Access DB LibraryDB.accdb.
2. Create Book (BookID AutoNumber PK, Title, Author, ISBN).
3. Create Member (MemberID AutoNumber PK, Name, Phone).
4. Create Borrow (BorrowID PK, BookID FK, MemberID FK, BorrowDate, ReturnDate).
5. Define relationships with Referential Integrity (no cascade delete).
6. Enter sample data and write a query that shows Member Name, Book Title, BorrowDate.
7. Produce a simple report of current borrowed books.

Expected deliverable: ER diagram, three tables with data, working query, and a short reflection on why Enrollment/Borrow table is necessary.

1.5 MS ACCESS — Creating Forms to Enter Data & Filtering Data

Prerequisite
You should already have tables created (e.g., Student, Course, Enrollment) with primary keys and foreign keys. If not, create those first (see earlier MS Access materials).

1. Types of Forms in Access (quick summary)

- **Simple Form / AutoForm (Form View)**: Quick form generated automatically.
- **Form Wizard**: Guided creation with layout choices.
- **Design View (Blank Form)**: Full control — place controls exactly where you want.
- **Split Form**: Shows Form view + Datasheet view simultaneously. Good for editing one record while scanning others.
- **Continuous Form**: Shows multiple records in a stacked layout (like repeating detail rows).
- **Popup / Modal Forms**: Small windows for data entry or messages.

2. Example scenario & goal
We will build a **Student** data-entry form and a **Student Enrollments** form that includes a subform showing courses the student has enrolled in. We'll also build filters and a search box on the Student form.
Tables used:

- Student(StudentID PK, FirstName, LastName, DOB, Email)
- Course(CourseID PK, CourseName, Credits)
- Enrollment(EnrollmentID PK, StudentID FK, CourseID FK, EnrollDate, Grade)

3. Step-by-step: Create a basic form using Form Wizard
A — Using Form Wizard (fast start)

1. In Access ribbon → **Create** → **Form Wizard**.
2. Choose table/query: select **Student**.
3. Move fields you want on the form (e.g., StudentID, FirstName, LastName, DOB, Email) to the Selected list.
4. Click **Next** → Choose layout (Columnar is good for single-record forms).
5. Click **Next** → Give the form a name, e.g., frmStudent.
6. Click **Finish**. Access opens the form in **Form View** ready for data entry.

Diagram (wizard flow):

Create → Form Wizard
Student table -> select fields
Next -> Choose layout (Columnar)
Next -> Name form (frmStudent)
Finish -> Form View

4. Step-by-step: Create a custom Blank Form (Design View) — more control
B — Blank Form → Design View

1. **Create → Blank Form**. Access shows a blank canvas and the Field List.
2. From **Field List** pane drag fields (FirstName, LastName, DOB, Email) onto the form canvas.
3. Use **Design** and **Arrange** tabs to position controls (text boxes, labels).
4. Set StudentID control as a **bound** control (Control Source = StudentID). Usually StudentID is AutoNumber; you may hide it or set it ReadOnly.
5. Format fonts, add a title label and set tab order (Design → Tab Order).
6. Save form as frmStudent_Design. Switch to **Form View** to test.

Diagram (simple form layout ASCII):

```
+-------------------------------------------+
| [Label: Student Details]                  |
|                                           |
| First Name: [_____________]               |
| Last Name : [_____________]               |
| DOB       : [  dd/mm/yyyy  ]              |
| Email     : [_____________________]       |
| [Save Button]  [New Record]  [Delete]     |
+-------------------------------------------+
```

5. Add controls & set properties (important fields)
Controls you will use

- **Text Box** — for text and dates (bound to a field via Control Source).
- **Combo Box** — for selecting from a list (good for Course selection in Enrollment).
- **List Box** — multi-select options.
- **Command Button** — run macros/VBA (Save, New, Delete, Close).
- **Subform/Subreport** — embed a subform showing related records (Enrollments).
- **Label** — static text.
- **Image** — logo.

Setting properties (Property Sheet)

- **Control Source**: bind control to a field (e.g., FirstName).
- **Name**: give a meaningful name like txtFirstName, cboCourse.
- **Format**: date formatting, input masks.
- **Enabled / Locked**: control editing.
- **Visible**: hide controls like PK.
- **Default Value**: e.g., Date() for EnrollDate.
- **Validation Rule / Validation Text**: enforce data rules.

Tip: Right-click control → **Properties** to open Property Sheet.

6. Create combo box for lookups (recommended for FK fields)
Use case: select Course when creating an Enrollment record

1. On Enrollment form in Design View, **Create → Combo Box**.

2. Wizard options: choose "I want the combo box to get the values from another table or query."
3. Select Course table, choose CourseID and CourseName.
4. Choose to **hide key column** (so user sees CourseName), but Control Source remains CourseID.
5. Name the control cboCourse.

Diagram (combo box mapping):
cboCourse shows: [Database 101]
but stores: CourseID = 1 (Control Source=CourseID)

7. Add a subform for Enrollments in the Student form (one-to-many)
Why a subform?
A subform displays the many side (Enrollment) for the current Student. It's ideal for viewing/editing all enrollments belonging to the displayed student.
Steps

1. Open frmStudent in Design View.
2. **Create → Subform/Subreport**. Use the wizard.
3. Choose "Use an existing form" (create a form for Enrollment first, e.g., frmEnrollment_Continuous). Alternatively the wizard can create a datasheet subform.
4. When asked, choose the relationship: StudentID in Student → StudentID in Enrollment (Link Master Fields / Link Child Fields).
5. Finish. Resize the subform area.

Diagram (form with subform):
[frmStudent]
Student Details...

Subform: [Enrollment list for current Student]
EnrollmentID | CourseName | EnrollDate | Grade
---
1 | DB 101 | 2025-06-01 | A
2 | Networks | 2025-07-10 | B
Tip: Use **Continuous Form** or **Datasheet** layout for subform so multiple rows show.

8. Navigation & command buttons (Create common actions)
Add Navigation Buttons

- In Design View → **Design** tab → Controls → **Button** (Command Button).
- The Command Button Wizard helps create:
  - Move record buttons (First, Previous, Next, Last) — you can also add Navigation control from Design → Navigation Controls.
  - Add New Record: Action = Record Operations → Add New Record.
  - Save Record: Action = Record Operations → Save Record (or use VBA DoCmd.RunCommand acCmdSaveRecord).
  - Delete Record: Action = Record Operations → Delete Record.

Example: Create a Search Button (macro)

- Command Button Wizard → Miscellaneous → Run Macro.
- Or create a simple embedded macro: On Click → RunCommand → FindDialog or use filtering macro (OpenForm with WhereCondition).

9. Tab order & keyboard shortcuts (usability)

- **Design → Tab Order**: set logical order users will tab through controls.
- Useful shortcuts in form view: Ctrl + + (New Record), Ctrl + S (Save), Ctrl + F (Find), Ctrl + PageUp/PageDown (move record).

10. Saving and testing forms

- Save form (Ctrl + S).
- Switch to **Form View** and try entering sample data.
- Test validation rules and the behavior of combo boxes and subforms.

11. Step-by-step: Filtering data in forms

Access offers several quick and advanced filters. We'll demonstrate three common techniques.

A — Filter By Selection (quick)

1. In **Form View**, click a value in a control (e.g., LastName = "Rao").
2. Right-click → **Filter by Selection**. Access filters records that match that value.
3. To remove filter: **Home → Advanced → Toggle Filter** or click **Remove Filter/Sort** in the ribbon.

Diagram:

[All records] -> choose 'Rao' -> Filter by Selection -> [Only records with LastName=Rao]

B — Filter By Form (complex, multi-field)

1. In Form View → **Home → Advanced → Filter by Form**. Form becomes blank for entering criteria.
2. In the blank form, type criteria you want (e.g., LastName = "Rao", DOB >= #01/01/2000#).
3. Click **Toggle Filter** (Apply). Access shows records matching all criteria (AND).
4. For OR criteria: use the second row (click the Or row in the design) and enter alternative values.

Diagram (Filter by Form):

Filter By Form:
[FirstName] [LastName] [DOB]
Row1: Rahul Rao >=01/01/2000 -> Apply => matches AND
Row2 (OR): Anjali -> alternative OR option

C — Advanced Filter/Sort (saveable filter)

1. Form View → **Home → Advanced → Advanced Filter/Sort**.
2. Access switches to a query-like grid where you can drag fields, set Sort, and criteria.
3. After setting criteria, click **Toggle Filter** to apply.
4. You can **Save As Query** to reuse the filter later.

D — Using a Search Box (unbound control)

1. Add a TextBox (name txtSearch) and a Command Button btnSearch.
2. In the button's **On Click** event, use a small macro or VBA to apply a filter:

Macro approach (embedded macro):

- Action: ApplyFilter
- Where Condition: "[LastName] Like '*" & [Forms]![frmStudent]![txtSearch] & "*' OR [FirstName] Like '*" & [Forms]![frmStudent]![txtSearch] & "*'"

VBA approach:

```
Private Sub btnSearch_Click()
   Dim s As String
   s = Me.txtSearch
   If s <> "" Then
      Me.Filter = "[FirstName] LIKE '*" & s & "*' OR [LastName] LIKE '*" & s & "*'"
```

```
    Me.FilterOn = True
  Else
    Me.FilterOn = False
  End If
End Sub
```

Diagram (search flow):
User types "Rah" into txtSearch -> clicks btnSearch
Form applies Filter => shows FirstName or LastName containing "Rah"

12. Requery vs Refresh vs Repaint

- **Me.Requery** reloads the form's recordsource (useful after adding records via subform).
- **Me.Refresh** refreshes current record(s) without re-running the query.
- **Repaint** redraws UI. Use Me.Requery in AfterUpdate of a form that affects subform data.

13. Using Macros for common filtering tasks (no VBA)

- Create → Macro → Add action ApplyFilter with WhereCondition.
- Save macro and attach to a button's On Click property.
- Advantage: no code required; easier for beginners and safer for locked-down environments.

14. Example: Build a Student form with subform and search (summary of steps)

1. Create frmStudent with fields (FirstName, LastName, DOB, Email).
2. Add a subform control that uses frmEnrollment_Datasheet (showing CourseName through a lookup) and link via StudentID.
3. Add txtSearch textbox and btnSearch button. Implement simple VBA (or macro) to filter FirstName/LastName on click.
4. Add navigation buttons (New, Save, Delete) using Command Button wizard.
5. Test: add student, go to subform and add enrollment rows, click Save, verify data in table.

15. Best practices & usability tips

- Use **meaningful control names** (txtEmail, cboCourse, subEnrollments) to make VBA/macros readable.
- Keep forms **clean and uncluttered**; group related fields visually.
- Use **combo boxes** for foreign keys but store the ID (hide the key column).
- **Validate** critical fields via Validation Rule or AfterUpdate events.
- Add **help tooltips** to complex fields (Control → Tooltip Text).
- Use **Split Forms** for quick browsing + detailed editing.
- Set **Allow Additions**, **Allow Deletions** properties appropriately for user roles.
- When building search, avoid full-table filters on very large datasets — use parameter queries for performance.

16. Common problems & troubleshooting

- **Filter returns no records**: check criteria syntax, date formats (#MM/DD/YYYY# vs local).
- **Subform not showing records**: verify Link Master/Child Fields are set to StudentID and that types match.
- **Combo box shows blank**: check Row Source and Bound Column settings.
- **Changes not visible**: use Me.Requery after inserts/updates.

- **Form slow**: avoid complex recordsource queries that return large numbers of records; use search to restrict result set.

17. Classroom exercise (lab)

Task A — Build Student Entry Form

1. Create frmStudent using Form Wizard (Student table).
2. Convert to Design View and add a search box txtSearch and button btnSearch. Implement the VBA search code above.
3. Add navigation buttons and set Tab Order.

Task B — Add Subform

1. Create form frmEnrollment_Datasheet bound to Enrollment (include CourseName via lookup or join query). Save it as datasheet layout.
2. Add frmEnrollment_Datasheet as a subform to frmStudent and set Link Master/Child Fields to StudentID.
3. Test adding an enrollment via subform and verify record appears in Enrollment table.

Deliverables: Working frmStudent with subform, search functionality, at least 5 sample students and 8 enrollments.

1.6 SUMMARY

MS Access is a relational database management system that helps users store, organize, and manage large amounts of data efficiently. It allows the creation of databases with tables, fields, and relationships to structure data logically. Forms in Access make data entry easier and more user-friendly. Proper use of primary keys, data types, and relationships ensures data integrity and supports effective data management for business, education, and research purposes.

1.7 KEYWORDS

Database – A collection of related data organized for easy access and management.
Table – A structure in Access used to store data in rows (records) and columns (fields).
Field – A column in a table that stores a specific type of data.
Primary Key – A unique identifier for each record in a table.
Form – A user-friendly interface for entering, editing, and viewing data in tables.

1.8 SELF-ASSESSMENT QUESTIONS

1. Explain the basic features and purpose of MS Access.
2. Describe how tables and fields are used to organize data in Access.
3. Discuss the importance of primary keys and data types in database design.
4. Explain the role and benefits of forms in MS Access.
5. Write an essay on how MS Access helps in managing data efficiently for organizations.

1.9 SUGGESTED READINGS

1. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams.* Paperback.
2. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365).* Paperback / eBook.
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4. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook.* Paperback / eBook.
5. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner.* Hardback.

LESSON-14

MICROSOFT ACCESS USING QUERIES FOR DATA MANIPULATION & GENERATING REPORTS

LEARNING OBJECTIVES

Students will learn to:

- Build Select queries (simple, criteria, joins, aggregate, crosstab).
- Create and run Action queries: Make-Table, Append, Update, Delete.
- Create parameter and calculated-field queries.
- Use Query Design view and SQL view.
- Design and generate reports from queries/tables, adding grouping, sorting, totals, headers/footers and charts.
- Export or print reports and use report properties for professional output.

STRUCTURE

1.1 Introduction to QUERIES (Data retrieval & manipulation)

1. What is a Query?

A **query** is a saved database object that retrieves records from one or more tables (or other queries). In Access you build queries in **Design View** using a visual grid, or in **SQL View** using SQL statements.

2. Query Types (quick list)

- **Select Query** — retrieve rows/columns.
- **Action Queries** — Make-Table, Append, Update, Delete (change data).
- **Parameter Query** — prompts user for criteria at runtime.
- **Crosstab Query** — pivot-style summary.
- **Aggregate (Totals) Query** — SUM, AVG, COUNT, GROUP BY.
- **Union / SQL-specific queries** — combine results (SQL view).
- **Pass-Through / Stored Procedure** — advanced (server-side).

3. Building a basic Select Query (Design view) — step-by-step

Goal: list students with FirstName, LastName, Email sorted by LastName.

Steps:

1. In Access ribbon → **Create** → **Query Design**.
2. Add table **Student** to the design window → Close the Add Tables dialog.
3. Double-click fields FirstName, LastName, Email to add to the grid (or drag).
4. In the grid, under LastName set **Sort: Ascending**.

5. Click **Run** (red exclamation) to view results.
6. Save query as qry_StudentList.

Diagram (Design view simplified):
[Student table] Query Grid
StudentID PK ─┐ Field: FirstName | Table: Student | Sort: ( )
FirstName |-- Field: LastName | Table: Student | Sort: Asc
LastName |
Email |-- Field: Email | Table: Student | Sort: ( )

Equivalent SQL:

```
SELECT FirstName, LastName, Email
FROM Student
ORDER BY LastName ASC;
```

4. Using Criteria to filter records
Example: students with LastName = 'Rao' and DOB after 01-Jan-2000
Design grid: in LastName row put Rao; in DOB row put >#01/01/2000#.
SQL:

```
SELECT * FROM Student
WHERE LastName = 'Rao' AND DOB > #2000-01-01#;
```

Notes:

- Dates in Access SQL use # markers.
- Use Like with wildcards for partial matches: Like "Ra*".

5. Calculated fields in queries
Add an expression in the Field cell, e.g. full name:
In Field row:
FullName: [FirstName] & " " & [LastName]
This creates a runtime field FullName.
SQL:

```
SELECT [FirstName] & ' ' & [LastName] AS FullName, Email
FROM Student;
```

6. Joining tables — Inner Join example
Goal: show Student full name with CourseName and Grade (join Enrollment & Course)
Design Steps:

1. Create Query Design, add Student, Enrollment, Course.
2. Ensure relationships lines show Student.StudentID → Enrollment.StudentID and Course.CourseID → Enrollment.CourseID (access draws them automatically if relationships defined).
3. Add fields: [FirstName],[LastName],[CourseName],[Grade].
4. Run and save as qry_StudentEnrollments.

SQL:

```
SELECT s.FirstName, s.LastName, c.CourseName, e.Grade
FROM (Student AS s
    INNER JOIN Enrollment AS e ON s.StudentID = e.StudentID)
    INNER JOIN Course AS c ON e.CourseID = c.CourseID;
```

7. Aggregate (Totals) query — SUM / AVG / COUNT
Example: find average marks or count enrollments per course
Design Steps:

1. Query Design → add Enrollment and Course.
2. Click the **Totals (Σ)** button to show the Totals row.
3. Add CourseName (Group By) and EnrollmentID (Count) or Grade with Avg if numeric.
4. Run.

SQL:

```
SELECT c.CourseName, COUNT(e.EnrollmentID) AS NumStudents
FROM Course AS c
LEFT JOIN Enrollment AS e ON c.CourseID = e.CourseID
GROUP BY c.CourseName;
```

8. Crosstab query (pivot-style)
Example: Count students per course by grade
Design Steps:

1. Create Query Design → click **Crosstab** button.
2. Add CourseName as Row Heading, Grade as Column Heading, EnrollmentID as Value with Count.
3. Run and save.

Result example (visual):

```
CourseName | A | B | C
-----------------------------
DB101      | 10 | 4  | 1
Networks   | 5  | 7  | 2
```

9. Parameter queries (prompt user)
Example: ask for a minimum grade
Design:
In Criteria row for Grade: >= [Enter minimum grade:]
When user runs the query, a dialog prompts: Enter minimum grade: and uses the input.
SQL:

```
SELECT StudentID, CourseID, Grade
FROM Enrollment
WHERE Grade >= [Enter minimum grade:];
```

10. Action queries — Make-Table, Append, Update, Delete
Important: Back up data before running action queries. They change data.
A — Make-Table Query (create a new table from query results)
Use case: make a snapshot table for reporting.
Steps:

1. Build Select query that returns required rows.
2. In Design View, Query Type → **Make Table**.
3. Provide new table name e.g., Snapshot_2025.
4. Run → confirms creation.

SQL example:

```
SELECT s.StudentID, s.FirstName, s.LastName INTO Snapshot_2025
FROM Student AS s
WHERE s.DOB < #2005-01-01#;
```

B — Append Query (add rows to existing table)
Use case: import cleaned rows into master table.
Steps:
1. Build Select query.
2. Query Type → **Append**. Choose target table. Map fields.
3. Run.

SQL example:
```
INSERT INTO MasterStudents (StudentID, FirstName, LastName)
SELECT StudentID, FirstName, LastName FROM TempStudents;
```
C — Update Query (modify existing records)
Use case: increase credits for certain courses.
Steps:
1. Create Select query to identify target rows.
2. Query Type → **Update**. In Update To row provide new expression (e.g., Credits + 1).
3. Run.

SQL example:
```
UPDATE Course
SET Credits = Credits + 1
WHERE CourseName LIKE "Intro%";
```
D — Delete Query (remove records)
Use case: remove test accounts.
Steps:
1. Query Type → **Delete**. Set criteria to target rows.
2. Run (Access warns you before deletion).

SQL example:
```
DELETE FROM Student WHERE Email LIKE '*@test.local';
```

11. Saving & scheduling queries
- Save queries with descriptive names: qry_, aq_ prefix for action queries.
- Access doesn't have built-in scheduling — use Windows Task Scheduler calling a macro/VBA or export results on a schedule via code. (Advanced topic.)

12. Using Query Results as Record Source for Forms/Reports
- When you build a form/report, set its **Record Source** to a saved query (qry_StudentEnrollments) so the UI always shows latest computed results.

1.2 REPORTS (Presentation & printing)
1. What is a Report?
A **report** formats query/table data for printing or PDF export. Reports support headers, footers, grouping, sorting, totals and charts.

2. Report Types & Tools
- **Report Wizard** — fast report creation using query/table.
- **Layout View** — quick visual edit (drag/resize).
- **Design View** — full control over controls and sections.
- **Report Header/Footer, Page Header/Footer, Group Header/Footer, Detail** — structural sections for layout.

3. Create a basic report (Report Wizard) — step-by-step
Goal: create a report showing students with their courses and grades

Steps:

1. **Create → Report Wizard**.
2. Choose table/query: pick qry_StudentEnrollments (or add Student & Enrollment and use grouping).
3. Select fields to include (FirstName, LastName, CourseName, Grade).
4. Choose how to view data: choose grouping — group by StudentID or LastName (so enrollments appear under each student).
5. Choose sort order (LastName Asc).
6. Choose layout (Tabular/Stepped) and orientation (Portrait/Landscape).
7. Finish — Access creates the report.

Diagram (report sections simplified):
Report Header: [School Logo] [Title]
Page Header: [Column headings: Course | Grade]
Group Header (Student): [Student: Rahul Sharma]
Detail rows: DB101 | A
Networks | B
Group Footer: [Student total/notes]
Report Footer: [Prepared on: date]
Page Footer: [Page 1 of N]

4. Modify report layout (Design / Layout view)
Common tasks:

- Move or resize controls (labels, text boxes).
- Add logo: **Design → Image →** place in Report Header.
- Add grouping: **Group & Sort** pane → Add a group level (e.g., StudentID). Set group header/footer options.
- Add totals: In group/footer row add a text box with Control Source =Count([EnrollmentID]) or =Sum([Credits]). Use the Totals button in Design.
- Add page numbers: Insert → Page Number (choose location and format).
- Add a calculated control: =Format([EnrollDate],"dd-mmm-yyyy").

5. Chart in report

- Insert chart: Design → Insert Chart (or use Chart control).
- Set Row/Column source to query fields and configure series/labels via the Chart Data window.
- Use to show totals per course or grade distribution.

6. Grouping, sorting & totals (example)
Example: Grouping by Course, showing average Grade
Steps:

1. Open report in Design View → **Group & Sort** → add group on CourseName.
2. In Group Footer add a text box: =Avg([GradeNumeric]) (use numeric grade field).
3. Label as Average Grade: and format.

Notes: Grades often stored as text; to AVG them convert or store as numeric.

7. Formatting for print (best practices)

- Use Report Header for title & logo; Page Header for column headings.
- Keep margins consistent (Page Layout → Margins).
- Use Keep Together settings to avoid splitting grouped records awkwardly.
- Preview before printing (File → Print Preview).
- Use Can Grow / Can Shrink for text boxes with variable content.

8. Exporting & Distribution

- Export report to PDF: **External Data → PDF or XPS**.
- Email report: **File → Share → Email** (or use VBA to automate).
- Export data: save query results to CSV/Excel if recipients need raw data.

9. Example: Report building flow (diagram)

Design query -> Save as qry_ReportSource
↓
Create Report using Wizard (select qry_ReportSource)
↓
Open in Layout / Design View -> Add grouping, totals, logo
↓
Add charts if needed -> Preview
↓
Export PDF / Print

10. Advanced: Sub-reports (reports within a report)

- Useful to show detail lists inside a parent report (e.g., Student details with a subreport listing enrollments).
- Create subreport bound to Enrollment query; insert into parent report and set Link Master/Child fields (StudentID).

Diagram (parent with subreport):
[Parent report: Student info]
[Subreport control: Enrollment list for that student]

11. Common report controls & their uses

- **Text Box**: displays field values or expressions.
- **Label**: static text (column heading).
- **Line / Rectangle**: visual separation.
- **Image**: logos/photos.
- **Subreport**: embedded report.
- **Chart**: graphical data display.

12. Practical classroom exercises

Exercise 1 — Query Practice (30–40 minutes)

1. Create qry_StudentsAboveGrade that shows students with Grade >= B (use numeric mapping or text criteria).
2. Create qry_CourseCounts that lists course name and number of enrolled students (use COUNT and GROUP BY).
3. Create a parameter query qry_FilterByCourse prompting: Enter course name: and shows enrolled students for the chosen course.

Exercise 2 — Action Query (15 minutes)

1. Create a Make-Table query Snapshot_Enrolled that creates a backup table of current enrollments.
2. Create an Update query to give all students in "Database 101" a grade bump of +1 point (use numeric grade field), then test on a copy or undo by restoring snapshot.

Exercise 3 — Report (45–60 minutes)

1. Build a report rpt_StudentsWithEnrollments grouped by Student (Student Header shows name & email).
2. Add subreport listing each student's courses.
3. Add group footer showing number of courses per student.
4. Add page header with logo and footer with page numbers. Export to PDF.

13. Troubleshooting & tips

- **No results in query:** check criteria, joins (Left Join vs Inner Join), date formats using #.
- **Action query fails:** check permissions and always back up before running.
- **Report layout broken:** use Can Grow and test with long values; check grouping settings.
- **Slow report:** limit recordset with pre-filtered query; avoid pulling huge datasets into reports.
- **Charts wrong:** ensure underlying query fields are numeric where needed; use aggregated queries as chart source.

1.3 SUMMARY

Queries in MS Access are used to search, filter, sort, and manipulate data from one or more tables. They help users extract specific information, update records, and perform calculations. Reports are used to present data in a structured and printable format. By using queries and reports, users can convert raw data into meaningful information that supports analysis and organizational decision-making.

1.4 KEYWORDS

Query – A request to retrieve or modify data from a database.
Select Query – A query used to display specific data from one or more tables.
Action Query – A query that makes changes to data such as update, delete, or append.
Report – A formatted output used to present data clearly for viewing or printing.
Filter – A tool used to display only records that meet specific conditions.

1.5 SELF-ASSESSMENT QUESTIONS

1. Explain the concept and types of queries in MS Access.
2. Describe the steps involved in creating and using select and action queries.
3. Discuss the importance of queries in data manipulation.
4. Explain the process of generating reports in MS Access.
5. Write an essay on how queries and reports help in effective data analysis and decision-making.

1.6 SUGGESTED READINGS

1. Linda Foulkes (2022). *Learn Microsoft Office 2021: Your one-stop guide to upskilling with new features of Word, PowerPoint, Excel, Outlook, and Teams*. Paperback.
2. Joan Lambert & Curtis Frye (2022). *Microsoft Office Step by Step (Office 2021 and Microsoft 365)*. Paperback / eBook.
3. Curtis Frye & Joan Lambert (2022). *Microsoft Excel Step by Step (Office 2021 and Microsoft 365)*. Paperback.
4. Linda Foulkes (2020). *Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook*. Paperback / eBook.
5. M. L. Humphrey (2021). *Microsoft Office 2019 Beginner*. Hardback.

LESSON-15

STATISTICAL PROGRAM FOR SOCIAL SCIENCES

LEARNING OBJECTIVES

- Understand the purpose and applications of SPSS.
- Identify the components of the SPSS interface.
- Enter, edit, and manage data in SPSS.
- Define variables and measurement levels.
- Perform basic statistical operations.

STRUCTURE

1.1 SPSS – INTRODUCTION

SPSS stands for **Statistical Package for the Social Sciences**. It is a powerful software application used for statistical data analysis. SPSS is widely used by researchers, students, healthcare professionals, business analysts, and social scientists to analyze quantitative data and generate accurate statistical results. The software provides an easy-to-use, menu-driven interface where users can enter, edit, and analyze data without needing advanced programming skills. SPSS was originally developed in 1968 and is now maintained and distributed as **IBM SPSS Statistics** by **IBM**. It supports data management, statistical analysis, and graphical representation of data, making it one of the most trusted tools in research and analytics.

1.2 Scope of SPSS

The scope of SPSS is very broad and extends across multiple academic and professional fields. In education and academic research, SPSS is used to analyze survey results, experimental data, and thesis or dissertation datasets. In healthcare and medical research, it is used for clinical studies, epidemiological research, and hospital quality improvement projects. In business and management, SPSS helps in market research, customer satisfaction analysis, sales forecasting, and financial analysis. In social sciences such as psychology, sociology, and political science,

SPSS is used for behavioral studies and policy research. Government organizations also use SPSS for census data analysis and public welfare studies. Because of this wide applicability, SPSS is considered a versatile and industry-relevant statistical tool.

1.3 Uses of SPSS

SPSS is primarily used for managing and analyzing data. It allows users to enter raw data manually or import data from Excel, CSV files, and databases. Users can clean and transform data by handling missing values, recoding variables, and creating new variables using mathematical formulas. SPSS is widely used to calculate descriptive statistics such as mean, median, mode, standard deviation, and frequency distributions. It is also used to perform inferential statistical tests like t-tests, ANOVA, correlation, regression analysis, and chi-square tests. In addition, SPSS is used to create visual outputs such as bar charts, pie charts, line graphs, and histograms, and to generate professional statistical reports.

1.4 Advantages of SPSS

One of the major advantages of SPSS is its user-friendly graphical interface, which makes it suitable for beginners and non-programmers. Users can perform complex statistical operations through simple menu selections. SPSS can handle large datasets efficiently and provides strong data management capabilities such as sorting, filtering, merging, and transforming data. Another major advantage is the reliability and accuracy of statistical results, which makes it widely accepted in academic and professional research. SPSS also provides high-quality tables and charts that are ready for inclusion in reports and publications. In addition, it offers extensive documentation and community support.

1.5 Disadvantages of SPSS

Despite its strengths, SPSS also has some disadvantages. The software is commercial and requires a paid license, which can be costly for students or small organizations. Compared to programming-based tools such as R or Python, SPSS offers limited flexibility for advanced custom analyses. It can also be slower when working with extremely large datasets. Another limitation is that users who rely only on the graphical interface may find it difficult to automate repetitive tasks unless they learn SPSS syntax. The software is also less suitable for advanced machine learning and big data analytics.

1.6 Important Features of SPSS

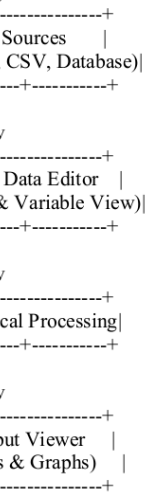
SPSS provides two primary working views: Data View and Variable View. Data View is used for entering and viewing actual data values, while Variable View is used to define variable properties such as name, type, label, values, and measurement level. SPSS includes features for data transformation such as Compute Variable and Recode. It supports split-file analysis, weighting of cases, and handling of missing data. SPSS also allows users to save commands as syntax files to ensure reproducibility of analysis. The Output Viewer window displays results in the form of tables, charts, and logs.

SPSS Data Structure (Text Diagram)

Rows → Cases (Individual records)
Columns → Variables (Attributes)

	Age	Gender	Score	Income
Case 1	25	M	78	30000
Case 2	30	F	85	40000
Case 3	22	M	69	25000

SPSS System Architecture (Text Diagram)



Main Components of SPSS (Text Diagram)

Menu Bar → File | Edit | View | Data | Transform | Analyze | Graphs

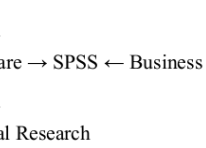
Data View <----------> Variable View

Output Viewer (Results Window)

File Types in SPSS

SPSS uses different file formats to store data and results. The .sav file stores the dataset, .spv file stores output results, .sps file stores syntax commands, and .por is a portable file format used for data transfer between systems.

Applications of SPSS (Text Diagram)



Part A: SPSS Practical – Step-by-Step Lab Exercises

Lab Exercise 1: Creating a New Data File

Aim: To create a new dataset in SPSS.

Steps:

1. Open **SPSS** → Click **File** → **New** → **Data**
2. Go to **Variable View** (bottom tab)
3. Enter variables:

Name	Type	Label	Measure
id	Numeric	Student ID	Scale
age	Numeric	Age	Scale
gender	String	Gender	Nominal
marks	Numeric	Marks	Scale

4. Click **Data View**
5. Enter sample data:

id	age	gender	marks
1	20	M	75
2	21	F	82
3	19	M	68

6. Save file → **File** → **Save As** → **name.sav**

Diagram (Data Entry Flow):

Variable View → Define Variables
↓
Data View → Enter Data
↓
Save File (.sav)

Lab Exercise 2: Descriptive Statistics (Mean, Median, SD)

Aim: To calculate basic descriptive statistics.

Steps:

1. Click **Analyze** → **Descriptive Statistics** → **Descriptives**
2. Move variables like **age** and **marks** to the right box
3. Click **Options** → Select Mean, Std. Deviation, Minimum, Maximum
4. Click **OK**

Output: Table showing mean, standard deviation, min, and max values.

Diagram:

Analyze
↓
Descriptive Statistics
↓
Descriptives
↓
OK → Output Table

Lab Exercise 3: Frequency Distribution

Aim: To generate a frequency table.

Steps:

1. Click **Analyze** → **Descriptive Statistics** → **Frequencies**
2. Select **gender**
3. Click **Charts** → **Bar chart** → **Continue**
4. Click **OK**

Diagram:
Frequencies → Select Variable → Charts → OK

Lab Exercise 4: Correlation Analysis
Aim: To find correlation between age and marks.
Steps:

1. Click **Analyze → Correlate → Bivariate**
2. Move **age** and **marks**
3. Tick **Pearson**
4. Click **OK**

Lab Exercise 5: t-Test (Independent Sample)
Aim: To compare marks between males and females.
Steps:

1. Click **Analyze → Compare Means → Independent-Samples T Test**
2. Move **marks** to Test Variable
3. Move **gender** to Grouping Variable
4. Click **Define Groups** → Enter values (e.g., M and F)
5. Click **OK**

Lab Exercise 6: Creating Graphs
Aim: To create a bar chart.
Steps:

1. Click **Graphs → Chart Builder**
2. Choose **Bar Chart**
3. Drag variable to X-Axis
4. Click **OK**

Lab Exercise 7: Recoding Variables
Aim: To create categories from marks.
Steps:

1. Click **Transform → Recode into Different Variables**
2. Select **marks**
3. Give new name: **result**
4. Define:
   - 0–49 = Fail
   - 50–100 = Pass
5. Click **OK**

1.7 SUMMARY

SPSS (Statistical Package for the Social Sciences) is a software tool used for data management and statistical analysis. It provides a user-friendly interface for entering and organizing data using Variable View and Data View. Users can define variable types, labels, and measurement levels. SPSS helps in performing basic statistical tests such as frequencies, averages, and simple charts, making it widely used in research, healthcare, business, and education.

1.8 KEYWORDS

SPSS – A software package used for data management and statistical analysis.
Variable View – The section where variable properties such as name and data type are defined.
Data View – The spreadsheet-like area where actual data values are entered.
Measurement Level – The type of data classification such as nominal, ordinal, or scale.
Descriptive Statistics – Statistical methods used to summarize and describe data.

1.9 SELF-ASSESSMENT QUESTIONS

1. Explain the process of creating a dataset and performing descriptive analysis in SPSS.
2. Describe the steps involved in performing a t-test in SPSS.
3. Explain correlation analysis with steps and output interpretation.
4. Discuss advantages and disadvantages of SPSS.
5. Explain different types of graphs available in SPSS.

1.10 SUGGESTED READINGS

1. Pallant, J. (2020). *SPSS Survival Manual*. McGraw-Hill Education.
2. Field, A. (2018). *Discovering Statistics Using SPSS*. SAGE Publications.
3. George, D., & Mallery, P. (2019). *IBM SPSS Statistics Step by Step: A Simple Guide and Reference*. Routledge.
4. Green, S. B., & Salkind, N. J. (2020). *Using SPSS for Windows and Macintosh: Analyzing and Understanding Data*. Pearson Education.
5. Leech, N. L., Barrett, K. C., & Morgan, G. A. (2015). *SPSS for Intermediate Statistics: Use and Interpretation*. Routledge.

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