ICT

LAB MANUAL

Dr. Muhammad Siddique

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Contents

1 Week 1: Introduction to Computer Hardware and Software 2

2 Week 2: Operating System Basics and File Management 14

3 Week 3: Introduction to Word Processing (MS-Word) 21

4 Week 4: Working with Images and Shapes in Word 25

5 Week 5: Working with Tables, Page Layout, and Mail Merge 30

6 Week 6: Introduction to Spreadsheets (MS Excel) 34

7 Week 7: Formulas, Functions, and Named Ranges 38

8 Week 8: Data Sorting, Filtering, and Validation 42

9 Week 9: Charts and Data Visualization 46

10 Week 10: Spreadsheet Printing, Page Setup and Templates 50

11 Week 11: Creating Slide Presentations (Microsoft PowerPoint) 54

12 Week 12: Tables and Charts in Presentations 58

13 Week 13: Advanced Presentation Techniques (Transitions, Animations, and Slide Design) 62

14 Week 14: Multimedia Integration in Presentations (Audio, Video, Hyperlinks, and Embedding Media) 65

15 Week 15: Internet Basics, Web Browsing, and Online Research Skills 69

16 Week 16: Email Communication and Cloud-Based Collaboration 73

1 Week 1: Introduction to Computer Hardware and Software

Objective: To build a strong foundation in understanding computer systems by exploring the structure, function, and classification of hardware and software. This expanded module adds deeper theoretical explanations, real-world examples, two schematic TikZ diagrams, step-by-step safe lab procedures, observation/measurement tables, troubleshooting tips, an assessment rubric, and extended viva with model answers. Students will perform hands-on activities (hardware identification, I/O testing, software classification, system comparison and controlled disassembly/reassembly) and produce a short report.

Learning Outcomes (detailed)

After completing this week the student will be able to:

- Explain the internal data flow between CPU, memory and I/O subsystems and sketch a block diagram of a PC.
- Identify physical hardware components and explain their roles, interfaces and performance impact.
- Distinguish types of storage (HDD, SATA SSD, NVMe SSD) and memory (DRAM, SRAM) and explain trade-offs.
- Configure basic OS utilities to view system specifications and diagnose simple hardware problems.
- Safely disassemble and reassemble a desktop PC following ESD and power-safety procedures.
- Produce a concise comparison report evaluating two systems for target workloads (office, multimedia, AI).

High-level Architecture (Block Diagram)

Below is a simplified block diagram showing the primary subsystems and their interconnections (CPU, Memory, Storage, GPU, I/O and PSU). Use this diagram when explaining data/control flow.

Detailed Component Notes

CPU (Central Processing Unit)

- **Function:** Executes instructions, performs arithmetic and logic operations, controls peripherals. The CPU speed is determined by clock rate (GHz), IPC (instructions per cycle) and number of cores/threads.
- **Real-world examples:** Intel Core i5/i7 vs AMD Ryzen 5/7. For AI workloads, more cores and higher memory bandwidth help; for single-threaded tasks, higher IPC and clock matter.
- **Interfaces:** Socket type (LGA1700, AM4), supported memory channels (dual/quad), PCIe lanes for GPUs and NVMe.
- **Benchmarks to mention:** Cinebench (multi-core), single-thread score, and synthetic tests—these guide real-world performance differences.

Memory (RAM)

- **Function:** Stores runtime data and program state; volatile (loses data on power-off).
- **Types:** DDR3 / DDR4 / DDR5 — DDR5 offers higher bandwidth and lower voltage; latency and frequency both matter.
- **Capacity vs Speed:** For general tasks 8–16GB suffices; for AI/ML experimentation 32GB+ recommended.

- **Channels:** Single vs dual vs quad channel affects throughput (pair sticks correctly into DIMM slots).

Storage (HDD / SSD / NVMe)

- **HDD:** Mechanical, higher capacity per cost, lower IOPS (good for bulk storage).
- **SATA SSD:** Flash-based, faster than HDD (sequential reads/writes up to ∼500 MB/s).
- **NVMe (PCIe) SSD:** Uses PCIe lanes, much higher throughput (1–7 GB/s depending on PCIe generation) and very low latency; recommended for OS and applications requiring fast I/O.
- **Example:** Samsung 970 EVO (NVMe) vs a 7200RPM HDD — the NVMe drives drastically reduce boot and load times.

Motherboard

- **Role:** Electrical backbone connecting CPU, memory, storage, and peripherals. Contains chipset, VRMs, BIOS/UEFI.
- **Form factors:** ATX, mATX, ITX (affects expansion and cooling options).
- **Connectivity:** SATA ports, M.2 slots, PCIe slots, USB headers, fan headers and power connectors.

Power Supply Unit (PSU)

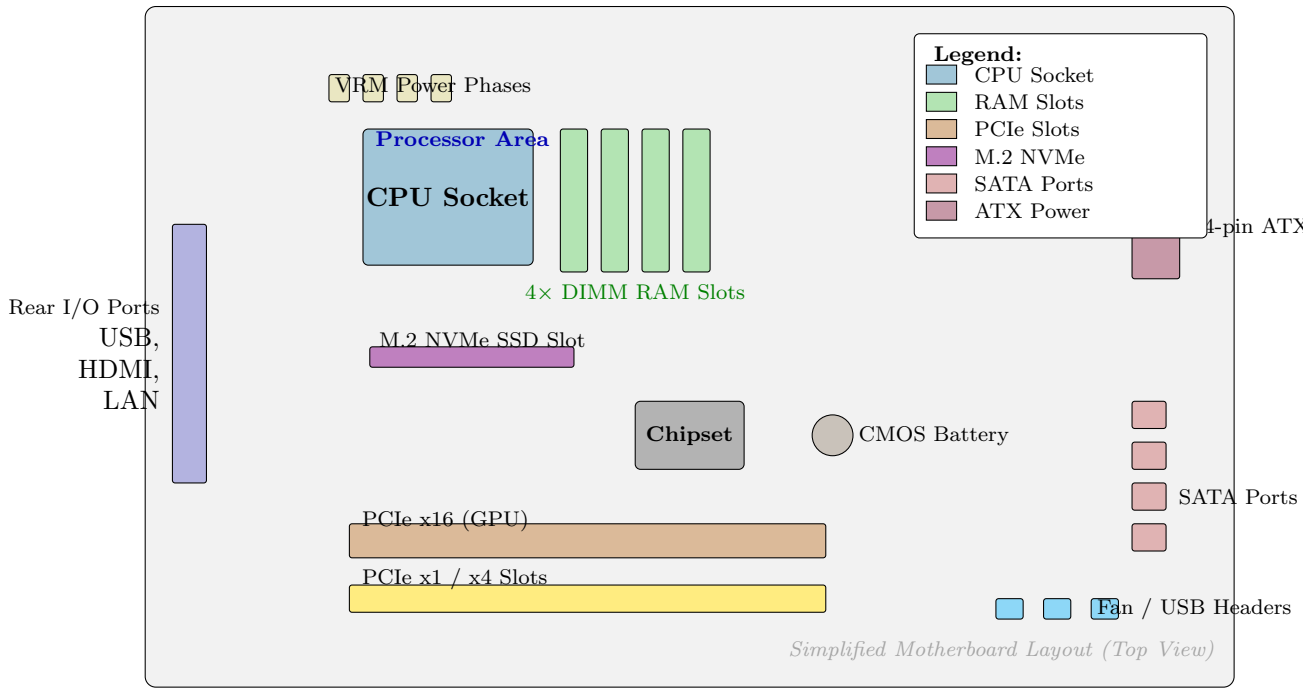
- **Function:** Converts AC mains to regulated DC rails (12V, 5V, 3.3V). Provides connectors to motherboard (24-pin, 4/8-pin CPU), PCIe (6/8-pin), SATA/Molex.
- **Quality:** Wattage rating, efficiency (80+ Bronze/Silver/Gold), stable rails matter — poor PSU causes reboots, instability.

Graphics Processing Unit (GPU)

- **Use-cases:** Rendering, GPU-accelerated compute (CUDA / OpenCL / ROCm). For ML training, dedicated GPUs (NVIDIA RTX/GTX or AMD) with large VRAM are preferred.
- **Interfaces:** PCIe x16 lanes, power connectors (6/8-pin).

Peripherals and I/O

- **Examples:** Keyboard, mouse, monitor (LCD/LED, refresh rate), scanner, printer, microphone, speakers, NIC (Ethernet/Wi-Fi).
- **Interfaces:** USB, HDMI/DP, 3.5mm audio, RJ-45, Bluetooth.



Practical Preparation & Safety Notes

- **Pre-lab checklist:** Lab coat, anti-static wrist strap, small Philips and flat screwdrivers, container for screws, marker for labeling, camera/mobile for photos, lab record notebook.
- **Electrical safety:** Always shut down OS properly and unplug mains. Wait 30 seconds after unplugging to allow capacitors to discharge.
- **ESD precaution:** Use an anti-static wrist strap connected to chassis ground or touch a grounded metal surface frequently. Avoid working on carpet.

- **Handling components:** Hold RAM/CPU/GPU by edges; avoid touching contacts and components. Place removed cards on anti-static mats.
- **Documentation:** Photograph each major step to include in lab report.
- **Instructor supervision:** Only perform PSU or mains-level repairs under instructor supervision. Do not open PSU.

Detailed Lab Procedures (Tasks 1–5)

Task 1: Hardware Identification (Extended Procedure)

Time allocation: 40–50 minutes
Tools: Screwdriver, camera, anti-static strap.

1. **Pre-check:** Confirm instructor permission and take a photograph of the closed chassis with system powered off but plugged in (showing labels). Log existing BIOS/UEFI settings (if available).
2. **Shutdown and unplug:** Properly shut down the OS, turn off PSU switch (if present), and unplug mains. Press power button 1–2 times to discharge residual power.
3. Fit anti-static wrist strap and connect to metal chassis ground.
4. Remove side panel(s) using the screwdriver; keep screws labeled and in a container.
5. Locate and **identify** each component: CPU (with heatsink/fan), DIMM sticks, storage drives, power connectors, PCIe cards. For each, record: manufacturer, model printed on component (if visible), connector types.
6. **Label components** lightly with a removable sticker (e.g., CPU_1, RAM_A) and take a clear photo of the interior.
7. Reassemble the panel and perform a power-on test to ensure system still boots (do not change components yet).
8. **Report:** In your lab record include photos, a labeled diagram (use your photos as reference), and a short paragraph describing the role of each part.

Observation Table (Task 1)

Component	Model/Label (as seen)	Connector / Slot	Notes / Condition
CPU		Socket	
RAM		DIMM slot (channel)	
Storage		SATA / M.2 / NVMe	
GPU		PCIe x16	
PSU		24-pin, 8-pin	
Motherboard		Form factor, chipset	

Task 2: Input / Output Device Demonstration (Extended Procedure)

Time allocation: 25–35 minutes

1. **Keyboard:** Verify layout (ANSI/ISO), test key rollover and special function keys. Use an online key tester (teacher-provided offline tool) or text editor. Record any nonfunctional keys.
2. **Mouse:** Test left/right buttons, middle wheel, DPI switch (if present). Practice drag-and-drop and right-drag context menus.
3. **Scanner:** Place a sample page and scan at 300 DPI to JPEG and 150 DPI to PDF to observe file size vs quality. Save both and record file sizes.
4. **Printer:** Print a one-page test: text and an image. Change page orientation and quality settings (Draft vs Normal vs Best). Record approximate time-to-print and visible quality.
5. **Audio:** Open sound recorder, record 10 seconds via microphone, listen through speakers/headphones, check levels and noise (note any distortions).
6. **Network:** Optional — plug in Ethernet, check link LED and use `ping 8.8.8.8` to verify connectivity.

Expected Measurements (Task 2)

- Scanner: JPEG @300 DPI → file size 0.5–2 MB (varies by image complexity).
- Printer: Draft vs Best — Draft is faster, uses less ink; Best takes 2–3x longer.
- Audio: Clear waveform with minimal clipping at normal speaking levels.

Task 3: Software Classification and Basic Utilities (Extended Procedure)

Time allocation: 30 minutes

1. Log into the OS and open **System Information** (Windows: `msinfo32`, Linux: `neofetch`/`lscpu`).
2. List installed applications (Control Panel -¿ Programs and Features in Windows; package manager list in Linux).
3. Identify:
   - System software: OS name, version, kernel build.
   - Device drivers: display, storage, network drivers (note outdated drivers).
   - Application software: Office suite, browsers, media players.
   - Utility software: antivirus name/version, compression tool (e.g., 7-Zip), disk utility (defrag/CHKDSK).
4. Run a small task: create a Word document, insert an image and a table; in Excel create a chart from sample data; save and export as PDF.
5. Demonstrate disk space check and cleanup (Windows Disk Cleanup or Linux `du`).

Deliverable: Categorized list of software with version numbers and one-sentence justification for classification.

Task 4: Computer Specification Comparison (Extended Procedure)

Time allocation: 40 minutes

1. Choose two lab machines (A and B). For each machine, collect:
   - CPU model, cores, base/turbo clocks.
   - RAM type, capacity and speed (e.g., DDR4-3200MHz).
   - Storage type and capacity (HDD 1TB 7200RPM / NVMe 256GB).
   - GPU model and VRAM (if present).
   - OS and notable drivers.

2. Record simple benchmark observations: boot time (cold boot to login), application launch time (e.g., Word launch), and file copy speed (copy 500MB file between drives).

3. Create a comparison table and add a short recommendation: which machine is best for (a) Office tasks, (b) Multimedia editing, (c) AI experiments — justify using measured metrics and component specs.

Comparison Table (example)

Metric / Component	**Machine A**	**Machine B**	**Recommendation / Notes**
CPU	Intel Core i5-10400 (6c/12t)	AMD Ryzen 7 3700X (8c/16t)	B better for multi-threaded loads
RAM	8 GB DDR4-2666	32 GB DDR4-3200	B preferred for ML experiments
Storage	1TB HDD	512GB NVMe SSD	SSD reduces boot/load times
Boot time	45 sec	15 sec	SSD noticeably faster
File copy 500MB	80 sec	8 sec	NVMe ¿¿ HDD

Task 5: Controlled Disassembly / Reassembly (Extended Procedure)

Time allocation: 50–70 minutes
WARNING: Do not attempt PSU internals, mains-level repairs or soldering. Only remove replaceable components.

1. Ensure system is powered off, PSU switch off, mains unplugged.

2. Wear anti-static strap and place screws/parts in labeled containers.

3. Document current configuration (photos and notes) — especially cable locations.

4. Remove GPU (if present): unscrew PCIe bracket screw(s), unlock PCIe latch and carefully withdraw card.

5. Remove RAM: open DIMM latches and extract sticks vertically.

6. Remove storage drives: unscrew caddies and carefully disconnect SATA or M.2 connectors.

7. Do not remove the CPU from socket unless instructed — CPU removal requires special care and knowledge of socket lever mechanism and thermal paste handling.

8. Reassemble in reverse order, reconnect all power/data cables and perform a POST (Power On Self Test) — observe fans, beep codes and POST indicator LEDs.

9. If system does not boot, disconnect non-essential cards and re-test (minimal boot configuration).

POST / Boot Troubleshooting checklist

- No power / fans not spinning: check PSU switch, 24-pin and 8-pin connectors, mains.
- Beep codes: record beep pattern, consult motherboard manual.
- No display: reseat GPU, check monitor cable, test onboard video if available.
- Random reboots: check PSU wattage, CPU cooler seating, RAM seating.

Assessment Rubric (Task grading)

Criterion	Max Marks	Remarks / Expectations
Safety and procedures followed	10	Proper shutdown, ESD precautions, documented photos.
Identification accuracy labeled components with models.	15	Correctly identified
Measurements and observations	15	Boot times, file copy timings, scanner/printer outputs recorded.
Report quality (diagrams, photos, clarity)	20	Clean labeled photos, TikZ or hand-sketch, concise conclusions.
Troubleshooting and reasoning	10	Logical diagnosis for any observed issue.
Viva / Oral understanding	20	Clear answers to viva questions (below).
Total	90	(Convert to lab marks as per course scheme)

Viva Questions (Extended) — with Model Answers

1. **Q: What is the difference between hardware and software?**
   A (model): Hardware are the physical components of a computer (CPU, RAM, storage, motherboard). Software are the programs and data (OS, applications), intangible instructions that run on hardware. Hardware executes the instructions provided by software; both are required for a working system.

2. **Q: Give at least three examples of input and output devices.**
   A (model): Inputs: Keyboard, mouse, scanner, microphone. Outputs: Monitor, printer, speakers.

3. **Q: What is the role of RAM in a computer system? Why is it faster than HDD/SSD?**
   A (model): RAM stores active program data and machine state for fast CPU access. It is semiconductor-based and provides random access in nanoseconds, while HDD uses mechanical movement (milliseconds) and SSD, though flash-based, has higher latency and lower sustained bandwidth than DRAM.

4. **Q: Why do we need both system software and application software?**
   A (model): System software (OS) manages hardware, memory, processes and provides a platform and APIs. Application software runs on top of the OS to perform user tasks (document editing, spreadsheets). Without OS, apps cannot access hardware in a standardized way.

5. **Q: Which specification (CPU, RAM, or storage) has the greatest effect on performance for AI applications?**
   A (model): For many AI training tasks, the GPU and RAM (capacity and bandwidth) matter most; CPU matters for coordination and some preprocessing. NVMe storage improves dataset loading times but is secondary to GPU and RAM for training speed.

6. **Q: What is the main function of the power supply unit?**
   A (model): Convert mains AC to regulated DC rails (12V, 5V, 3.3V) and supply stable, sufficient current to components; protect against surges; provide connectors for motherboard, CPU, GPU and drives.

7. **Q: How do SSDs differ from HDDs in terms of speed and durability?**
   A (model): SSDs have no moving parts (flash memory) so they have much lower access latency and higher throughput; they are more

robust to shock. HDDs are mechanical and subject to wear; they may offer higher capacity per dollar for bulk storage but are slower and less durable mechanically.

Common Issues & Quick Remedies

- **PC doesn't power up:** Check mains, PSU switch, 24-pin and 8-pin connectors; test with known-good PSU if available.
- **No display:** Reseat GPU, try onboard video, check monitor input selection and cable.
- **Frequent crashes:** Check CPU temperatures (heatsink seating), check PSU capacity, run memory test (MemTest86).
- **Slow boot:** Check drive type (HDD vs SSD), disable unnecessary startup programs.
- **Peripheral not detected:** Try different USB port, check drivers in Device Manager, test on another computer.

Required Deliverables (per student / pair)

1. Photographic evidence of disassembly and labelled interior (2–4 photos).
2. Completed observation tables for Tasks 1–4.
3. A short comparison report (max 1 page) recommending one machine for an assigned workload with justification.
4. Lab record signed by instructor.
5. Viva performance (oral Q&A).

Report Template (short)

- Title, Student name, Roll No., Date.
- Objective (one line).
- Equipment and software used.
- Steps performed (numbered).

- Observations (tables + screenshots).
- Conclusion (recommendation + any anomalies).
- Instructor signature.

Instructor note: Encourage students to keep concise notes and to discuss observed differences (e.g., boot time variance) in groups — this builds critical thinking about how specifications translate to real performance.

2 Week 2: Operating System Basics and File Management

Objective: To understand the structure, functionality, and practical usage of Operating Systems (OS) in managing computer hardware and software resources. Students will explore user interfaces, perform file-management operations, investigate different types of file paths, manage storage devices, and examine essential system utilities. Emphasis will be on hands-on experience with both Windows and Linux environments to develop cross-platform confidence.

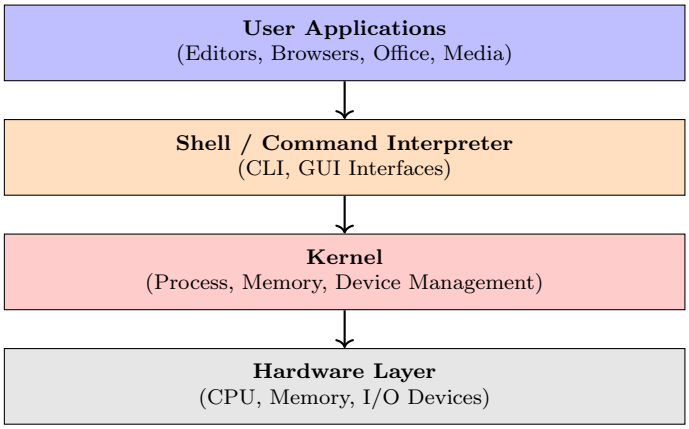
Theoretical Background

An **Operating System (OS)** is a system software that acts as an interface between the user and the computer hardware. It manages hardware components, coordinates processes, and provides an environment for application execution.

- **Kernel:** Core component that controls CPU, memory, and device management.
- **Shell:** Interface (CLI or GUI) that allows users to interact with the kernel.
- **File System:** Responsible for data organization, storage, and retrieval.
- **Utilities:** Provide maintenance and monitoring tools (e.g., Task Manager, Disk Cleanup).
- **Examples:** Windows 10/11, Ubuntu Linux, macOS, Android.

Operating systems also ensure efficient **resource allocation**, handle **multitasking**, enforce **security**, and maintain **user interfaces**.

TikZ Diagram: OS Architecture and File System Hierarchy



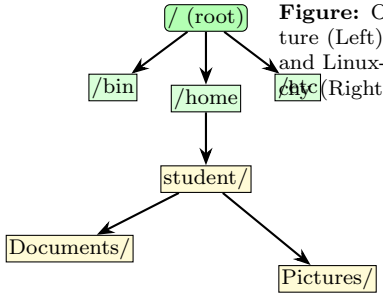


Figure: Operating System Architecture (Left) and Linux-style File-System Hierarchy (Right)

Tasks and Learning Outcomes

1. **Task 1:** Explore the OS user interface — understand graphical and command interfaces.

2. **Task 2:** Perform file and folder management — create, rename,

move, copy, delete.

3. **Task 3:** Understand file paths (absolute vs. relative) and file extensions.
4. **Task 4:** Manage storage devices and navigate directories using GUI and CLI.
5. **Task 5:** Explore system utilities for performance monitoring and resource control.

Detailed Procedures and Activities

Task 1: Exploring OS User Interface

Objective: To understand how an operating system presents information and accepts user commands.

Procedure:

1. Power on the computer and log into the provided user account.
2. Identify the key elements: **Desktop**, **Taskbar / Dock**, **Start Menu (Windows)** or **Launcher (Linux)**.
3. Observe icons such as *This PC*, *Recycle Bin*, and *Control Panel*.
4. Open applications (Word, Terminal, Browser) and switch between them using:
   - `Alt+Tab` – Windows window switcher.
   - `Super+Tab` – Linux application switcher.
5. Customize the desktop: change wallpaper, adjust display resolution.
6. Explore the difference between GUI and CLI environments.

Observation Table:

Feature	**Windows**	**Linux (Ubuntu)**
Desktop environment	Explorer.exe GUI	GNOME / KDE
Main menu access	Start Menu	Activities → Applications Menu
File browser	File Explorer	Nautilus (File Manager)
Shortcut for switching apps	Alt+Tab	Super+Tab

Task 2: File and Folder Management

Objective: Practice creating, manipulating, and organizing files.
Procedure:

1. Launch the file manager (*File Explorer* or *Nautilus*).
2. Create a folder `Lab2` → inside it make subfolders `Docs`, `Images`, `Projects`.
3. Use Notepad/gedit to create sample files and store them in respective folders.
4. Perform:
   - Copy (`Ctrl + C`) and Paste (`Ctrl + V`)
   - Move via drag-and-drop or cut-paste
   - Rename (Right-click → Rename)
   - Delete (Move to Recycle Bin / Trash)
5. Restore a deleted file to observe recovery behavior.

Results: Students should be able to organize data logically and observe OS handling of file operations.

Task 3: Understanding File Paths and Extensions

Objective: Learn how operating systems locate and categorize files.
Procedure:

1. Create folder tree: `Desktop → Lab2 → Docs`.
2. Save a file named `report.txt`.
3. Determine its:
   - **Absolute Path:** Full path from root (e.g., `C:\Users\Student\Desktop\Lab2\Docs\`
   - **Relative Path:** Path relative to current directory (`.\Docs\report.txt`)
4. Explore file extensions: `.docx`, `.xlsx`, `.jpg`, `.pdf`, `.exe`.
5. Record which applications open each extension.

Observation Table:

Extension	Associated Application	Purpose
.docx	MS Word / LibreOffice Writer	Word Processing
.xlsx	MS Excel / Calc	Spreadsheet Data
.jpg / .png	Photo Viewer / ImageMagick	Image Display
.pdf	Acrobat Reader / Evince	Document Viewing
.exe / .bin	System Loader	Executable Program

Task 4: Managing Storage Devices and Directories

Objective: Gain experience in managing drives and navigation using both GUI and CLI.

Procedure:

1. Connect a USB flash drive and verify detection:
   - Windows → "File Explorer → This PC"
   - Linux → Mounted under `/media/username/`
2. Copy data to and from the USB, then safely eject.
3. Check disk space:
   - Windows: Right-click → Properties.
   - Linux: `df -h`.
4. Command-line navigation:
   - Windows: `dir`, `cd`, `mkdir`, `rmdir`
   - Linux: `ls`, `cd`, `mkdir`, `rm -r`
5. Compare directory structures and permissions between both systems.

Safety Note: Always unmount/eject drives before removal to avoid data corruption.

Task 5: Exploring System Utilities

Objective: Understand how to monitor and control system performance.

Procedure:

1. Launch **Task Manager (Ctrl + Shift + Esc)** or **System Monitor**.

2. Record CPU, RAM, and Disk usage statistics.
3. Observe process priorities and multitasking.
4. Open **Disk Management (Windows)** / use `lsblk` in Linux to inspect partitions.
5. Adjust basic settings (Date/Time, Display, Network) through Control Panel / Settings.

Result: Students should interpret live performance data and describe the function of active processes.

Expected Outcomes

- Students can navigate and personalize OS environments.
- Students can perform essential file-management and storage operations.
- Students can differentiate between GUI and CLI tools.
- Students can identify absolute and relative paths.
- Students can use built-in system utilities for diagnostics.

Viva Questions with Answers

1. **What is the primary role of an Operating System?**
   It manages hardware and software resources and provides a user interface for communication with the computer.
2. **Differentiate between absolute and relative paths.**
   An absolute path shows the complete route from the root directory, while a relative path is based on the current working directory.
3. **Explain what happens when you delete a file.**
   In Windows, it moves to the Recycle Bin; in Linux, it goes to Trash or is permanently removed via terminal commands.
4. **List common file extensions and their applications.**
   `.docx { Word`, `.xlsx { Excel`, `.jpg { Images`, `.exe { Executable`, `.pdf { Documents`.
5. **What is multitasking in an OS?**
   The ability to run multiple processes simultaneously by time-sharing CPU resources.

6. **How can you check system performance?**
   Using Task Manager (Windows) or System Monitor (Linux) to view CPU, Memory, Disk, and Network activity.

7. **Why is safe-ejecting storage devices important?**
   It ensures all pending read/write operations complete before removal, preventing file corruption.

3 Week 3: Introduction to Word Processing (MS-Word)

Objective: This lab aims to introduce students to the fundamentals of word processing using Microsoft Word or equivalent open-source software such as LibreOffice Writer or Google Docs. Students will learn how to create, edit, format, and organize professional documents. Emphasis will be placed on understanding formatting conventions, document structure, and layout design, enabling learners to produce academic, business, and technical documents effectively. By the end of this session, students will be proficient in handling text, applying formatting styles, using templates, inserting tables and images, and managing page setup and printing options.

Tasks

1. **Task 1:** Create a new document, save it using an appropriate file-name and folder structure.
2. **Task 2:** Apply text formatting such as font type, size, style (bold, italic, underline), color, and paragraph alignment.
3. **Task 3:** Perform essential editing operations like cut, copy, paste, undo, redo, and Find/Replace.
4. **Task 4:** Insert and format headers, footers, and page numbers.
5. **Task 5:** Adjust page layout settings (margins, orientation, and size) and use Print Preview.
6. **Task 6:** Insert a table and image, and apply borders, shading, and text wrapping.
7. **Task 7:** Apply styles and themes to maintain a consistent document appearance.
8. **Task 8:** Save the document in multiple formats (`.docx`, `.pdf`) and organize files properly.

Details of Lab Experiment

Task 1: Creating and Saving a New Document

1. Launch MS-Word (or alternative software).
2. Select **Blank Document** from the startup screen.
3. Type the document title: *"My First Word Processing Document"*.

4. Save the file using **File → Save As**, navigate to the folder `ICT_Labs → Week3`, and name it `Lab3_YourName.docx`.
5. Reopen the file to confirm successful saving.

Task 2: Applying Basic Formatting

1. Type a paragraph about "Applications of Word Processing in Education and Industry."
2. Highlight the text and change:
   - Font: Times New Roman
   - Size: 12 pt
   - Alignment: Justified
   - Line spacing: 1.5 lines
3. Apply bold to important terms like "formatting," "template," and "editing."
4. Use bullet and numbered lists for clear information.
5. Apply a heading style (**Heading 1**) to the main title.

Task 3: Editing and Navigation Tools

1. Use Cut (Ctrl + X), Copy (Ctrl + C), and Paste (Ctrl + V) to duplicate or relocate content.
2. Experiment with Undo (Ctrl + Z) and Redo (Ctrl + Y).
3. Use Find → Replace to replace a specific word (e.g., change "computer" to "system").
4. Navigate quickly using Ctrl + Home (top of document) and Ctrl + End (bottom of document).

Task 4: Headers, Footers, and Page Numbers

1. Go to **Insert → Header → Blank**.
2. Type your full name and student ID on the left.
3. Insert a footer and choose **Page Number → Bottom of Page → Center**.
4. Verify that numbering updates on each page automatically.
5. Insert a **Date Field** using **Insert → Date Time**.

Task 5: Page Layout and Print Preview

1. Open the **Layout Tab**.
2. Adjust margins to 1 inch on all sides.
3. Set page orientation to Portrait.
4. Insert a **Page Break** after the first page.
5. Use **File → Print Preview** to review layout.
6. Save the file again before printing.

Task 6: Inserting Tables and Images

1. Navigate to a blank area in the document.
2. Go to **Insert → Table → 3×3 grid**.
3. Fill the table with sample data (e.g., student names, marks, grades).
4. Apply border color and cell shading for visual appeal.
5. Insert an image (**Insert → Pictures → This Device**).
6. Use **Text Wrapping → Square** to position text around the image.

Task 7: Styles and Themes

1. Select a heading and apply **Heading 1 Style**.
2. Apply **Normal Style** for body text.
3. Choose a document theme from **Design → Themes → Office**.
4. Modify the color scheme and font set as desired.

Task 8: Saving and Exporting Documents

1. Save your file using **Ctrl + S**.
2. Export as PDF via **File → Save As → PDF**.
3. Compare file sizes of `.docx` and `.pdf` formats.
4. Store both files in the folder `ICT_Labs → Week3`.

Mini Project

Prepare a two-page report on "Evolution of Smart Grid Technologies" using proper headings, subheadings, bullet lists, and a table summarizing advantages and challenges. Insert an image, add page numbers, and export the report as a PDF for submission.

Conceptual Diagram: Word Processing Workflow

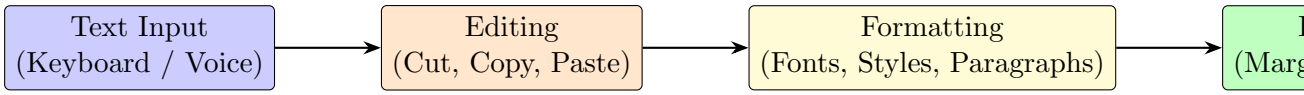


Figure: Word Processing Workflow — from content input to final formatted output.

Viva Questions

1. Differentiate between "Save" and "Save As".
2. Explain the importance of document formatting and consistency.
3. What are "Styles" in MS-Word and how do they improve efficiency?
4. How do you insert and format a table?
5. What is the purpose of headers and footers?
6. Describe how to adjust page layout and margins.
7. What are the advantages of exporting documents as PDFs?
8. How do you insert and wrap text around an image?
9. What are the shortcut keys for bold, italic, and underline?
10. Why is Print Preview used before printing?

4 Week 4: Working with Images and Shapes in Word

Objective: This lab aims to develop students' ability to create visually appealing and information-rich documents using MS Word or similar word processing tools. By mastering the insertion, formatting, and manipulation of images, shapes, and SmartArt, students will understand how visual design supports clear communication and professional presentation. The exercise also strengthens the understanding of layout management, wrapping styles, and file export options for publication or submission.

Theoretical Background

Word processors such as Microsoft Word allow users to enhance textual content with visual elements like images, illustrations, and diagrams. These elements play a crucial role in technical, business, and academic documents, where visuals help interpret data, illustrate mechanisms, or simply improve document aesthetics.

- **Images:** Can be inserted from the computer, clipboard, or online sources. They support multiple formats such as `.jpg`, `.png`, `.gif`, and `.bmp`.
- **Shapes:** Vector-based elements such as rectangles, arrows, and callouts used for diagrams, flowcharts, or annotations.
- **SmartArt:** Predefined graphical structures representing relationships, hierarchies, or processes (e.g., organizational charts or cycle diagrams).
- **WordArt:** Text-based design feature for decorative headings and titles.

The **Format Picture** and **Drawing Tools** tabs in MS Word provide controls for modifying these objects, while **Wrap Text** and **Position** options determine their placement relative to the surrounding text. Understanding these features is essential for creating professional reports, proposals, and project documentation.

Tasks Overview

1. Insert and format pictures, ensuring proper scaling and quality.
2. Apply different text wrapping styles to control text flow.

3. Insert and customize shapes for annotation and layout illustration.
4. Use SmartArt graphics to depict structured information visually.
5. Apply WordArt for attractive document titles.
6. Align, group, and arrange multiple objects harmoniously.
7. Export the document in PDF format with all graphical content preserved.

Details of Lab Experiment

Task 1: Inserting and Arranging Pictures

1. Open your existing `Lab3_YourName.docx`.
2. Navigate to **Insert** → **Pictures** → **This Device**.
3. Choose an image such as a smart grid diagram, motherboard photo, or institutional logo.
4. Insert the image and drag it to the top-right corner of the page.
5. Click **Picture Format** → **Wrap Text** → **Square** to make the text flow naturally.
6. Resize by holding **Shift** while dragging the corner handle to preserve aspect ratio.
7. Observe the difference between wrapping styles: *Inline with Text*, *Tight*, *Behind Text*, and *In Front of Text*.
8. Add a border (`1pt solid black`) and apply a light shadow for a professional appearance.

Task 2: Image Enhancement and Optimization

1. Select the image and open the **Picture Format** ribbon.
2. Apply artistic effects (e.g., grayscale or glow edges).
3. Use **Crop** → **Crop to Shape** for creative framing (e.g., rounded rectangle).
4. Test compression via **Compress Pictures** → **Email/Web**.
5. Compare image clarity before and after compression.

Note: Excessive image size can increase file size dramatically; always compress images for reports to reduce storage usage and improve upload performance.

Task 3: Working with Shapes

1. Go to **Insert → Shapes** and select a **Rounded Rectangle**.
2. Draw it beside the inserted image and add the text: *"Figure 1: Smart Grid Architecture"*.
3. Format the shape: Fill color (light blue), border color (dark red), and apply soft shadow.
4. Insert arrows to link image parts using **Insert → Shapes → Arrow**.
5. Add callouts (**Cloud Callout**) to annotate specific elements.
6. Adjust layering via **Right-click → Bring Forward / Send Backward**.

Task 4: SmartArt and WordArt Integration

1. Create a bulleted list of "Steps in Smart Grid Communication":
   - Data Collection
   - Data Processing
   - Decision Making
   - Control Action
2. Select the list and convert it via **Home → Convert to SmartArt**.
3. Choose **Process** layout and apply the **Colorful – Accent 2** style.
4. Add a title using **Insert → WordArt → Gradient Fill (Blue)**.
5. Type "Smart Grid Workflow" and center it above the SmartArt.
6. Experiment with 3D rotation and shadow to enhance visibility.

Task 5: Grouping, Alignment, and Export

1. Hold **Ctrl** and select the image, shape, and SmartArt.
2. Right-click → **Group → Group**.
3. Use **Align → Center** to align objects horizontally.

4. Save your file as `Lab4_YourName.docx`.
5. Export via **File → Save As → PDF**.
6. Reopen the PDF to ensure that image resolution and formatting are preserved.

Observation and Results

Table: Image and Object Properties

Object Type	Formatting Applied	Effect Observed
Inserted Image	Border, Shadow, Crop	Image looks focused and visually separated from text.
Shape (Rectangle)	Light blue fill, red border	Highlights annotation beside image.
SmartArt	Process style with accent color	Clearly depicts workflow steps.
WordArt	Gradient Blue, 3D rotation	Adds professional, eye-catching title.

Conclusion: Through this lab, students demonstrated the ability to manage graphical components effectively within Word. The document now combines text and visuals harmoniously, improving clarity and aesthetics suitable for academic and professional presentation.

Conceptual Diagram: Word Visual Integration Workflow

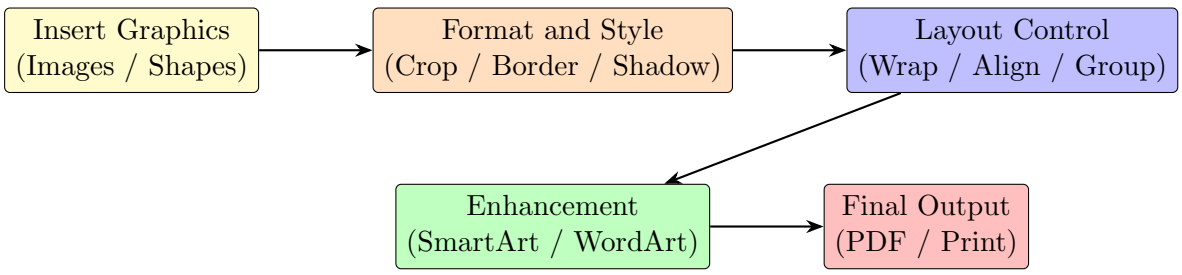


Figure: Workflow showing integration, formatting, and enhancement of visual elements in Word.

Viva Questions

1. Define the term "text wrapping" and explain its different modes.
2. How can you compress images in a document without losing clarity?
3. What are the advantages of using SmartArt for data visualization?
4. Explain the role of "Bring Forward" and "Send Backward" in object arrangement.
5. Differentiate between raster and vector graphics in Word.
6. Why is grouping objects useful in complex layouts?
7. List three advantages of exporting documents as PDF.
8. What are the key differences between WordArt and normal text formatting?
9. Explain how alignment tools help maintain a clean document structure.
10. How would you prepare a visually professional title page using images and shapes?

5 Week 5: Working with Tables, Page Layout, and Mail Merge

Objective: To develop advanced document design and automation skills in MS Word (or LibreOffice Writer) by creating and formatting professional tables, adjusting complex page layouts, and implementing mail merge for personalized bulk document creation such as letters, certificates, or address labels. Students will learn to organize tabular data effectively, control document structure with sections and columns, and automate repetitive documentation tasks through merging templates with data sources.

Tasks

1. **Task 1:** Create, format, and modify tables — including adjusting borders, merging/splitting cells, applying shading, and using table styles.
2. **Task 2:** Implement multi-column layouts for professional documents such as newsletters, reports, and magazines.
3. **Task 3:** Perform a complete Mail Merge operation — linking a document with an external data source to automate letters, labels, or envelopes.

Details of Lab Experiment

Task 1: Creating and Formatting Tables

1. Open MS Word and start a new blank document named `Lab5_Tables.docx`.
2. Navigate to the Insert tab and select Table → 5x4.
3. Create a sample table of student marks with columns: `Name, Roll No, Subject, Marks`.
4. Enter data for at least five students.
5. Select the top row and apply:
   - Bold font style.
   - Background color (light gray or light blue).
   - Center alignment.
6. Adjust column widths to fit content neatly.

7. Merge the first-row cells to create a table title *"Student Marks Report"*.
8. Add gridlines and a 1.5 pt border around the table.
9. Use the Design → Table Styles gallery to apply a professional style (e.g., Medium Style 2 – Accent 1).
10. Demonstrate how to:
    - Split a merged cell into multiple cells.
    - Convert a table to plain text (Layout → Convert to Text) and back again.

Task 2: Multi-Column Page Layout and Section Breaks

1. After completing the table, insert a Section Break (Next Page) from Layout → Breaks.
2. In the new section, type a short newsletter article titled *"Technology in Education"*.
3. Highlight the text and navigate to Layout → Columns → Two.
4. Adjust spacing between columns to 0.5 inches.
5. Insert a line between columns (More Columns → Line Between).
6. Add a decorative heading using WordArt.
7. Insert a relevant image in one column and set text wrapping to `Tight`.
8. Adjust margins (`1 inch`) and verify column alignment using ruler guides.
9. Save this section as `Newsletter_Layout.docx`.

Task 3: Mail Merge for Labels and Letters

1. Open a new blank document and navigate to the Mailings tab.
2. Click Start Mail Merge → Letters.
3. Prepare a data source in Excel or CSV format with the following columns: `Name, Address, City, PostalCode`.
4. Click Select Recipients → Use an Existing List and browse your CSV file.

5. Type a sample letter such as: *"Dear **Name**, thank you for attending our workshop held in City. Your participation certificate is enclosed."*
6. Insert fields using Insert Merge Field.
7. Preview merged documents via Preview Results.
8. Finish and merge using Finish & Merge → Edit Individual Documents.
9. Save and export as `MailMerge_Letters.docx`.
10. Optionally, print address labels using Start Mail Merge → Labels.

Observation and Results

- Tables improve document clarity by aligning information in a structured way.
- Section breaks and multi-column layouts are essential for professional design.
- Mail Merge enables mass personalization, reducing manual work and minimizing errors.
- Students successfully created and printed professional layouts and personalized letters.

Mail Merge Process Flow (TikZ Diagram)

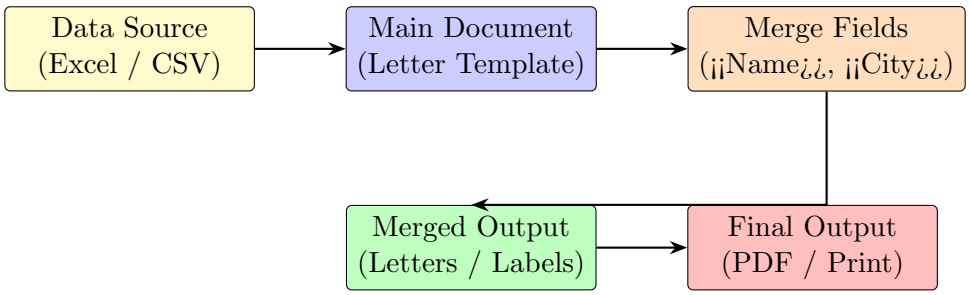


Figure: Mail Merge Process Flow — linking a data file to a main document to generate personalized outputs.

Safety and Best Practices

- Always verify data formatting (especially in CSV files) before merging.

- Avoid blank rows or columns in data source — they cause skipped records.
- Preview all merged documents before printing in bulk.
- Save both the template and data source in the same folder for easy linkage.

Viva Questions

1. How can you repeat table headers automatically across multiple pages? Select the header row → `Table Tools → Layout → Repeat Header Rows`.
2. What is the difference between page breaks and section breaks? Page breaks simply start a new page, while section breaks divide the document into independent sections with separate headers, footers, or column layouts.
3. What are the key steps for performing a Mail Merge? (1) Prepare data source, (2) Create main document, (3) Insert merge fields, (4) Preview, (5) Merge and print.
4. Why is Mail Merge used in offices or universities? It automates repetitive document generation, such as certificates, letters, or result sheets, saving time and ensuring consistency.
5. Can Mail Merge import data from Excel directly? How? Yes — by choosing "Select Recipients → Use an Existing List" and selecting the Excel file.

6 Week 6: Introduction to Spreadsheets (MS Excel)

Objective: To enable students to understand and utilize spreadsheet software as a computational and organizational tool. The lab focuses on building foundational skills such as entering, formatting, and manipulating tabular data, applying mathematical formulas and functions, and interpreting calculated results. Students will learn how to automate calculations, maintain data accuracy, and prepare spreadsheets suitable for academic, business, or engineering applications.

Tasks (Detailed Practical Objectives)

1. **Task 1: Workbook and Worksheet Creation — Data Entry and Organization** Students will create a new spreadsheet, plan the layout, and understand the hierarchy of workbooks, worksheets, rows, and columns. They will design a small dataset suitable for performing calculations. Steps include naming, saving, and structurally organizing the document.

   (a) Launch MS Excel and choose "Blank Workbook."

   (b) Immediately save as `Lab6_YourName.xlsx` in the ICT Lab folder.

   (c) Rename Sheet1 to "Sales Ledger".

   (d) Define column headers: `Item`, `Quantity`, `Unit Price`, `Total`, and `Remarks`.

   (e) Enter at least 8 sample items such as *Pen, Notebook, Ruler, Eraser, Marker, Pencil, Sharpener, Scale.*

   (f) Leave one blank row at the end for summary formulas (e.g., Grand Total).

   (g) Explore workbook structure: add a second sheet named "Practice Formulas".

2. **Task 2: Formatting and Presentation of Data** This task reinforces the importance of data presentation and visual clarity. Students will apply consistent number formats, cell borders, text alignment, and conditional formatting to make the spreadsheet readable and professional.

   (a) Select the header row (`A1:E1`) and apply:

   - Bold and Center alignment.
   - Font style `Calibri`, size 12.

- Cell shading (light blue or gray).

(b) Highlight numeric columns (`B, C, D`) and set Number → Currency format.

(c) Adjust column widths by double-clicking the separator between column letters.

(d) Apply borders around the data region: `Home → Borders → All Borders`.

(e) Use Conditional Formatting → Highlight Cell Rules → Greater Than to color totals above a specified value.

(f) Freeze the top row: `View → Freeze Panes → Freeze Top Row`.

(g) Insert a header/footer with the student's name and page number.

3. **Task 3: Using Formulas and Built-in Functions** Students will learn the use of cell references and formulas for calculations such as multiplication, summation, and averaging. The emphasis is on understanding how Excel dynamically updates results when source data changes.

   (a) In cell `D2`, enter the formula `=B2*C2` to calculate the total value for the first item.

   (b) Drag the fill handle down to apply the formula to all rows.

   (c) Verify the automatic relative reference adjustment (`=B3*C3`, etc.).

   (d) Below the table, calculate:

   - `=SUM(D2:D9)` — total of all items.
   - `=AVERAGE(C2:C9)` — mean unit price.
   - `=MAX(D2:D9)` and `=MIN(D2:D9)` — highest and lowest totals.

   (e) Modify one quantity and observe how totals update automatically.

   (f) Save the file after each stage to record progress.

4. **Task 4: Relative and Absolute Cell Referencing** This exercise helps students distinguish between relative, absolute, and mixed references, which are crucial when replicating formulas.

   (a) In cell `F1`, type `Tax Rate` and in `F2`, enter `10%`.

   (b) Add a new column labeled `With Tax`.

   (c) In `E2`, enter the formula: `=D2*(1+$F$2)` and copy it down.

(d) Note that the tax rate reference remains fixed because of the $ symbol (absolute reference).

(e) Change the value in `F2` to 12% and observe automatic recalculation.

5. **Task 5: Data Validation, Sorting, and Filtering** Students will enhance spreadsheet integrity by controlling data input and exploring data management features.

   (a) Select the `Quantity` column → `Data → Data Validation → Whole Number > 0`.

   (b) Sort the table alphabetically by item name.

   (c) Apply a filter (`Data → Filter`) to view only items with total ¿ 50.

   (d) Remove filters and return to the full view.

6. **Task 6: Visualization (Optional Advanced)** Students will create a basic chart to represent their data visually.

   (a) Select the `Item` and `Total` columns.

   (b) Insert a Column Chart from `Insert → Charts → Column`.

   (c) Add a chart title, data labels, and axis titles.

   (d) Move the chart to a new sheet named "Sales Chart."

Observation and Analysis

- Excel automatically propagates relative formulas, reducing human error.
- Absolute references anchor constant parameters such as tax or discount rates.
- Conditional formatting assists in identifying key figures visually.
- Sorting and filtering improve data manageability and reporting.
- Charts transform raw numeric data into easily interpretable visuals.

Spreadsheet Data Flow (TikZ Diagram)

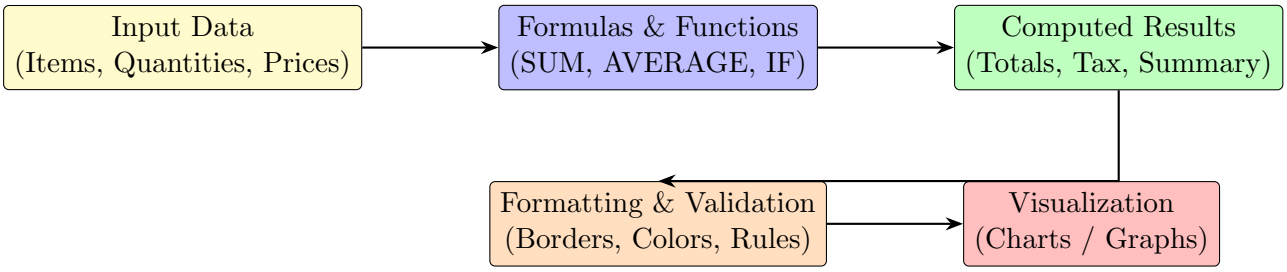


Figure: Typical Spreadsheet Workflow — from data entry to analysis and visualization.

Best Practices and Safety Notes

- Keep one variable per column and use clear, descriptive headers.
- Avoid merged cells in data tables; they interfere with sorting and formulas.
- Save workbooks using meaningful filenames and maintain version control.
- Use consistent units (e.g., all prices in PKR) for accurate calculations.
- Always double-check formulas before sharing or printing results.

Viva Questions

1. Explain the difference between relative, absolute, and mixed references with examples.
2. What is the importance of data validation in Excel?
3. How can you ensure that a formula automatically updates when source data changes?
4. Describe the purpose of freezing panes in a large dataset.
5. How can conditional formatting help in decision-making?
6. What is the benefit of using charts and graphs in spreadsheets?

7 Week 7: Formulas, Functions, and Named Ranges

Objective: To enable students to apply advanced spreadsheet logic using formulas and functions for automated calculations and data analysis. This lab focuses on practical mastery of built-in functions (`SUM, AVERAGE, MIN, MAX, IF, COUNTIF, VLOOKUP`), as well as the creation and application of named ranges for structured, maintainable, and error-free workbooks. Students will also learn to build nested and logical functions that enhance decision-making within spreadsheets.

Tasks (Detailed Practical Objectives)

1. **Task 1: Review and Setup of Dataset** Students will begin by preparing or importing a dataset that can be used to apply multiple functions. A typical dataset may contain student names, marks in various subjects, and attendance percentages.
   (a) Open `Lab6_YourName.xlsx` and create a new worksheet named `Functions_Lab`.
   (b) Design the following columns: `Student Name, Marks, Attendance, Grade, Result`.
   (c) Enter at least 10 sample student records with marks between 0–100 and attendance between 50–100.
   (d) Save the file and prepare it for applying formulas.
2. **Task 2: Applying Basic Statistical Functions** Students will apply arithmetic and statistical functions to extract summary information from the dataset.
   (a) Use `=SUM(B2:B11)` to find total marks.
   (b) Apply `=AVERAGE(B2:B11)` to compute mean marks.
   (c) Use `=MIN(B2:B11)` and `=MAX(B2:B11)` to find the lowest and highest scores.
   (d) Insert `=COUNT(B2:B11)` to count how many entries contain numeric data.
   (e) Combine results in a summary table below the data, labeling each result clearly.
3. **Task 3: Logical Decision-Making Using `IF` and Nested Functions** Students will create formulas that automatically classify data based on logical conditions. They will understand how to nest functions for multi-condition scenarios.

(a) In the `Result` column, apply: `=IF(B2>=50,"Pass","Fail")`.

(b) In the `Grade` column, use nested logic: `=IF(B2>=80,"A",IF(B2>=60,"B",IF(B2>=50,`

(c) Extend both formulas down to all rows.

(d) Use the `AND` and `OR` functions to apply compound conditions such as: `=IF(AND(B2>=50,C2>=75),"Eligible","Not Eligible")`.

(e) Highlight results using conditional formatting for Pass/Fail outcomes.

4. **Task 4: Conditional Counting and Summation Functions** Students will use conditional aggregate functions to analyze subsets of data dynamically.

   (a) Use `=COUNTIF(D2:D11,"Pass")` to count how many students passed.

   (b) Use `=COUNTIF(C2:C11,">=75")` to find students with high attendance.

   (c) Apply `=SUMIF(D2:D11,"Pass",B2:B11)` to sum marks of passed students.

   (d) Compare average marks of passed vs failed students using `AVERAGEIF`.

   (e) Discuss how such formulas can automate performance reports.

5. **Task 5: Named Ranges for Simplified Formula References** Students will define and use named ranges to improve readability and reduce formula errors.

   (a) Select the marks column (`B2:B11`) and assign the name `Marks` via: `Formulas → Define Name → Marks`.

   (b) Define another range `Attendance` for column `C2:C11`.

   (c) Use named ranges in formulas: `=AVERAGE(Marks)` and `=MAX(Attendance)`.

   (d) Insert a formula combining names: `=IF(AVERAGE(Marks)>=60,"Good Class","Needs Improvement")`.

   (e) Modify the range content and observe that named references auto-update.

6. **Task 6: Lookup and Data Retrieval (Cross-Sheet Functions)** Students will retrieve related data from another worksheet using lookup functions, enhancing data connectivity across sheets.

   (a) Create a new sheet named `Student_Details` with columns: `RollNo, StudentName, City`.

   (b) Return to the main sheet and add a `RollNo` column.

(c) Use `VLOOKUP` to fetch city data based on roll number: `=VLOOKUP(A2,Student_Details`

(d) Replace with `XLOOKUP` if available: `=XLOOKUP(A2,Student_Details!A:A,Student_Det Found")`.

(e) Discuss the differences and limitations between `VLOOKUP` and `XLOOKUP`.

7. **Task 7: Error Checking and Formula Auditing** Students will practice identifying, tracing, and correcting formula errors using Excel's built-in auditing tools.

   (a) Introduce an intentional error (delete a referenced cell) and observe `#REF!`.

   (b) Use `Formulas → Error Checking` to identify issues.

   (c) Use `Trace Precedents` and `Trace Dependents` to visualize formula relationships.

   (d) Correct the error and verify recalculations.

Observation and Discussion

- Functions automate repetitive calculations and improve reliability.
- Logical and nested functions help apply multiple decision criteria within data.
- Named ranges provide clear and reusable references, especially in large spreadsheets.
- Lookup functions connect separate data sheets, enabling relational analysis.
- Formula auditing tools are essential for maintaining data integrity.

Functional Logic Flow (TikZ Diagram)

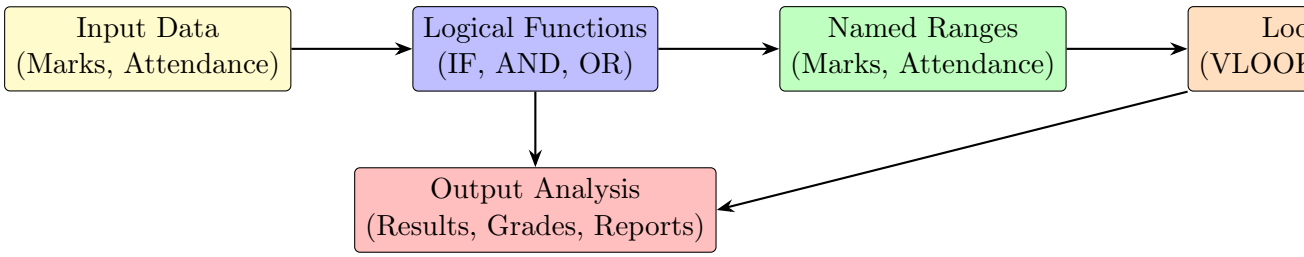


Figure: Logical flow of formulas and functions — data input passes through logical decisions and named ranges to produce structured analytical results.

Best Practices and Tips

- Always use descriptive names for ranges (avoid spaces or special characters).
- Keep formulas concise; break down complex logic into helper columns if needed.
- Use `Formulas → Name Manager` to edit or delete named ranges.
- Apply consistent data validation to avoid incorrect formula results.
- Test formulas with sample data before applying to large datasets.
- Document formulas and assumptions for future users.

Viva Questions

1. Explain the concept of a nested function with an example.
2. Differentiate between `COUNT`, `COUNTA`, and `COUNTIF`.
3. Why are named ranges preferred in large spreadsheets?
4. Describe the difference between `VLOOKUP` and `XLOOKUP`.
5. How can you trace and correct errors in formulas?
6. Give a real-world example where logical functions (`IF, AND, OR`) can automate decision-making.

8 Week 8: Data Sorting, Filtering, and Validation

Objective: To organize, analyze, and maintain data quality in spreadsheets using sorting, filtering, and validation tools. This week emphasizes data cleaning, rule-based validation, and efficient visualization of large datasets. Students will learn how to prepare structured data for reporting and analytics through step-by-step manipulation, ensuring accuracy and reliability.

Tasks (Detailed Practical Objectives)

1. **Task 1: Understanding Dataset and Setup** Students will begin by reviewing an existing dataset or creating one suitable for sorting and filtering operations.
   (a) Open the previous workbook `Lab7_YourName.xlsx` and create a new worksheet named `Data_Tools`.
   (b) Design a structured table with columns: `Student Name, Roll No, Marks, Grade, City, Attendance (%)`.
   (c) Enter at least 15–20 rows of data with realistic values.
   (d) Convert the dataset to a table format using `Insert → Table`.
2. **Task 2: Sorting Data (Single and Multi-Level)** Students will apply sorting tools to arrange and prioritize data logically.
   (a) Sort data by `Marks` in descending order (highest marks first).
   (b) Perform a secondary sort by `Student Name` in ascending order to resolve ties.
   (c) Add a third sorting level based on `City` alphabetically.
   (d) Discuss the difference between full-table sorting and column-only sorting (and why the latter can corrupt data).
   (e) Save the workbook after sorting.
3. **Task 3: Filtering and Custom Filters** Students will learn to extract subsets of data dynamically using filters.
   (a) Enable the `AutoFilter` feature from the `Data` tab.
   (b) Apply a filter to show only students with `Marks > 70`.
   (c) Use a custom filter to display only those from a specific `City` (e.g., "Multan").

(d) Apply multiple criteria filters: students with `Grade = "A"` and `Attendance  80`.

(e) Clear filters and note how to revert to the full dataset.

4. **Task 4: Data Validation and Input Control** Students will define validation rules to restrict and control data entry for consistency and accuracy.

   (a) Select the `Grade` column and apply validation to accept only specific values: `A, B, C, D, F`.

   (b) Add input message: "Enter only valid grades (A–F)."

   (c) Create a numeric validation rule for `Marks` between 0 and 100.

   (d) For `Attendance`, restrict input to values between 0 and 100 with a warning alert.

   (e) Use a drop-down list for the `City` column containing predefined cities (e.g., Multan, Lahore, Karachi).

   (f) Test the validation by entering incorrect data and observing Excel's alert messages.

5. **Task 5: Conditional Formatting and Data Visualization** Students will apply conditional formatting to visualize patterns and trends within the dataset.

   (a) Highlight top 10% of students using conditional formatting rules.

   (b) Use a color scale (green–yellow–red) to represent performance levels based on marks.

   (c) Apply data bars to the `Attendance` column for quick visual comparison.

   (d) Add icon sets (, ,) to represent grades (A/B = , C = , D/F =).

   (e) Discuss how visual indicators improve decision-making in data analysis.

6. **Task 6: Data Cleaning and Error Handling** Students will practice cleaning inconsistent or incomplete data entries before performing analysis.

   (a) Identify and remove blank rows or duplicate records using `Data → Remove Duplicates`.

   (b) Use `TRIM` and `PROPER` functions to correct text formatting.

   (c) Apply `Find and Replace` to standardize values (e.g., "lahore" → "Lahore").

(d) Observe how cleaned and validated data improves reliability of filters and sorting.

Observation and Discussion

- Sorting arranges records logically for easier reading and reporting.
- Filters extract meaningful subsets of data for focused analysis.
- Validation rules prevent data entry errors and ensure dataset integrity.
- Conditional formatting enhances data interpretation visually.
- Data cleaning is an essential step before applying analytical or charting tools.

Data Management Workflow (TikZ Diagram)

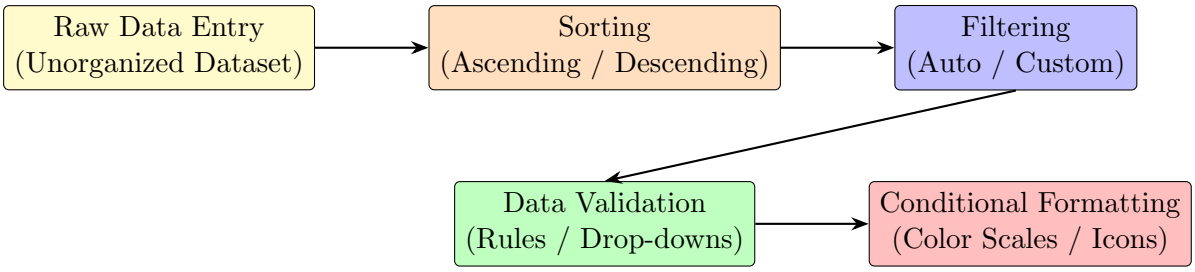


Figure: Data management workflow — from raw data entry to sorting, filtering, validation, and visual enhancement for clean analytical results.

Best Practices and Tips

- Always convert data ranges to tables before sorting or filtering.
- Avoid leaving blank rows or columns inside datasets.
- Use meaningful headers for easy identification during sorting.
- Validate all input fields to ensure numeric and categorical accuracy.
- Apply consistent formatting and capitalization across all records.
- Use `Clear All Filters` before saving or sharing the workbook.

Viva Questions

1. What happens to data order when you apply multiple-level sorting?
2. How can you clear all filters applied to a dataset?
3. Explain the difference between AutoFilter and Advanced Filter.
4. Why is data validation important in professional reports?
5. Give two examples where conditional formatting improves readability.
6. What is the significance of cleaning data before analysis?

9 Week 9: Charts and Data Visualization

Objective: To master the creation, customization, and interpretation of charts for effective data visualization using Microsoft Excel (or equivalent tools). Students will learn to choose appropriate chart types based on the nature of data, apply design principles for readability, and export charts for professional reporting. Emphasis is placed on both technical proficiency and the communication of insights through visual means.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Data Visualization Basics** Students will begin by learning the role of charts in data analysis, including how to select suitable visual formats for different data types.
   (a) Discuss the importance of visual representation for decision-making.
   (b) Identify chart types suitable for different data patterns: categorical, temporal, or percentage-based.
   (c) Review dataset types such as marks, monthly sales, or attendance records.

2. **Task 2: Preparing the Dataset** Before creating charts, the dataset must be structured properly.
   (a) Open the workbook `Lab8_YourName.xlsx` and create a new sheet named `Charts`.
   (b) Prepare sample data with columns like `Month, Sales, Profit, Expenses`.
   (c) Ensure numeric columns contain valid numbers and no blanks.
   (d) Convert the data range into a formatted table (`Ctrl + T`) for dynamic referencing.

3. **Task 3: Creating Basic Charts** Students will generate different types of charts and understand their use cases.
   (a) Create a Column Chart to represent `Sales per Month`.
   (b) Insert a Line Chart to visualize `Profit trends over time`.
   (c) Generate a Pie Chart showing percentage contribution of each month's profit to total profit.
   (d) Discuss why each chart type is suitable for a given dataset.

4. **Task 4: Customizing Charts** Students will modify chart elements to enhance readability and professionalism.
   (a) Add descriptive `Chart Titles` and `Axis Titles`.
   (b) Format the `Legend` and reposition it for clarity.
   (c) Add `Data Labels` and percentage values for pie charts.
   (d) Apply consistent `Color Schemes` using Excel's design templates.
   (e) Remove unnecessary gridlines to reduce visual clutter.
5. **Task 5: Advanced Chart Customization** Students will explore advanced visualization features and dual-axis charts.
   (a) Create a Combo Chart combining `Sales (Column)` and `Profit (Line)`.
   (b) Enable a `Secondary Axis` for comparing variables of different scales.
   (c) Insert `Trendlines` to show data progression.
   (d) Experiment with chart styles (flat, 3D, gradient) and discuss pros and cons.
6. **Task 6: Data Highlighting and Conditional Visualization** Students will use chart formatting to emphasize specific data insights.
   (a) Change color of the highest and lowest bars in a column chart.
   (b) Add markers to highlight peak values in a line chart.
   (c) Use `Insert → Shapes → Callouts` to annotate specific points.
   (d) Apply `Data Labels → Value from Cells` to display custom annotations.
7. **Task 7: Chart Placement and Printing** Students will practice managing chart locations and preparing for output.
   (a) Move chart to a new sheet (`Move Chart → New Sheet`).
   (b) Adjust chart dimensions for better visibility.
   (c) Set page orientation and scaling in `Page Layout → Print Area`.
   (d) Print or export the chart as PDF using `File → Save As → PDF`.
8. **Task 8: Integrating Charts with Reports** Students will insert charts into Word or PowerPoint for professional presentations.
   (a) Copy chart as an image and paste into a Word document.
   (b) Insert chart using `Insert → Chart` directly within Word.
   (c) Adjust text wrapping to "Square" for a clean layout.
   (d) Save and include in final lab report as `Lab9_Charts.docx`.

Details of Lab Experiment

1. Use the dataset prepared in Task 2.
2. Insert three charts:
   - **Column Chart:** Sales per Month.
   - **Pie Chart:** Percentage of Monthly Profit.
   - **Line Chart:** Expense Trend across the year.
3. Modify colors, titles, and data labels for clarity.
4. Add a legend and apply a background gradient.
5. Combine two series (Sales and Profit) in one chart with dual axes.
6. Save charts as images (`.png`) and embed them in a Word report.
7. Export final report as PDF for submission.

Observation and Interpretation

- Column charts clearly compare quantitative categories.
- Line charts are best suited for trends over time.
- Pie charts illustrate proportional relationships but can be misleading with too many categories.
- Combo charts provide multidimensional insights (e.g., profit vs sales).
- Chart aesthetics—color, scale, and simplicity—significantly affect interpretation accuracy.

Chart Creation Process (TikZ Illustration)

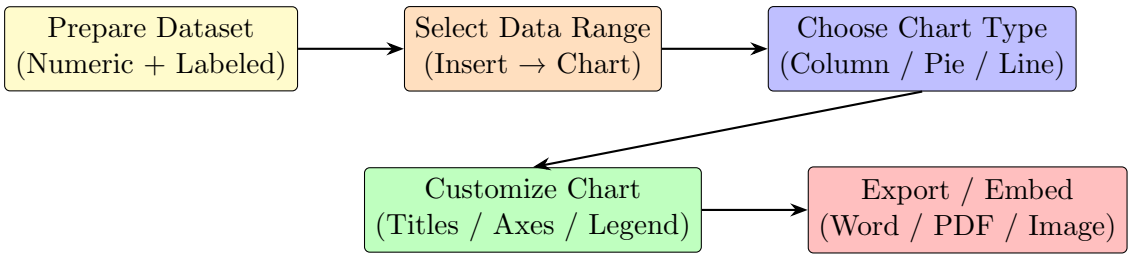


Figure: Workflow for creating and customizing charts — from preparing data to exporting visual reports.

Best Practices and Tips

- Use appropriate chart types for your data—avoid cluttered visuals.
- Limit pie charts to 5–6 categories for clarity.
- Always label axes and include units of measurement.
- Apply color consistently (avoid using too many random colors).
- Use chart titles that clearly describe the insight.
- Avoid unnecessary 3D effects; prioritize readability.

Viva Questions

1. What factors influence the choice of chart type?
2. How does Excel handle dual-axis charts and what are their advantages?
3. What is the purpose of a legend in data visualization?
4. Why can pie charts be misleading for data comparison?
5. What is a combo chart and when should you use it?
6. Explain how chart design affects data interpretation.
7. What are trendlines used for and how do you add them?
8. How can charts be exported and reused in reports or presentations?

10 Week 10: Spreadsheet Printing, Page Setup and Templates

Objective: To gain proficiency in preparing spreadsheets for professional presentation and printing. Students will learn how to define print areas, manage page layouts, add headers and footers, apply scaling, and use templates to maintain consistent report formatting. Emphasis is placed on document aesthetics, efficient pagination, and reusable design patterns for recurring tasks such as mark sheets, attendance registers, and invoices.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Print Layout Fundamentals** Students will explore how Excel converts a worksheet into a printable page.
   (a) Discuss the difference between the "Normal" and "Page Layout" views.
   (b) Identify non-printing elements such as gridlines and formula bars.
   (c) Learn about page boundaries and print margins.
2. **Task 2: Setting Up Print Areas** Students will define the specific region of the worksheet to print.
   (a) Open the marks or ledger sheet created in previous labs.
   (b) Select the main data range and choose `Page Layout → Print Area → Set Print Area`.
   (c) Verify print boundaries using `File → Print Preview`.
   (d) Clear and redefine print areas as needed.
3. **Task 3: Page Orientation, Scaling and Margins** Students will control how content fits into a page.
   (a) Change orientation between `Portrait` and `Landscape` modes.
   (b) Set scaling to "Fit All Columns on One Page."
   (c) Adjust top, bottom, left, and right margins for balanced white space.
   (d) Preview and ensure that all content is visible without truncation.
4. **Task 4: Inserting Headers and Footers** Students will design professional printed reports.

(a) Add a header containing `Institute Name, Department, and Lab Title`.

(b) Insert a footer with `Page Number` and `Date Printed`.

(c) Center align the header text and ensure readability.

(d) Include a logo or watermark (optional) in the header section.

5. **Task 5: Managing Page Breaks and Print Titles** Students will learn pagination control for large datasets.

   (a) Switch to `Page Break Preview` mode.

   (b) Move or insert manual page breaks to prevent table rows from splitting.

   (c) Set repeating rows as `Print Titles` (e.g., column headers on every page).

   (d) Adjust scaling to print cleanly on A4 sheets.

6. **Task 6: Creating Custom Templates** Students will design templates for repetitive tasks.

   (a) Open a formatted marks sheet and remove student-specific data.

   (b) Keep formulas, formatting, and headers intact.

   (c) Save the file as `Excel Template (*.xltx)` with the name `MarksTemplate.xltx`.

   (d) Locate the saved template in the Excel templates directory.

   (e) Open a new workbook from this template and verify that design elements persist.

7. **Task 7: Printing and PDF Export** Students will finalize and export professional reports.

   (a) Use `File → Print` to preview the final layout.

   (b) Adjust scaling options to fit the table within a single page width.

   (c) Use "Custom Scaling Options" to optimize layout.

   (d) Save the worksheet as PDF using `File → Save As → PDF`.

   (e) Print a sample copy on paper for submission.

8. **Task 8: Audit and Quality Check** Before submission, students will verify document quality.

   (a) Confirm correct margins, orientation, and page numbering.

   (b) Ensure headers and footers are consistent across all pages.

   (c) Review spacing, gridline visibility, and color contrasts.

   (d) Save both the Excel and exported PDF files in the `Lab10` folder.

Details of Lab Experiment

1. Open the file `Lab9_Charts.xlsx` or your marks sheet.
2. Go to `Page Layout → Print Area → Set Print Area` and select your table region.
3. Insert a header with "NFC IET Multan – Department of Computer Science."
4. Add footer elements:
   - Left section: `Lab 10: Printing and Templates`
   - Center section: `Page Number`
   - Right section: `Date Printed`
5. Adjust orientation to landscape and scale the sheet to one page width.
6. Switch to `Page Break Preview` and verify that no rows are split.
7. Define print titles to repeat column headers on every printed page.
8. Save your file as `MarksTemplate.xltx`.
9. Export a sample page as PDF and print for review.

Spreadsheet Print Setup Workflow (TikZ Illustration)

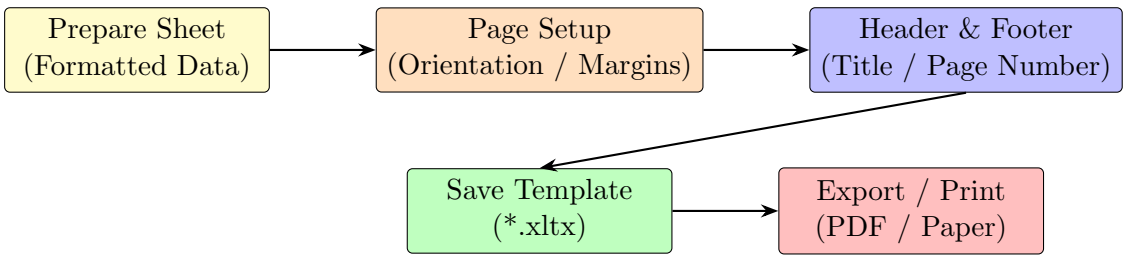


Figure: Workflow for preparing and printing formatted spreadsheets — from layout setup to reusable templates and final output.

Best Practices and Common Mistakes

Best Practices:

- Always preview before printing to save paper and ink.
- Use consistent fonts and alignments for professional appearance.

- Keep margins balanced and data centered on the page.
- Store templates for recurring reports (e.g., attendance sheets, marks records).

Common Mistakes:

- Printing without setting a print area, causing extra blank pages.
- Forgetting to repeat header rows across pages.
- Using inconsistent scaling that distorts data readability.
- Saving templates as normal workbooks instead of `.xltx`.

Viva Questions

1. What is the difference between "Fit Sheet on One Page" and "Fit All Columns on One Page"?
2. Why is it recommended to use headers and footers in printed reports?
3. Where are Excel templates stored and how can you reuse them?
4. How do print titles improve readability in multi-page documents?
5. Describe the process of inserting manual page breaks.
6. What precautions should be taken when scaling worksheets for printing?

11 Week 11: Creating Slide Presentations (Microsoft PowerPoint)

Objective: To develop professional presentation design and delivery skills using Microsoft PowerPoint (or equivalent tools). Students will learn to create structured slides, apply design templates, manage layouts and Slide Masters, integrate multimedia elements, and use transitions and animations effectively. Emphasis is placed on producing visually appealing, concise, and professional slides suitable for academic or technical presentations.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding PowerPoint Interface** Students will familiarize themselves with PowerPoint's workspace.
   (a) Explore tabs such as `Home`, `Insert`, `Design`, `Transitions`, and `View`.
   (b) Identify the purpose of `Slides Pane`, `Notes Pane`, and `Ribbon`.
   (c) Examine different `View Modes`: Normal, Slide Sorter, Reading View, and Presenter View.

2. **Task 2: Creating a Basic Slide Deck** Students will learn to construct a complete presentation.
   (a) Open PowerPoint and create a new blank presentation.
   (b) Save as `Lab11_YourName.pptx`.
   (c) Create six slides in total:
   - Slide 1 – Title Slide (Topic and Student Information)
   - Slide 2 – Outline or Agenda
   - Slides 3–5 – Main Content (with images, bullet points, charts)
   - Slide 6 – Conclusion and Contact Info

3. **Task 3: Applying Themes and Layouts** Students will apply professional visual design and slide consistency.
   (a) Apply a pre-defined `Theme` (e.g., Office, Gallery, Retrospect).
   (b) Explore `Variants` to modify color schemes and fonts.
   (c) Change slide layout types such as `Title and Content`, `Two Content`, or `Comparison`.
   (d) Use `Format Background` to set solid, gradient, or image fills.

4. **Task 4: Working with Slide Master** Students will design a consistent format across all slides.
   (a) Access `View → Slide Master`.
   (b) Add footer placeholders for `Student Name`, `Slide Number`, and `Institute Name`.
   (c) Apply logo or header image on the master slide.
   (d) Close Master View and verify that all slides follow the same layout.

5. **Task 5: Inserting Multimedia and Visual Elements** Students will enhance slides with multimedia for visual clarity.
   (a) Insert relevant images, icons, and screenshots.
   (b) Add a SmartArt diagram to summarize information visually.
   (c) Insert shapes (arrows, rectangles, circles) and apply color styles.
   (d) Add a short video or sound clip (optional).

6. **Task 6: Using Transitions, Animations and Notes** Students will improve presentation flow and practice delivery.
   (a) Apply slide transitions such as `Fade` or `Push`.
   (b) Animate bullet points or objects for sequential appearance.
   (c) Add speaker notes under each slide to aid presentation.
   (d) Use `Slide Show → Rehearse Timings` to test timing.

7. **Task 7: Collaboration and Review Tools** Students will learn to collaborate on shared presentations.
   (a) Add comments for peer review.
   (b) Use the `Compare` feature to merge edits from another version.
   (c) Save a copy to OneDrive or shared folder for group access.

8. **Task 8: Printing and Exporting the Presentation** Students will finalize their slides for different distribution formats.
   (a) Use `File → Export → Create Handouts` for printed notes.
   (b) Save presentation as `PDF` for submission.
   (c) Export as `Video (MP4)` with slide timings.
   (d) Review the presentation using `Presenter View`.

Details of Lab Experiment

1. Create a new PowerPoint presentation and save as `Lab11_YourName.pptx`.
2. Add six slides: Title, Outline, three Content slides, and a Conclusion.
3. Apply a professional design theme and format background as gradient.
4. Use Slide Master to insert a footer with your name and slide number.
5. Add speaker notes explaining each slide's key message.
6. Insert at least one SmartArt diagram and one image.
7. Apply transitions (Fade) and simple entrance animations.
8. Rehearse slide timings and enable "Auto-play" for a continuous presentation.
9. Export the file as PDF and print in Handout format (3 slides per page).

PowerPoint Workflow (TikZ Illustration)

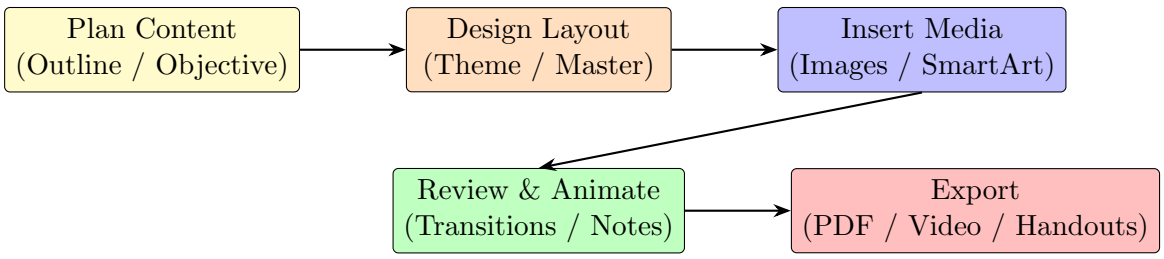


Figure: Workflow for creating a professional PowerPoint presentation — from content planning to design, review, and export.

Best Practices for Slide Design

- Keep each slide simple — one main idea per slide.
- Use high-contrast color schemes (light text on dark background or vice versa).
- Limit bullet points to 4–6 per slide.
- Maintain consistent fonts and alignment throughout.

- Use visuals (charts, images, SmartArt) to replace long text.
- Avoid overuse of animations and sound effects.
- Practice presenting — slides should support, not replace, the speaker.

Viva Questions

1. What is the difference between Slide Layout and Slide Master?
2. How do themes ensure consistency in a presentation?
3. What are speaker notes and how are they useful?
4. How can you add animations and transitions to slides?
5. What are the best practices for choosing fonts and colors in slides?
6. Explain the process of exporting slides as a video or PDF.
7. What precautions should be taken when adding multimedia content?

12 Week 12: Tables and Charts in Presentations

Objective: To develop proficiency in integrating tabular and graphical data into PowerPoint presentations. Students will learn to insert, format, and manage tables and charts, as well as to link Excel data dynamically with slides. Emphasis is placed on readability, clarity, and the visual communication of data-driven insights during presentations.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Data Presentation Principles** Students will explore the importance of visualizing quantitative data effectively in PowerPoint.
   (a) Identify the key differences between tables and charts.
   (b) Discuss when to use charts instead of raw data tables.
   (c) Analyze how font size, color, and slide layout impact readability.
2. **Task 2: Creating Tables within PowerPoint** Students will learn to design and format presentation-ready tables.
   (a) Insert a table using `Insert → Table`.
   (b) Create a table with columns: `Name, Marks, Grade, Remarks`.
   (c) Apply pre-defined `Table Styles` for color and borders.
   (d) Align text centrally and adjust cell spacing for clarity.
   (e) Use shading or alternate row colors for improved contrast.
3. **Task 3: Importing Charts from Excel** Students will import and link visual data created in Excel.
   (a) Open your `Lab9_Charts.xlsx` file and copy a chart (e.g., Sales or Marks).
   (b) In PowerPoint, use `Paste → Paste Special → Link to Excel Chart`.
   (c) Verify the dynamic link by changing a value in Excel and refreshing PowerPoint.
   (d) Adjust chart size and position to maintain slide balance.
4. **Task 4: Creating Charts Directly in PowerPoint** Students will generate and edit charts within PowerPoint without external files.

(a) Go to `Insert → Chart` and select `Column, Line, or Pie`.

(b) Enter sample data in the embedded Excel grid.

(c) Format axes, titles, and legends for readability.

(d) Apply a uniform color scheme for consistency with presentation theme.

5. **Task 5: Enhancing Visual Design of Tables and Charts** Students will apply advanced formatting for a professional look.

   (a) Adjust chart elements such as gridlines, borders, and data labels.

   (b) Use animations to introduce charts and tables step-by-step.

   (c) Emphasize key data points using color or bold labels.

   (d) Ensure charts remain readable when projected on large screens.

6. **Task 6: Maintaining Data Linkage and Updates** Students will explore how linked charts update automatically.

   (a) Reopen linked PowerPoint and Excel files simultaneously.

   (b) Modify Excel data (e.g., update a mark or percentage).

   (c) Observe automatic update in PowerPoint charts after refresh.

   (d) Discuss benefits and risks of using linked vs. embedded objects.

7. **Task 7: Designing Comparative and Analytical Slides** Students will create data-driven slides with both tables and charts.

   (a) Combine a table and a chart on a single slide.

   (b) Align both objects symmetrically using `Format → Align`.

   (c) Add a descriptive caption under each visual element.

   (d) Use animations to reveal each visual element progressively.

8. **Task 8: Exporting and Printing Data Slides** Students will finalize data presentation slides for distribution.

   (a) Use `File → Export → Create Handouts` to print tables and charts.

   (b) Save presentation as `Lab12_DataSlides.pptx` and also export to PDF.

   (c) Check that linked charts remain visible in exported format.

   (d) Submit both PowerPoint and PDF versions for review.

Details of Lab Experiment

1. Create a new PowerPoint file titled `Lab12_YourName.pptx`.
2. Insert a table showing students' marks, grades, and percentages.
3. Format table headers with bold text and shading.
4. Import a bar or pie chart from Excel showing "Overall Grade Distribution."
5. Link the chart to the Excel data source (`Paste → Link`).
6. Adjust font size and color for projector-friendly readability.
7. Add chart title and legend for context clarity.
8. Save and export the slide as PDF for submission.

Data Visualization Workflow (TikZ Illustration)

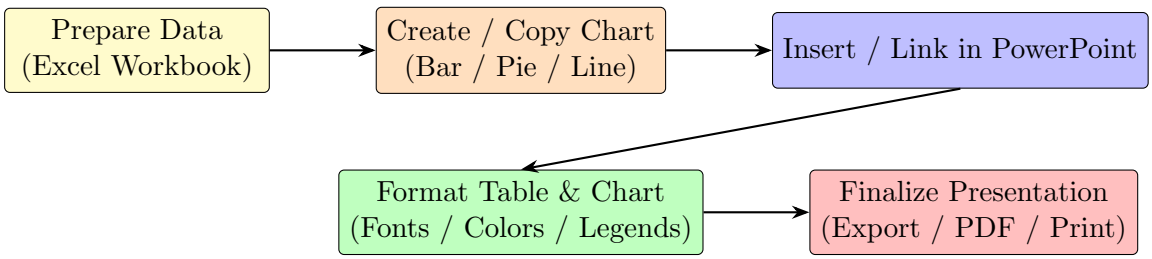


Figure: Workflow for integrating Excel data and charts into PowerPoint slides for professional data presentation.

Best Practices for Presenting Data in Slides

- Simplify tables — avoid more than 5–6 rows per slide.
- Increase font size for readability on projector screens.
- Label axes and provide meaningful chart titles.
- Use contrasting colors but maintain consistency with theme.
- Avoid 3D effects that distort data interpretation.
- Ensure linked data sources are accessible during presentations.
- Keep tables and charts aligned symmetrically for a clean look.

Viva Questions

1. What is the difference between embedding and linking Excel charts in PowerPoint?
2. How can you ensure a chart remains readable during a live presentation?
3. When should you use a table instead of a chart?
4. Explain how updates in Excel reflect automatically in PowerPoint.
5. What are the benefits of handout layouts for data presentations?
6. How do you export slides containing tables and charts to PDF with notes?
7. Why is color choice critical in data visualization?

13 Week 13: Advanced Presentation Techniques (Transitions, Animations, and Slide Design)

Objective: To develop advanced PowerPoint design and delivery skills by applying animations, transitions, and visual consistency across slides. Students will learn to use Slide Master for global design control, manage object-level animations, and apply custom transitions to enhance audience engagement. Emphasis will be placed on professional presentation flow, non-distracting motion, and effective timing.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Visual Hierarchy and Consistency**
   (a) Review examples of well-structured presentations.
   (b) Identify the use of consistent colors, fonts, and layout alignment.
   (c) Adjust slide master elements to ensure uniform title and footer placement.
2. **Task 2: Working with Slide Master and Themes**
   (a) Open a new presentation and navigate to `View → Slide Master`.
   (b) Apply an institutional theme or custom color palette.
   (c) Add a footer with student name and course title.
   (d) Save the custom master as a new template (`ICT_Master.potx`).
3. **Task 3: Applying Slide Transitions**
   (a) Apply transitions (e.g., Fade, Push, Wipe) to selected slides.
   (b) Modify transition speed and sound effects.
   (c) Use `Apply to All` for uniform transitions across slides.
   (d) Test presentation flow using `Slide Show → From Beginning`.
4. **Task 4: Creating Object Animations**
   (a) Select key text or image elements and apply `Entrance Animations`.
   (b) Use `Animation Pane` to control sequence and timing.
   (c) Combine `Entrance`, `Emphasis`, and `Exit` effects logically.
   (d) Avoid overuse of animations that distract from content.
5. **Task 5: Designing Dynamic Slide Sequences**

(a) Insert an infographic or process diagram slide.

(b) Animate each part step-by-step to create storytelling flow.

(c) Use `Appear` or `Fade` effects for smooth visual transitions.

6. **Task 6: Timing and Rehearsal**

   (a) Use `Rehearse Timings` to practice pacing.

   (b) Adjust slide durations automatically for auto-run mode.

   (c) Enable `Use Timings` for automated presentation playback.

7. **Task 7: Export and Presentation Delivery**

   (a) Save final presentation as `Lab13_YourName.pptx`.

   (b) Export presentation as `MP4 Video` using `File → Export → Create a Video`.

   (c) Review playback for timing and animation correctness.

Details of Lab Experiment

1. Open PowerPoint and create a new file titled `Lab13_YourName.pptx`.
2. Insert 6 slides: Title, Objectives, Content 1, Content 2, Summary, and Thank You.
3. Apply consistent design using Slide Master and a professional theme.
4. Add Fade transitions to all slides and customize duration to 1.5 seconds.
5. Apply animations to bullet points (Appear, Fly In).
6. Sequence animations using the Animation Pane.
7. Rehearse timing and preview transitions in Slide Show mode.
8. Save and export the presentation as a video file for evaluation.

Workflow for Slide Animation and Transition Design (TikZ Illustration)

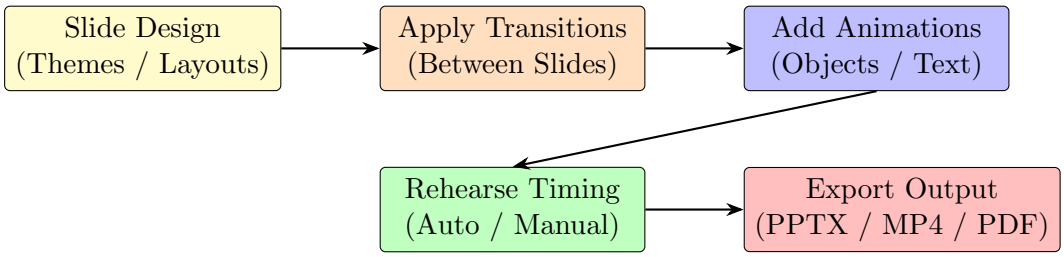


Figure: Workflow illustrating the process of slide design, transitions, and animations for creating professional and engaging presentations.

Best Practices for Professional Slide Animation

- Use consistent transitions throughout the presentation.
- Limit animation types — simple is often more effective.
- Ensure all animations support the message (not distract).
- Maintain visual contrast between text and background.
- Rehearse with animations to check timing and flow.
- Avoid using sound effects unless contextually justified.
- Preview presentation on projector for real-world readability.

Viva Questions

1. What is the difference between transition and animation?
2. How does Slide Master simplify consistent formatting?
3. Why should transition speed and animation timing be controlled carefully?
4. How can animations be sequenced logically in PowerPoint?
5. Explain how to convert a PowerPoint presentation into a video file.
6. What are common mistakes in overusing transitions and animations?

14 Week 14: Multimedia Integration in Presentations (Audio, Video, Hyperlinks, and Embedding Media)

Objective: To enable students to create interactive and engaging presentations by embedding multimedia elements such as audio, video, and hyperlinks. Students will learn how to insert, format, and control playback of media files, as well as integrate hyperlinks and action buttons for dynamic navigation. The objective is to enhance presentation interactivity and visual appeal using multimedia techniques.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Multimedia in Presentations**
   (a) Discuss how multimedia (audio, video, hyperlinks) enhances audience engagement.
   (b) Identify supported media file formats in PowerPoint (`.mp3, .wav, .mp4, .wmv`).
   (c) Explain the difference between embedding and linking multimedia files.
2. **Task 2: Inserting and Formatting Images**
   (a) Insert an image using `Insert → Pictures`.
   (b) Resize and position the image for balance.
   (c) Apply picture effects such as reflection, glow, and border.
   (d) Add alt text for accessibility and clarity.
3. **Task 3: Adding and Controlling Audio Clips**
   (a) Insert an audio clip using `Insert → Audio → Audio on My PC`.
   (b) Set playback options: `Play Automatically` or `On Click`.
   (c) Trim audio to play only the required section.
   (d) Add fade-in and fade-out effects for smoother transitions.
4. **Task 4: Inserting and Editing Videos**
   (a) Insert a video using `Insert → Video → This Device`.
   (b) Resize the video frame proportionally to fit within the slide layout.

(c) Apply poster frame and shadow effects for better visual presentation.

(d) Configure playback: loop, mute, or play full screen.

5. **Task 5: Using Hyperlinks and Action Buttons**

   (a) Insert a hyperlink to a website, document, or email address.

   (b) Add an action button that links to another slide or external file.

   (c) Customize button shapes, colors, and hover effects.

   (d) Test inter-slide navigation during Slide Show mode.

6. **Task 6: Embedding External Media and Objects**

   (a) Embed an Excel chart using `Insert → Object → Create from File`.

   (b) Link a Word document for reference.

   (c) Test the linked objects to ensure accessibility.

   (d) Discuss pros and cons of embedded vs linked media.

7. **Task 7: Designing Interactive Multimedia Slides**

   (a) Combine text, image, audio, and video on a single slide.

   (b) Add animation triggers to start media on specific clicks.

   (c) Use `Animation Pane` to manage playback order.

   (d) Preview the slide to test interactivity.

8. **Task 8: Exporting and Testing Multimedia Presentations**

   (a) Save the file as `Lab14_YourName.pptx`.

   (b) Export as `MP4 Video` and test playback quality.

   (c) Check compatibility on a different computer.

   (d) Compress media using `File → Info → Compress Media`.

Details of Lab Experiment

1. Create a new PowerPoint file named `Lab14_YourName.pptx`.
2. Add a title slide titled `"Power of Multimedia in Presentations"`.
3. Insert an image and apply formatting effects.
4. Embed an audio narration for the introduction slide.

5. Insert a short video clip (15–20 seconds) explaining a topic of your choice.
6. Add a hyperlink to an educational website (e.g., `https://www.khanacademy.org`).
7. Insert an action button to jump from Slide 2 to Slide 4.
8. Export the completed presentation as a video file and test all media components.

Multimedia Integration Workflow (TikZ Illustration)

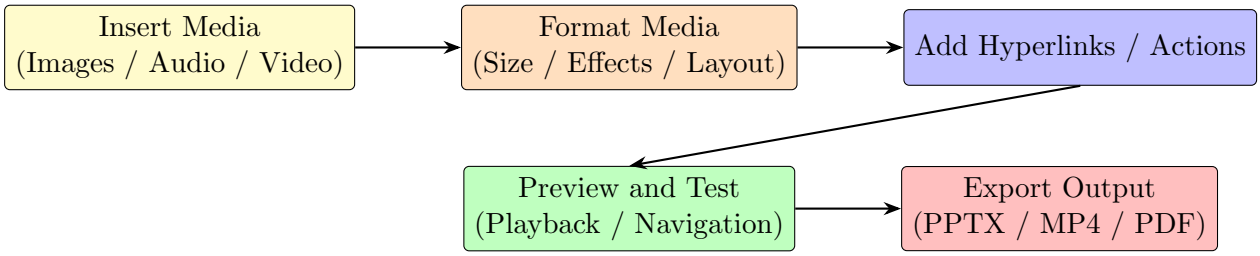


Figure: Workflow showing the integration of multimedia (audio, video, hyperlinks) into PowerPoint presentations.

Best Practices for Multimedia Integration

- Use high-quality images and audio for professional results.
- Keep file sizes reasonable to prevent playback delays.
- Avoid autoplay audio on every slide — use manual triggers.
- Maintain consistent volume levels across audio clips.
- Compress video files before embedding.
- Test hyperlinks and media paths on different systems.
- Always carry all linked media files when transferring presentations.

Viva Questions

1. What are the advantages of using multimedia in presentations?
2. Differentiate between embedded and linked multimedia.
3. How can you control audio and video playback settings?

4. What is the role of hyperlinks and action buttons in interactive presentations?
5. What are common file formats supported for video and audio in PowerPoint?
6. Why is testing on different systems important before final presentation?

15 Week 15: Internet Basics, Web Browsing, and Online Research Skills

Objective: To introduce students to the fundamentals of Internet usage, including understanding URLs, domains, and web browsers. Students will learn effective browsing, search engine optimization techniques, downloading information responsibly, and evaluating the credibility of online sources. Emphasis is on practical digital literacy and research competence for academic and professional contexts.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Understanding Internet Concepts** Students will develop a conceptual understanding of Internet architecture and communication.
   (a) Define Internet, intranet, and World Wide Web (WWW).
   (b) Identify components: browser, search engine, URL, IP address, domain name.
   (c) Discuss protocols such as `HTTP`, `HTTPS`, `FTP`, and `SMTP`.
2. **Task 2: Exploring Web Browsers** Students will learn to use modern browsers effectively.
   (a) Open and navigate web browsers (Chrome, Edge, Firefox).
   (b) Explore tabs, bookmarks, and download managers.
   (c) Adjust browser settings such as home page and privacy options.
   (d) Clear browsing data (cache, cookies, history).
3. **Task 3: Conducting Effective Online Searches** Students will use search engines for academic and technical research.
   (a) Perform keyword-based searches on Google and Bing.
   (b) Use advanced operators: `\"` for exact phrases, `site:`, `filetype:`, and `-` for exclusions.
   (c) Practice searching for ICT-related research papers or tutorials.
   (d) Evaluate relevance and credibility of search results.
4. **Task 4: Downloading and Managing Online Resources** Students will practice responsible downloading.
   (a) Download a PDF article and store it in a designated folder.

(b) Rename and organize files using meaningful naming conventions.

(c) Understand copyright and fair-use rules for academic content.

(d) Discuss safe downloading practices (avoiding malware and ads).

5. **Task 5: Evaluating Online Information Sources** Students will learn how to identify credible and authentic web resources.

   (a) Compare information from .edu, .gov, and .com domains.

   (b) Check author credentials and publication dates.

   (c) Identify indicators of fake or unreliable websites.

   (d) Use plagiarism-checking tools or paraphrasing aids ethically.

6. **Task 6: Using Online Productivity Tools** Students will explore useful Internet-based platforms for collaboration.

   (a) Create a Google account (if not already existing).

   (b) Access Google Drive, Docs, and Sheets online.

   (c) Share a file using a public or restricted link.

   (d) Understand cloud storage limits and sharing permissions.

7. **Task 7: Practicing Safe and Secure Browsing** Students will learn essential online safety techniques.

   (a) Identify phishing websites and unsafe downloads.

   (b) Verify secure websites via HTTPS and padlock symbol.

   (c) Avoid sharing personal information on untrusted sites.

   (d) Enable browser security extensions and use strong passwords.

Details of Lab Experiment

1. Open Google Chrome and navigate to `www.google.com`.
2. Search for "Applications of ICT in Smart Grids."
3. Use advanced operators like `filetype:pdf` and `site:edu`.
4. Bookmark three useful resources and organize them in a "Research" folder.
5. Visit a government (.gov) and educational (.edu) website; note their structure and reliability.
6. Download a PDF article, rename it, and store it under `C:\ICT\Week15`.

7. Access Google Drive and upload the article; share it with the instructor via link.

8. Test safe browsing by identifying secure and insecure websites.

Internet Research Workflow (TikZ Illustration)

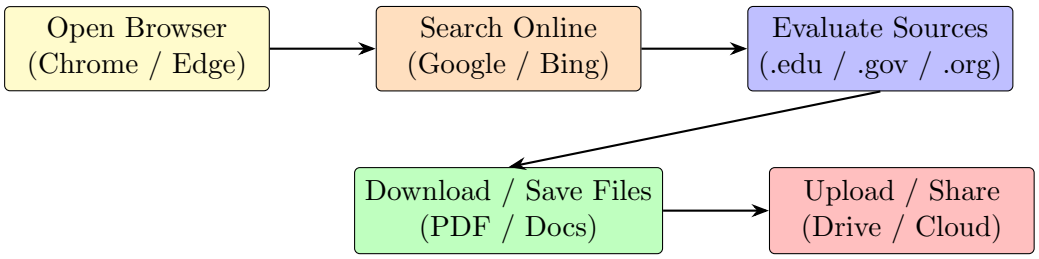


Figure: Workflow illustrating the stages of Internet research and online information management.

Best Practices for Online Research and Browsing

- Use specific and meaningful keywords for efficient searching.
- Always verify the authenticity and source of information.
- Keep your browser updated for better security and performance.
- Avoid downloading files from unknown or suspicious websites.
- Bookmark frequently used research websites for easy access.
- Respect copyright laws when downloading or citing online content.
- Use incognito or private browsing for sensitive searches.

Viva Questions

1. What is the difference between the Internet and the World Wide Web?

2. Explain the purpose of search engine operators like `site:` and `filetype:`.

3. How can you check if a website is secure?

4. Why is evaluating online sources important for research?

5. What are the advantages of using cloud storage like Google Drive?

6. How does HTTPS differ from HTTP in terms of data security?
7. What precautions should you take when downloading files from the Internet?

16 Week 16: Email Communication and Cloud-Based Collaboration

Objective: To develop proficiency in professional email communication and the use of cloud-based tools for collaboration. Students will learn to create and manage email accounts, compose formal emails with attachments, use cloud storage platforms (e.g., Google Drive, OneDrive), and collaborate in real time on shared documents. Emphasis is placed on netiquette, productivity, and digital collaboration ethics in academic and professional environments.

Tasks (Comprehensive Practical Objectives)

1. **Task 1: Creating and Managing Email Accounts** Students will learn to create and configure an email account using Gmail or an institutional mail service.
   (a) Create a Gmail account (if not already available).
   (b) Explore inbox, sent mail, drafts, spam, and trash folders.
   (c) Customize settings such as signature, profile picture, and labels.
   (d) Enable two-step verification for account security.
2. **Task 2: Composing and Formatting Professional Emails** Students will compose structured and formal email messages suitable for academic and workplace communication.
   (a) Compose an email to your instructor with the subject "ICT Lab Assignment Submission."
   (b) Use a proper greeting, introduction, body, and closing.
   (c) Attach a file and use `Cc` and `Bcc` fields appropriately.
   (d) Format text using bold, italics, and bullet points to emphasize key details.
3. **Task 3: Understanding Email Etiquette (Netiquette)** Students will learn the principles of professional email conduct.
   (a) Use concise, respectful, and grammatically correct language.
   (b) Avoid using all caps, slang, or emojis in formal communication.
   (c) Write descriptive subject lines that reflect message purpose.
   (d) Proofread emails before sending and respond promptly to important messages.

4. **Task 4: Working with Attachments and File Management** Students will practice sending, receiving, and organizing attachments securely.
   (a) Attach a document, image, or spreadsheet to an outgoing email.
   (b) Download an attachment safely and organize it in a dedicated folder.
   (c) Understand attachment size limits and use cloud links for large files.
   (d) Compress files into ZIP format before uploading.
5. **Task 5: Cloud Storage and File Sharing** Students will use cloud storage platforms for backup and collaboration.
   (a) Log in to Google Drive or OneDrive.
   (b) Create folders named "ICT Lab" and "Assignments."
   (c) Upload a few documents and share one file with the instructor via link.
   (d) Set permissions: `Viewer`, `Commenter`, or `Editor`.
6. **Task 6: Real-Time Document Collaboration** Students will collaborate on a shared document using online editing tools.
   (a) Create a Google Docs file titled "Group Presentation Notes."
   (b) Share with classmates using `Editor` access.
   (c) Observe real-time typing and comments.
   (d) Track document changes using version history.
7. **Task 7: Cloud Integration with Desktop Applications** Students will link online documents with local applications.
   (a) Install Google Drive or OneDrive desktop client.
   (b) Sync local folder with cloud storage.
   (c) Demonstrate automatic backup and restore.
   (d) Discuss the benefits and challenges of cloud synchronization.
8. **Task 8: Collaborative Project Submission via Cloud** Students will simulate an academic group submission process.
   (a) Collaborate on a shared Google Sheet summarizing group attendance.
   (b) Insert comments, tag team members using "@Name."

(c) Generate a shared link for submission and restrict access after deadline.

(d) Submit the final shared link via email to the instructor.

Details of Lab Experiment

1. Log into your Gmail account and compose a formal message addressed to the lab instructor.
2. Attach your Week 15 PDF report and include a short message body summarizing your submission.
3. Create a shared folder on Google Drive titled `ICT_FinalProject`.
4. Upload all lab assignments to this folder and share with your instructor (Editor access).
5. Collaborate with classmates by editing a shared Google Docs report simultaneously.
6. Insert a table, image, and hyperlink within the shared document.
7. Observe revision history to track contributions.
8. Submit your group's final collaborative document via shared link and confirmation email.

Email and Cloud Collaboration Workflow (TikZ Illustration)

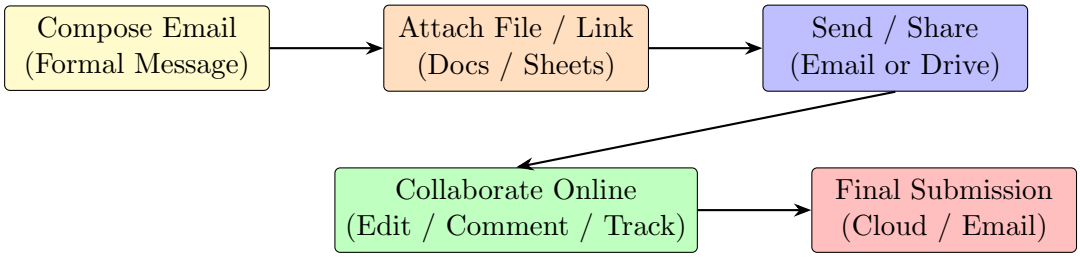


Figure: Workflow for composing, sharing, and collaborating through email and cloud-based tools in ICT environments.

Best Practices for Email and Cloud Collaboration

- Always use clear and professional subject lines.
- Attachments should be properly named (e.g., `LabReport_Name.pdf`).
- Avoid large attachments—share links instead.
- Check permissions before sharing documents.
- Regularly back up important data to cloud storage.
- Maintain digital etiquette: reply promptly and courteously.
- Keep collaboration transparent using comments and revision history.
- Log out from shared computers to protect privacy.

Viva Questions

1. What are the key differences between `Cc` and `Bcc` in emails?
2. How can you verify if a shared file is view-only or editable?
3. Explain the benefits of using cloud storage over local storage.
4. What is version history, and why is it important in collaborative editing?
5. Describe common security measures for protecting email accounts.
6. What are the ethical considerations when sharing documents online?
7. Why is maintaining professionalism in email communication essential in academia and industry?