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INTRODUCTION TO INFORMATION TECHNOLOGY

1.Information Technology (IT) refers to the use of computers, software, networks, and other electronic devices to create, process, store, retrieve, and exchange information.
Key Components

1. Hardware – physical devices (computers, printers)
2. Software – programs that run the hardware
3. Data – raw facts that are processed into information
4. People – users, IT specialists
5. Procedures – rules/steps used in handling information
6. Networks- system that connects computers for communication.

2. Data, Information, and Knowledge

Data- raw facts and figures
Information- processed data that is meaningful
Knowledge- insights derived from information used in decision making
3. Characteristics of Good Information

1. Accuracy – free from error
2. Relevance – applicable to the topic or decision
3. Timeliness – available when needed
4. Completeness – contains all essential details
5. Cost-effectiveness – value outweighs production cost
6. Reliability – trustworthy source
7. Accessibility – easy to obtain and format

4. Types of Computers

According to Size

1. Supercomputers – fastest; used for weather forecasting, scientific simulations
2. Mainframe Computers – used by banks and airlines for large transaction processing
3. Minicomputers – medium-sized organizations

4. Microcomputers/Personal Computers – desktops, laptops

According to Purpose

- General purpose – spreadsheets, word processing
- Special purpose – ATMs, traffic control systems

According to Data Handling

- Analog – measure physical quantities (thermometers)
- Digital – manipulate numbers and symbols (most computers)
- Hybrid – combination (used in hospitals)

5. Computer Hardware

Input Devices

- Keyboard, mouse, scanner, microphone, webcam, barcode reader

Output Devices

- Monitor, printer, speakers, projector, plotter

Storage Devices

- Primary storage: RAM, ROM
- Secondary storage: Hard drives, SSDs, flash drives, memory cards, CDs

Processing Unit

- CPU (Central Processing Unit)
    - o ALU – performs arithmetic & logic operations
    - o CU – directs operations of the computer
    - o Registers – high-speed storage locations

6. Software

Types of Software

1. System Software

- Controls the hardware
- Examples:

- Operating Systems (Windows, macOS, Linux, Android)
- Utility Programs (antivirus, backup tools)
- Device drivers

2. Application Software

- Used to perform user tasks
- Examples:
  - Word processors (MS Word)
  - Spreadsheets (Excel)
  - Browsers (Chrome)
  - Databases (MySQL)
  - Games

7. Operating Systems (OS)

Functions of an OS

1. Memory management
2. Processor management
3. File management
4. Device management
5. Security
6. User interface provision (CLI or GUI)

Types of Operating Systems

- Batch OS
- Multitasking OS
- Network OS
- Distributed OS
- Embedded OS
- Mobile OS

8. Computer Networks

Definition

A network is a system that connects computers to share information and resources.

Types of Networks

1. LAN (Local Area Network) – school, office
2. MAN (Metropolitan Area Network) – citywide
3. WAN (Wide Area Network) – national/international
4. PAN (Personal Area Network) – Bluetooth devices

Network Topologies

- Star
- Bus
- Ring
- Mesh
- Hybrid

Network Devices

- Router
- Switch
- Hub
- Modem
- Access point
- Firewall

9. The Internet

Definition

A global network connecting millions of computers.

Internet Services

- Email
- Web browsing
- Social media

- Cloud computing
- E-commerce
- VoIP
- File sharing

Web Concepts

- URL – web address
- HTTP/HTTPS – communication protocols
- Search engines – Google, Bing
- Web browser – Chrome, Firefox

10. Cybersecurity

Common Threats

- Viruses
- Worms
- Phishing
- Ransomware
- Spyware
- Hacking

Protection Measures

- Use antivirus software
- Strong passwords
- Two-factor authentication
- Firewall
- Regular updates
- Data backup

12. Roles of IT in the society

1. Education – e-learning, virtual labs

2. Health – telemedicine, electronic records
3. Business – e-commerce, automation
4. Banking – mobile banking, ATMs
5. Government – e-government services
6. Agriculture – weather info, smart irrigation
7. Transport – GPS, traffic control systems

FUNDAMENTALS OF COMPUTER OPERATIONS – DEEP NOTES

1. Input
2. Processing
3. Output
4. Storage
5. Control

These operations are guided by the operating system, CPU, memory, and input/output devices.
2. Basic Functions of a Computer

A. Input

The process of receiving data and instructions from the user or another device.
Examples of input devices:

- Keyboard
- Mouse
- Scanner
- Microphone
- Touchscreen

B. Processing

The transformation of raw data into useful information.
Handled by the CPU (Central Processing Unit).
Components:

1. ALU (Arithmetic and Logic Unit) – performs all mathematical and logical operations
2. CU (Control Unit) – coordinates operations
3. Registers – small, high-speed memory locations

C. Output

The process of presenting processed information to the user.
Output devices include:

- Monitor
- Printer
- Speakers
- Projector

D. Storage

Saving data/information for future use.
Storage components:

- Primary storage (Volatile): RAM
- Secondary storage (Non-volatile): HDD, SSD, flash drives, CDs

E. Control

Ensures all operations follow instructions in correct order.

Handled by the Control Unit and OS.

3. The Booting Process

Booting is the process of starting a computer.
Types of Booting

1. Cold Booting: Turning on a computer from OFF state
2. Warm Booting: Restarting a computer without turning off power

Steps in Booting

1. Power is turned on
2. POST (Power-On Self-Test) checks hardware
3. Firmware/BIOS is initialized
4. Bootloader is executed
5. Operating System loads into RAM
6. Computer becomes ready for use

4. The Fetch–Decode–Execute Cycle

This is the fundamental cycle through which the CPU carries out instructions.

Steps:

1. Fetch
    - CPU retrieves (fetches) the next instruction from memory
2. Decode
    - Instruction is interpreted (decoded) by the Control Unit
3. Execute
    - ALU performs the required operation
    - Results may be stored in registers or RAM

This cycle repeats millions of times per second.

5. Computer Memory in Operations

A. Primary Memory (Main Memory)

1. RAM (Random Access Memory)
    - Volatile
    - Stores data and instructions currently in use
2. ROM (Read Only Memory)
    - Non-volatile
    - Stores firmware and boot instructions

B. Secondary Memory

- Non-volatile, long-term storage
- Examples: SSD, HDD, Flash Drive, CD, Cloud storage

C. Cache Memory

- Very fast memory between CPU and RAM
- Stores frequently used instructions
- Speeds up CPU operations

6. File and Folder Operations

Computers manage data using the file system.
Common operations:

- Creating files/folders

- Opening files
- Saving files
- Editing and renaming
- Copying/moving
- Searching
- Deleting & restoring
- Organizing files by directories

8. Input/Output (I/O) Operations

I/O operations are controlled by device controllers and device drivers.
How I/O Works:

1. CPU sends request device controller
2. Device processes request
3. Device sends interrupt CPU
4. CPU processes the completed I/O task

9. Number Systems in Computer Operations

Computers operate using different number systems.
Binary (Base 2)

- 0, 1
- Used by the computer internally

Decimal (Base 10)

- 0–9
- Human-friendly

Hexadecimal (Base 16)

- 0–9, A–F
- Used in memory addressing, machine code

Octal (Base 8)

- 0–7
- Earlier computers used this more

COMPUTER INPUT AND OUTPUT DEVICES

1. Introduction

A computer system uses input devices to receive data and instructions, and output devices to present processed information to the user.

2. INPUT DEVICES

Input devices are hardware components used to enter data, commands, and signals into a computer.

A. Traditional Input Devices

1. Keyboard

- Most common input device
- Used to enter text, numbers, and commands
- Layouts: QWERTY, AZERTY, DVORAK
- Sections: Function keys, alphanumeric keys, navigation keys, numeric keypad

Advantages: Fast for text entry

Disadvantages: User must learn typing

2. Mouse

A pointing device used with GUIs.

Types:

- Mechanical mouse
- Optical mouse
- Laser mouse
- Wireless/Bluetooth mouse

Functions: Clicking, dragging, pointing, scrolling

3. Touchpad

- Built into laptops
- Detects finger movement

B. Pointing and Touch Input Devices

4. Touchscreen

Allows users to touch icons directly.

Types:

- Resistive

- Capacitive
- Infrared
- Surface acoustic wave

Applications: Smartphones, ATMs, kiosks
5. Light Pen

A pen-like device used with CRT screens for precision pointing.
6. Stylus and Digital Pen

Used for tablets and graphics design.
C. Scanning and Recognition Devices

7. Scanner

Converts physical documents into digital form.
Types:
- Flatbed scanner
- Sheet-fed scanner
- Handheld scanner

8. Barcode Reader

Reads barcodes using laser or camera technology.
Used in supermarkets and inventory systems.
9. QR Code Scanner

Reads 2D matrix codes with high storage capacity.
10. Optical Character Recognition (OCR)

Converts printed text into editable digital text.
11. Optical Mark Recognition (OMR)

Reads shaded areas on forms.
Uses:
- Exams (KCSE, SAT)
- Surveys

12. Magnetic Ink Character Recognition (MICR)

Reads characters printed in magnetic ink.
Used in banks for cheque processing.
13. Biometric Devices

Used for identification and authentication.
Examples:

- Fingerprint scanner
- Facial recognition scanner
- Iris scanner
- Retina scanner

D. Audio and Video Input Devices

14. Microphone

Captures audio.
15. Webcam

Captures video for conferencing and recording.
16. Digital Camera

Captures high-resolution images and videos.
E. Sensor-Based Input Devices

17. Sensors

Capture environmental data.
Examples:
- Temperature sensor
- Motion sensor
- Pressure sensor
- GPS receiver
- Accelerometer

Used in IoT devices, robotics, automated systems.
18. Joystick/Game Controller

Used for games and simulations (flight simulators).
3. OUTPUT DEVICES

Definition

Output devices display or produce the results of computer processing in forms such as text, graphics, audio, and hard copies.
Types of Output Devices

A. Visual Output Devices

1. Monitor (Display Screen)

Categories:

- CRT (Cathode Ray Tube) – older, bulky
- LCD (Liquid Crystal Display) – thin, energy-efficient
- LED (Light-Emitting Diode) – improved LCD with LED backlight
- OLED (Organic LED) – high contrast, flexible screens
- Touchscreen monitors – dual input-output

Characteristics:

- Resolution (pixels)
- Refresh rate (Hz)
- Size (inches)
- Contrast ratio

2. Projector

Displays output onto a large screen.
Types:

- LCD projector
- DLP projector
- Laser projector

Used in classrooms, meetings, cinemas.
3. Plotter

Produces large drawings and graphics.
Types:

- Drum plotter
- Flatbed plotter
- Inkjet plotter

Used in engineering, architecture.
B. Hard Copy Output Devices (Printers)

1. Dot Matrix Printer

- Impact printer
- Uses pins and ink ribbon
- Prints low-quality text
- Very durable

Used for receipts and multi-part forms.
2. Inkjet Printer

- Uses liquid ink sprayed through tiny nozzles
- Prints high-quality images
- Slower than laser

Good for photos and home use.
3. Laser Printer

- Uses toner and static electricity
- Fast, high-quality printing
- Expensive initially but cheap to operate

Used in offices and schools.
4. 3D Printer

Creates solid objects layer-by-layer.
Uses:

- Prototyping
- Medical implants
- Engineering models

C. Audio Output Devices

1. Speakers

Convert digital signals into sound.
2. Headphones/Earphones

Personal audio output.
3. Sound Cards

Interface that processes audio signals.
D. Haptic Output Devices

Provide tactile feedback.
Examples:

- Game controller vibrations
- VR gloves
- Medical simulation devices

Used in gaming, VR, training systems.

4. Combined Input–Output Devices

Some devices perform both input and output functions.
Examples:

- Touchscreens
- VR headsets
- Modems
- Network cards
- Multifunction printers (scan, print, copy)

5. Characteristics of Input & Output Devices

Input Device Characteristics

- Sensitivity
- Accuracy
- Speed
- Ergonomics
- Reliability

Output Device Characteristics

- Resolution (for monitors/printers)
- Speed (pages per minute, ms)
- Quality (DPI for printers)
- Color capability
- Cost of operation

6. Role of the Operating System in I/O Operations

The OS manages all input/output activities:

- Device drivers
- I/O scheduling
- Buffering
- Interrupt handling
- Spooling (especially for printers)

7. Ports and Interfaces for I/O Devices

- USB (Universal Serial Bus)
- HDMI
- VGA
- DisplayPort
- Thunderbolt
- Audio jacks (3.5mm)
- Bluetooth
- Wi-Fi
- Ethernet/LAN port

8. Advantages & Disadvantages

Input Devices

Advantages:
- Enables data entry
- Supports multimedia
- Increases productivity

Disadvantages:
- Can malfunction
- Requires training (e.g., keyboards)

Output Devices

Advantages:
- Communicate processed results
- Enhance understanding through visuals, audio

Disadvantages:
- Costly (monitors, projectors)
- Some require maintenance (printers)

COMPUTER STORAGE DEVICES & MEMORY

A computer memory system stores data, instructions, and information temporarily or permanently.
It is divided into:
1. Primary (Main) Memory – internal, fast, temporary

2. Secondary Storage – external, permanent, large capacity

2. PRIMARY MEMORY (MAIN MEMORY)

Primary memory is the memory that the CPU can access directly. It is faster but usually has smaller capacity.
It includes:

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

2.1 RAM (Random Access Memory)

RAM is volatile memory (contents lost when power goes off).

Used to store programs and data currently being used.
Types of RAM

1. DRAM (Dynamic RAM)
    - o Stores each bit in a capacitor
    - o Needs constant refreshing
    - o Cheaper
    - o Slower than SRAM
    - o Used in main memory of computers
2. SRAM (Static RAM)
    - o No need for refreshing
    - o Faster and more expensive
    - o Used in cache memory

Characteristics of RAM

- Volatile
- Fast access
- Temporary storage
- Directly accessible by CPU

2.2 ROM (Read Only Memory)

ROM is non-volatile (does not lose data when power is off).

Contains firmware – permanent instructions used during booting.
Types of ROM

1. PROM (Programmable ROM) – programmed once
2. EPROM (Erasable PROM) – erased with UV light
3. EEPROM (Electrically Erasable PROM) – erased electronically
4. Flash ROM – used in BIOS, smartphones, USB drives

Uses of ROM

- BIOS/UEFI
- Embedded systems
- Firmware in devices

2.3 CACHE MEMORY

A very fast, small memory located between CPU and RAM.
Levels of Cache

- L1 Cache – inside CPU, fastest, smallest
- L2 Cache – slightly larger, slower
- L3 Cache – shared among CPU cores, larger but slower

Purpose

- Stores frequently used instructions
- Reduces CPU waiting time
- Increases overall system speed

2.4 CPU REGISTERS

Smallest and fastest memory locations inside the CPU.
Types:

- Instruction Register (IR)
- Memory Address Register (MAR)
- Memory Data Register (MDR)
- Accumulator (ACC)

Used in fetch-decode-execute cycle.

3. SECONDARY STORAGE (AUXILIARY STORAGE)

Used to store data permanently.

Larger in capacity but slower than primary memory.

3.1 Magnetic Storage Devices

1. Hard Disk Drive (HDD)

- Stores data magnetically on spinning platters
- Contains read/write heads
- Large capacity (500GB–10TB)

Advantages:

- Cheaper per GB
- Large storage
- Long lifespan

Disadvantages:

- Slower
- Can be damaged by shock
- Noise

2. Magnetic Tapes

- Sequential access storage
- Used for backups and archives

Advantages: Very large capacity

Disadvantages: Slow access time, not good for everyday use

3. Floppy Disks (obsolete)

- Very small capacity (1.44MB)

3.2 Optical Storage Devices

Use laser technology to read/write data.

1. CD (Compact Disc)

- CD-ROM: Read-only
- CD-R: Write once
- CD-RW: Rewritable

- Capacity ~ 700MB

2. DVD (Digital Versatile Disc)

- Higher density than CD
- Capacity ~ 4.7–17GB
- Used for movies, software

3. Blu-ray Disc

- Uses blue-violet laser
- Capacity ~ 25–128GB
- High-definition video storage

3.3 Solid State Storage Devices

Use flash memory (no moving parts).

Fast, durable, portable.

1. Solid State Drive (SSD)

- Much faster than HDD
- Uses NAND flash
- Sizes: 120GB – 4TB

Advantages:

- Fast boot times
- Shock resistant
- Silent

2. USB Flash Drive

- Portable
- Capacity: 4GB – 1TB
- Uses flash ROM

3. Memory Cards

- SD card, microSD, CF card
- Used in cameras, phones, drones

4. eMMC Storage

- Embedded flash storage
- Used in low-cost smartphones & tablets

3.4 Cloud Storage

Data stored on remote servers accessed via the internet.
Examples:

- Google Drive
- OneDrive
- Dropbox
- iCloud

Advantages: Accessible anywhere, automatic backup

Disadvantages: Needs internet, privacy concerns
3.5 Network Attached Storage (NAS)

A dedicated storage server connected to a network.

Used in offices and enterprises.
4. COMPARISON OF STORAGE TYPES

5. STORAGE MEASUREMENT UNITS

Bit (b) – smallest unit

Byte (B) – 8 bits

Kilobyte (KB) – 1024 bytes

Megabyte (MB) – 1024 KB

Gigabyte (GB) – 1024 MB

Terabyte (TB) – 1024 GB

Petabyte (PB) – 1024 TB

6. FACTORS TO CONSIDER WHEN CHOOSING STORAGE

1. Capacity
2. Speed
3. Cost
4. Durability

5. Portability
6. Reliability
7. Security
8. Backup/Redundancy

7. MEMORY HIERARCHY

Memory is arranged by speed, cost, and capacity:
Registers (Fastest, smallest)
Cache
RAM
SSD / HDD
Magnetic Tapes (Slowest, largest)
Goal: keep critical data in the fastest layer.
8. DATA ACCESS METHODS

Sequential Access

- Data accessed in order
- Example: Magnetic tapes

mDirect Access

- Jump directly to the required data
- Example: HDD, SSD

Random Access

- Any location accessed instantly
- Example: RAM

9. REASONS FOR USING SECONDARY STORAGE

- Long-term data retention
- Backup and recovery
- Storage of large files
- Software installations
- Media content (videos, games)

COMPUTER SOFTWARE

Computer Software refers to a collection of programs, data, and instructions that tell a computer what to do and how to do it.

Software is the intangible part of a computer system, unlike hardware (which is physical).

2. Categories of Computer Software

1. System Software
2. Application Software

3. SYSTEM SOFTWARE

System software acts as a bridge between hardware and users.

It controls, manages, and coordinates the computer's physical components.

Types of System Software

1. Operating Systems (OS)
2. Utility Programs
3. Device Drivers
4. Firmware
5. Networking Software
6. Translation Software (Language translators)

3.1 Operating Systems (OS)

The most important software in a computer.

Functions of an Operating System

1. Processor Management
    - Schedules tasks for CPU
    - Handles multitasking
2. Memory Management
    - Allocates RAM to programs
    - Swapping and virtual memory
3. File Management
    - Organizes files/folders

- Controls storage devices

4. Device Management
    - Manages input/output hardware
    - Uses device drivers
5. Security
    - User accounts
    - Passwords
    - Access control
6. User Interface
    - GUI (Graphical)
    - CLI (Command line)
7. Error Detection & Handling

3.2 Types of Operating Systems

1. Single-user, Single-tasking (e.g., MS-DOS)
2. Single-user, Multi-tasking (e.g., Windows, macOS)
3. Multi-user OS (e.g., UNIX, Linux servers)
4. Real-time OS (RTOS) – embedded systems
5. Mobile OS (Android, iOS)
6. Network OS (Novell NetWare, Windows Server)
7. Distributed OS – cloud platforms
8. Embedded OS – microcontrollers, IoT devices

3.3 Utility Software

Utility programs perform maintenance and optimization tasks.

Examples of Utility Programs

- Antivirus software
- Disk cleanup tools
- Disk defragmenter

- Backup utilities
- File compression tools (WinRAR, ZIP)
- Firewall
- System monitoring tools
- Clipboard managers
- Password managers

3.4 Device Drivers

Drivers are programs that allow the OS to communicate with hardware devices.

Examples:

- Printer drivers
- Keyboard and mouse drivers
- Display drivers (NVIDIA, Intel)
- Audio drivers

Without drivers, the device cannot function.

3.5 Firmware

Permanent software stored in ROM.

Examples:

- BIOS / UEFI
- Embedded software in microwaves, TVs, routers
- Smartphone boot-loader

Firmware controls low-level hardware operations.

3.6 Networking Software

Used to manage, control, and secure computer networks.

Examples:

- Network operating systems
- Firewalls
- Packet analyzers

- Routing software
- VPN clients

3.7 Language Translators

Convert programming code into machine-readable form.

Types:

1. Compilers – translate whole program at once (C, C++)
2. Interpreters – translate line-by-line (Python, Ruby)
3. Assemblers – convert assembly language into machine code

4. APPLICATION SOFTWARE

These are programs that help users perform specific tasks.

DATA FILES AND FILE MANAGEMENT

A data file is a named collection of related data stored in a computer storage device. The data in a file can be textual, numeric, binary, audio, video, or executable.
Files allow data to be:

- Stored
- Organized
- Retrieved
- Updated
- Shared
- Protected

A file is the basic unit of data storage in a computer.
2. Types of Computer Files

Files can be classified based on purpose, format, usage, and structure.
A. Classification by Purpose

1. Program Files

These contain instructions that computers can execute.
Examples:

- Executable files (.exe, .bin)
- Scripts (.bat, .sh)
- Application files (MS Word, browsers)

2. Data Files

Contain raw data created or used by programs.
Examples:

- Text documents (.txt)
- Spreadsheets (.xlsx)
- Databases (.db)
- Audio (.mp3)
- Images (.png)

B. Classification by Format

1. Text Files

- Contain readable characters
- Created using text editors
- Examples: .txt, .csv, .html

2. Binary Files

- Encoded in binary format
- Not human-readable
- Examples: .exe, .jpg, .mp4, .docx

C. Classification by Structure

1. Sequential Files

- Records are stored one after another
- Access is linear (beginning to end)
- Good for large volumes of data with few updates
- Example: Payroll files

2. Random Access Files

- Records are accessed using an address or index
- Very fast access to specific records
- Used in databases

3. Indexed Sequential Files

- Combination of sequential and random
- Use an index to speed up access
- Example: Library catalog files

3. File Organization Methods

File organization determines how records are stored and retrieved physically.
1. Sequential Organization

- Records stored in order
- Best for batch processing

2. Direct/Random Organization

- Each record stored at a calculated address
- Enables immediate access

3. Indexed Organization

- Index contains pointers to records
- Balance between speed and efficiency

4. Operations on Files

1. Creating Files

- Assign a file name
- Choose file type
- Set location

2. Opening Files

- Loads file into memory for processing
- OS checks permissions

3. Reading Files

- Retrieves stored data

4. Writing Files

- Adds or updates data

5. Saving Files

- Stores updates permanently

6. Renaming Files

- Changing file name without altering contents

7. Deleting Files

- Removes the file pointer
- Data may still exist until overwritten

8. Copying/Moving Files

- Duplicate or relocate data

9. Searching Files

- Using keywords, metadata, or indexing

5. File Naming Conventions

File names typically include:

- Main name (identifier)
- Extension (type/format)

Example:

report.pdf
Rules:

- Avoid special characters (/?*<>|)
- Use meaningful names
- Maintain consistent naming patterns
- Keep names short but descriptive

6. File Extensions

Extensions help the OS determine how to open the file.

7. File Management

File management is the process of organizing and maintaining files on storage devices.
This is handled by:

- Users
- Operating system
- Utility programs

A. Functions of File Management

1. File creation
2. File storage and organization
3. File naming and indexing
4. Access control
5. File sharing
6. Backup and recovery
7. Deletion and archival
8. Monitoring disk usage

B. Tools for File Management

1. File Explorer (Windows)
2. Finder (macOS)
3. Linux file managers (Nautilus, Dolphin)
4. Command-line tools
    - cp, mv, rm, ls, dir, copy, xcopy
5. Cloud storage managers
    - Google Drive, OneDrive, Dropbox
6. Utility software
    - WinRAR, 7-Zip
    - Disk cleanup tools

8. Directories and Folders

A directory or folder is a container used to group files.
Types of directories:

- Root directory (top level)
- Parent directory
- Subdirectories

Directories improve:

- Organization
- Navigation

- Access control

9. File Paths

A path shows the location of a file.
Types of paths:

1. Absolute Path

Full path from the root directory.
2. Relative Path

Path from the current working directory.
10. File Access Methods

1. Sequential Access

Read file from start to end.
2. Direct/Random Access

Jump directly to specific data blocks.
3. Indexed Access

Use index to find location quickly.
11. File Security and Protection

Files need protection from:

- Unauthorized access
- Corruption
- Loss

Security Measures:

- Passwords
- File permissions
- Encryption
- Access control lists (ACLs)
- Backups
- Antivirus
- Firewalls

12. File Backup Methods

1. Full Backup

Copies everything.
2. Incremental Backup

Copies only changes since last backup.
3. Differential Backup

Copies changes since last full backup.
4. Cloud Backup

Automatic remote backup.
5. External Media Backup

- USB drives
- External hard drives

13. File Compression

Compression reduces file size.
Types of Compression:

1. Lossless

- No data lost
- ZIP, PNG

2. Lossy

- Some data removed
- MP3, JPG

Compression:

- Saves space
- Speeds up file transfer

14. File Management Challenges

1. File fragmentation
2. Duplicate files
3. Naming inconsistencies
4. Accidental deletion
5. Corruption
6. Malware attacks
7. Lack of backups

8. Storage limitations

15. Importance of Good File Management

- Saves time
- Improves productivity
- Enhances data security
- Reduces redundancy
- Facilitates collaboration
- Ensures data accuracy
- Improves system performance