

Fundamentals of

Information Communication Technology

for secondary schools

NEW EDITION

BY

Emmanuel Gidudu

© Copyright 2025

All rights reserved. No reproduction, copy or transmission of this publication in any form should be done without written permission from the copy right owner. No paragraphs of this publication may be reproduced, copied or transmitted without the written permission or in accordance with the provision of the copyright, designs and patents Act or under the terms of license. Any person who does any unauthorized act in relation to this publication may be liable to criminal prosecution and civil claims for damages.

Acknowledgement

The author would like to extend his special thanks to the following people for their valuable advice, encouragement and support towards development of this book:

My family members who have offered support in their prayers, through the grace of God it has been sufficient to bring this book to life.

Gratitude to all people who have offered me support in different ways, and gratitude to all my administrator whom I have worked with in the past years. Gratitude to all spiritual leaders, thanks for all the spiritual support you offered.

About the Author

The author pursued a bachelor of science in education from Islamic university in Uganda where he majored in **ICT**. He has got knowledge and experience in various **ICT** fields such as website development, software development and User Interface design. He has various applications developed using Visual Basic for Applications (VBA) programming languages. These include the lower secondary competence based curriculum marks entry and report card generation, Advanced level marks entry and report card system, data analysis application for analyzing UCE UNEB examination results, library management system, school fees management system, inventory management system, and many other applications. These were developed in Microsoft Excel, and with high knowledge and expertise in using Excel, this book is made of a very large explanation of Excel with advanced functions. Find more information from his website:

SUB-ICT NOTES S.5 Term 1

TOPIC 1: Introduction to ICTs (28 Periods)

TOPIC COMPETENCY:

The learner operates a variety of ICTs to perform tasks in the day-to-day life

1. Definition and Importance of ICT

- Key Concepts:

- **ICT** as a tool for communication, data management, and problem-solving.
- Applications in education, business, healthcare, and governance.

Define ICT

ICT is the short form of (Information communication technology).

ICT (Information communication technology) today us a transformative force driving global connectivity, innovation, and digital transformation. It encompasses integrated technologies like the internet, clod computing, artificial intelligence (AI), IoT (Internet of Things), 5G networks and blockchain, enabling real-time communication, data sharing, and automation across industries.

ICT (Information communication technology) in this modern society is the engine behind remote work, e-commerce, telemedicine, smart cities, and digital governance.

Innovations such as cutting edge computing, quantum computing, and generative AI are pushing boundaries in speed, efficiency, and problem solving techniques.

However, challenges like cyber threats, digital divide, data privacy concerns, and ethical implications of AI remain critical issues in this era. **ICT** continues to reshape sectors like economics, agriculture, health care, security, education, and social interactions, emphasizing sustainability, inclusivity, and resilience in an increasingly interconnected world.

Importance of ICT in society today

Information and Communication Technology (ICT) is the backbone of modern society, driving efficiency, innovation, and connectivity across all sectors. It enables rapid access to information, automates processes, and bridges geographical gaps, transforming how people live, work, and interact.

1.2 Impact of ICT on Society

- Key Concepts:

- Economic growth, improved communication, and access to information.
- Digital divide, job displacement, and environmental concerns.

Key Areas of Impact

1. Education

- Example: E-learning platforms like Coursera or Khan Academy use ICT to democratize education, offering global access to courses. Virtual classrooms (e.g., Zoom, Google Classroom) became essential during the COVID-19 pandemic, ensuring continuity in learning.
- Impact: Reduces educational disparities and supports lifelong learning.

2. Healthcare

- Example: Telemedicine (e.g., platforms like Teladoc) allows remote consultations, while AI-driven tools (e.g., IBM Watson) assist in diagnosing diseases. Electronic Health Records (EHRs) streamline patient data sharing.
- Impact: Improves access to care, especially in rural areas, and enhances treatment accuracy.

3. Economy

- Example: E-commerce giants like Amazon and digital payment systems (e.g., PayPal, M-Pesa) rely on ICT for seamless transactions. Blockchain technology secures supply chains and financial systems.
- Impact: Boosts global trade, creates jobs, and enables small businesses to reach wider markets.

4. Governance

- Example: Digital governance tools like India's Aadhaar (biometric ID system) or Estonia's e-residency program streamline public services. Online tax filing and voting systems increase civic participation.
- Impact: Enhances transparency, reduces bureaucracy, and combats corruption.

5. Social Interaction

- Example: Social media (e.g., Facebook, WhatsApp) and video conferencing tools connect people globally. Platforms like LinkedIn foster professional networking.
- Impact: Strengthens relationships, drives social movements (#BlackLivesMatter), and supports remote collaboration.

1.3 Using ICT to Solve Problems

- Key Concepts:

- Researching information, analyzing data, and presenting solutions.
- Collaborative problem-solving using digital tools.

Activity:

In groups, learners create a survey document that will be used to gather information from some random people in society. The survey should have questions about the impacts of ICT in society. Gather and analyze the results.

Present the results of the findings to the class.

According to the results, do you think people have appreciated the use of ICT (Information communication technology) in our society today? Make a write-up.

Activity: (In groups)

- Learners make plenary presentation role playing how **ICTs** are used in those fields.

- Learners take a tour and research around the school to explore how **ICT** tools are used within the school system.
- Learners in groups, discuss how the different **ICT** tools are used in different fields.
- Learners in groups, discuss and clearly makes a write-up on the impact of **ICT** in the society today.
- Learners in their groups research and brainstorm how **ICT** is practically being used to solve problems in the world today.

1.4 Introduction to Computers and ICT tools.

- Key Concepts:

- Input, processing, output, and storage.
- Types of computers (desktops, laptops, tablets, and smartphones).

Introduction to computers

Modern computers operate through a structured cycle of input, processing, output, and storage. These components work together to execute tasks efficiently. Try to relate a computer system to a human body system which accepts input from our body sensory organs, stores everything in the brain, the brain processes and outputs the results via means like speech, writing or any other actions.

Below is a detailed breakdown of each stage, with real-world examples and applications.

1. Input: Capturing Data

Definition: Input refers to the methods and devices used to send raw data or instructions into a computer.

Key Components:

- Hardware Devices:

- Keyboard: Translates keystrokes into digital signals (e.g., typing a report).
- Mouse: Converts physical movement into cursor movement on a screen.
- Microphone: Captures audio input for voice commands or recordings.

- Scanner: Digitizes physical documents or images (e.g., scanning a passport).
- Sensors: IoT devices like temperature sensors in smart homes.
- **Software Interfaces:**
 - Touchscreens (e.g., smartphones, ATMs).
 - Voice assistants (e.g., Siri, Alexa) interpreting spoken commands.

Real world Example:

A graphic designer uses a drawing tablet to sketch a logo. The tablet converts hand written digital pen movements into digital data, which is sent to design software like Adobe Illustrator.

2. Processing: Transforming Data

Definition: Processing involves manipulating raw data into meaningful information using the computer's Central Processing Unit (CPU) and memory.

Key Components:

- **CPU (Central Processing Unit):**
 - Arithmetic Logic Unit (ALU): Performs calculations (e.g., $5 + 3 = 8$).
 - Control Unit (CU): Directs data flow between components.
 - Example: Editing a video in Final Cut Pro requires the CPU to render frames.
- **Memory (RAM): Temporarily holds data during processing.**
 - Example: Running multiple apps (e.g., Chrome, Word, and PowerPoint) simultaneously.
- **Software Algorithms:**

- A spreadsheet formula (e.g., '=SUM(A1:A10)') calculates totals.
- AI models processing language (e.g., ChatGPT, DeepSeek generating responses).

Real world Example:

When you search “weather in Kampala” on Google:

1. The CPU fetches data from RAM.
2. Algorithms process the query, retrieve results from servers, and rank them.

3. Output: Presenting Results

Definition: Output devices display or communicate processed information to the user.

Key Components:

- Hardware Devices:

- Monitor: Displays text, images, or videos (e.g., streaming Netflix).
- Printer: Produces physical copies (e.g., printing a boarding pass).
- Speakers/Headphones: Output audio (e.g., playing music).

- Software Interfaces:

- Notifications on a smartphone screen.
- Graphs generated by Excel to visualize sales data.

Real world Example:

A fitness tracker processes heart rate data and outputs a visual graph on a smartphone app, showing the user's workout intensity.

4. Storage: Retaining Data

Definition: Storage preserves data, programs, and outputs for future use.

Types of Storage:

- Primary Storage (Volatile):

- RAM: Temporarily holds data during active tasks (e.g., unsaved Word doc).
- Cache Memory: Speeds up CPU access to frequently used data.

- Secondary Storage (Non-Volatile):

- Hard Disk Drive (HDD): Stores OS, apps, and files long-term.
- Solid-State Drive (SSD): Faster, durable storage (e.g., laptops).
- Cloud Storage: Remote servers (e.g., Google Drive, iCloud).
- USB Drives: Portable storage for transferring files.

Real world Example:

A photographer saves high-resolution images to an external SSD for backup. Later, they upload the files to Google Drive to share with a client.

Activity: In groups

Taking an example of an online shopping system where you want to buy a book from an online store, identify the input, processing, output, and storage procedures you will execute to finally send an order for the book.

Types of computers

Desktops, laptops, tablets, and smartphones each serve unique roles in modern computing, driven by advancements in portability, power, and connectivity. By understanding their strengths and integration potential, users and businesses can optimize workflows, creativity, and communication in an increasingly mobile-first world.

1. Desktop Computers

These are stationary, high-performance systems designed for power and customization.

Modern Use Cases:

- Video production studios (e.g., rendering 4K footage in Adobe Premiere Pro).
- Scientific research labs processing large datasets.

2. Laptop Computers

These are portable, all-in-one systems balancing performance and mobility.

Modern Use Cases:

- Remote workers using Zoom and Slack in coffee shops.
- Students collaborating on Google Docs during lectures.

3. Tablets

These are touchscreen devices bridging smartphones and laptops.

Modern Use Cases:

- Nurses updating patient records on hospital rounds with a Samsung Galaxy Tab.
- Artists sketching concept designs on a Wacom MobileStudio Pro.
- Enumerators capturing citizen data during national population census.

4. Smartphones

These are pocket-sized computers with cellular connectivity.

Modern Use Cases:

- Photographers editing RAW images on Adobe Lightroom Mobile.
- Farmers in rural India accessing crop prices via WhatsApp.

1.5 Using a Computer System

- Key Concepts:

- Powering on/off, using a keyboard and mouse, navigating the desktop.
- File management (creating, saving, organizing files and folders).

Powering On/Off a Computer System

Powering On (A windows computer system or MacOS)

1. Steps:

- Step 1: First, make sure the wall socket is switched on. Press the power button on the CPU (desktop) or top/side key (laptop). Check well on the laptop, the position usually varies depending on the brand.
- Step 2: Wait for the BIOS/UEFI screen to initialize hardware (e.g., Dell or HP logo will be displayed on the screen).
- Step 3: The operating system (OS) loads (e.g., Windows 11/10 login screen or macOS desktop).

2. Post-Boot Checks:

- Peripherals: Ensure keyboard, mouse, and monitor are connected and functional.
- Error Signals: Listen for beep codes (e.g., repeated beeps may indicate RAM issues).

Shutting Down

1. Proper Shutdown procedure for different operating systems:

- Windows: Start Menu > Power > Shut Down.

- MacOS: Apple Menu > Shut Down.
- Linux: Terminal command `sudo shutdown now -h`.

Safety Tips:

- Avoid unplugging during updates to prevent file corruption.
- Use a UPS (Uninterruptible Power Supply) to protect against sudden power loss.

Using a Keyboard and Mouse

Keyboard Basics

1. Key Functions:

- Alphanumeric Keys: Typing text (e.g., writing an email).
- Modifier Keys:
 - Ctrl/⌘ (Command): Shortcuts (e.g., Ctrl+C to copy).
 - Alt/Option: Alternate functions (e.g., Alt+Tab to switch apps).
- Function Keys (F1-F12): Volume control (F10), brightness (F2), or help (F1).

2. Shortcut Examples:

- Ctrl+S: Save a document.
- Ctrl+Z: Undo an action.
- Windows Key + L: Lock the computer instantly.

Activity:

Open a working computer system, open a program like Microsoft word, and create some content and use it to try the above keyboard shortcuts and take time to explore some more on the Microsoft word interface.

- i. Use Ctrl key randomly with other keys on the keyboard.
- ii. Use Shift key randomly with other keys on the keyboard.
- iii. Note down your findings.
- iv. Share your findings with the class

3. Scenario use case:

- A student opens a 50-page PDF document and uses Ctrl+F to search for "climate change" or any other word in the text.

Mouse Basics

1. Types:

- Wired/Wireless: Logitech MX Master (programmable buttons).
- Touchpad: Integrated into laptops (e.g., MacBook Force Touch).

2. Functions:

- Left Click: Select items (e.g., opening a file).
- Right Click: Access context menus (e.g., "Copy" or "Delete").
- Scroll Wheel: Navigate long pages or zoom (hold Ctrl + scroll).
- Drag-and-Drop: Move files between folders.

Navigating the Desktop

Desktop Components

1. Icons:

- Shortcuts: Double-click the Chrome icon to launch the browser.
- Files/Folders: Drag the "Downloads" folder to the trash to delete it.

2. Taskbar/Dock:

- Windows Taskbar: Pinned apps (e.g., Microsoft Edge, File Explorer).
- MacOS Dock: Trash bin on the right, frequently used apps on the left.

3. Start Menu (Windows) / Launchpad (macOS):

- Search for apps (e.g., type "Excel" to open Microsoft Excel).

4. System Tray (Windows) / Menu Bar (macOS):

- Check Wi-Fi, battery, and time.
- Adjust volume via the speaker icon.

File Management

Creating Files and Folders

1. Methods:

- Right-Click: Desktop > New > Folder (name it "Invoices_2024").
- File Menu: In Word, click File > New > Blank Document.
- Keyboard Shortcut: Ctrl+N (new file in most apps).

2. Naming Conventions:

- Use clear names (e.g., "Report_Q1.docx" instead of "Document1").
- Avoid special characters (e.g., / or ?) to prevent errors.

Saving Files

1. Save vs. Save As:

- Save (Ctrl+S): Updates an existing file.
- Save As: Creates a copy (e.g., saving a draft as "Essay_v2.pdf").

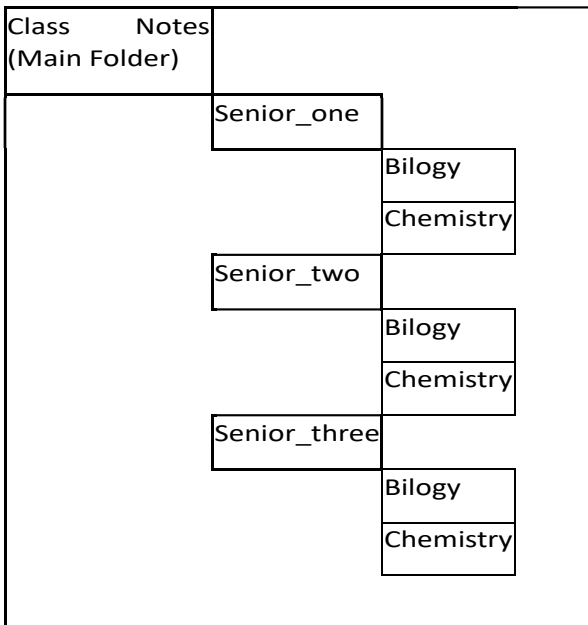
2. Choosing Locations:

- Default folders: Documents, Downloads, or Desktop.
- Cloud storage: Save directly to Google Drive or OneDrive.

Organizing Files and Folders

1. Folder Structure:

- Example Hierarchy:



Activity:

1. Creating: A student makes a folder named "Class Notes" on the desktop.
2. They create extra sub folders to represent Senior_one, Senior_two and Senior_three classes.
3. Saving: They save research notes as "Biology.docx and Chemistry.docx" inside the sub folders created.

Sorting and Searching:

- Sort By: Date modified, name, or file type (e.g., group all PDFs).
- Search Bar: Type "budget" to find "Budget_2024.xlsx" instantly.

Activity:

- In groups, learners collaborate to explore how different **ICT** components can be connected to form a working system. In groups, learners collaborate to explore how different **ICT** components can be connected to form a working system.
- In pairs, learners brainstorm the meaning of the booting process, discuss and create a flowchart of the steps involved in starting up a computer and opening applications.
- In small groups, learners practice steps to start and shut down **ICT** devices.
- Make a write-up of the significance of observing proper start-up and shutdown of **ICT** devices.
- In groups, learners create files and organize them into folders and subfolders based on a given task (e.g., creating a project directory for schoolwork or a business).
- In small groups, learners save files on different storage media such as USB drives, external hard drives etc
- Individually, learners save documents in specified formats (e.g., .docx, .pdf, .txt) and in designated folders.
- In small groups, learners simulate a real-world scenario (e.g., storing a client's information for a project) by creating a file structure and saving files to the appropriate locations.
- In groups, learners create a folder structure for a given scenario (e.g., organizing photos, school assignments, or business files) and present their approach to the class.
- In groups, learners create and organize files, then exchange computers with a partner to evaluate the file structure and organization for clarity and efficiency.

1.6 Critical Thinking and ICT

- Key Concepts:

- Identifying credible sources, detecting misinformation.
- Ethical decision-making in digital environments.

Activity:

- Learners in groups of five suggest a topic of interest e.g. programming, databases etc.

- Learners practice how to create digital content in the digital era using simple **ICT** tools like microphone, smartphones, etc ensuring that the information created is not misleading or wrong.
- Learner brainstorm on how to easily identify false digital content shared on different **ICT** digital platforms.

Resources and Tools

- Online Resources: Khan Academy, Coursera, Code.org.
- Software Tools: Microsoft Office Suite, Google Workspace, web browsers.

S.5 Term 1

TOPIC 2: Electronic Presentation (32 Periods)

TOPIC COMPETENCY:

The learner creates and delivers visually appealing, interactive electronic presentations to communicate ideas effectively

2.1. Definition and Purpose of Electronic Presentations

Activity:

- In pairs, learners discuss the meaning of an electronic presentation.
- In pairs, learners brainstorm the purpose of electronic presentations in our daily life activities.

- Key Concepts:

- Tools for creating presentations (e.g., Microsoft PowerPoint, Google Slides).
- Uses in education, business, and communication.
- Features, advantages, and limitations of each tool.

Activity:

- In pairs, learners research and present the tools used to create electronic publications in the world today.
- In pairs, learners discuss the relevance of electronic presentations in education, business, and communication.

Activity:

- Let learners explore and record the results in a table format different presentation tools spotting out their key features, advantages, and limitations.

- In groups, explore different template designs available in the chosen software, discussing which layouts are best suited for specific types of content (e.g., graphs for data, images for storytelling).
- In groups, learners create a presentation by applying suitable template designs and layout.

2.3 Planning a Presentation

- Key Concepts:

- Defining the purpose and audience.
- Organizing content into introduction, body, and conclusion.

Activity:

- In groups, learners create a basic presentation on a given topic within a set time, focusing on applying suitable templates and layouts efficiently.

2.4 Creating, designing and Editing Presentations

- Key Concepts:

- Use of fonts, colors, and layouts.
- Balancing text, images, and multimedia.
- Adding and formatting text, images, and shapes.
- Using slide templates and themes.

Activity:

- In pairs, students brainstorm and
- In groups, learners work in pairs to customize a presentation theme by changing background colors, fonts, and slide layouts to match a chosen topic.

- In groups, learners present their work to the class, applying features like speaker notes and slideshow mode, and receive feedback on their delivery and visual aids

2.5 Incorporating Multimedia

- Key Concepts:

- Inserting videos, audio, and animations.
- Using hyperlinks and interactive elements.

Activity:

- Work in groups to collaboratively incorporate multimedia elements (e.g., images, videos, animations, and audio) into your presentations to make them more engaging.
- In pairs, learners experiment with slide transitions and object animations, applying them to their presentation and discussing when to use them effectively
- Work in groups to improve poorly designed slides by applying design principles focusing on readability, visual hierarchy, and alignment.

2.6. Presentation Skills and using presentation tools during delivery.

- Key Concepts:

- Body language, eye contact, and voice modulation.
- Engaging the audience and handling questions.
- Using slide transitions and animations.
- Navigating slides and using presenter view.

Activity:

- In groups, learners format a presentation to tell a compelling story, focusing on how design elements guide the audience through the narrative.
- In groups, learners design a professional presentation for a mock event (e.g., product launch or educational seminar), ensuring it is visually appealing and audience-friendly.

2.7 Updating, collaborating and maintaining Presentations

- Key Concepts:

- Editing and revising content.
- Saving and sharing presentations in different formats.
- Create presentations using online tools such Canva, and Microsoft PowerPoint online.
- Collaborate online using tools like Google meet, zoom and others.

Activity:

- In groups, learners create a shared presentation using cloud-based tools like Google Slides, Microsoft PowerPoint Online, or Canva. Each member contributes to specific slides in real-time
- In groups, learners work from separate locations, using video conferencing tools (e.g., Zoom, Microsoft Teams, Google meet) to collaborate and rehearse their presentation online.

Resources and Tools

- Online Resources: LinkedIn Learning, YouTube tutorials.
- Software Tools: Microsoft PowerPoint, Google Slides, Keynote.

S.5 Term 2

TOPIC 3: Computer Hardware (28 Periods)

TOPIC COMPETENCY:

Understanding the Basics of Computer Hardware

Key Concepts:

- Definition of Computer Hardware:

These are physical components of a computer system, including internal and external parts.

These components work together to process, store, and transmit data. They collaborate with software to perform tasks, from basic operations (typing a document) to complex computations (like 3D rendering).

Modern systems range from compact devices (smartphones) to high performance rigs (server), with components tailored for speed, capacity, or energy efficiency.

- Main Components:

1. Central Processing Unit (CPU): The "brain" of the computer, responsible for executing instructions.

Let us look at the CPU in brief details.

- CPU Components:

- Arithmetic Logic Unit (ALU): Performs arithmetic and logical operations.
- Control Unit (CU): Directs the operation of the processor.
- Registers: Small, fast storage locations within the CPU.
- Cache Memory: High-speed memory used to store frequently accessed data.

- CPU Performance Factors:

- Clock speed (measured in GHz).
- Number of cores (single-core, dual-core, quad-core, etc.).
- Threading (e.g., hyper-threading).

Activity::

- Compare and contrast different CPUs based on their specifications.
- Create a flowchart showing how the CPU processes instructions.

2. Motherboard: The main circuit board that connects all hardware components.

Let us look at the motherboard in details.

- Motherboard Components:

- CPU Socket: Holds the CPU.
- RAM Slots: Hold memory modules.
- Chipset: Manages data flow between components.
- BIOS/UEFI: Firmware for hardware initialization and system configuration.
- Expansion Slots: PCI, PCIe, AGP for adding components like GPUs, sound cards, etc.

3. Random Access Memory (RAM): Temporary memory used to store data and instructions for quick access.

4. Storage Devices:

- Hard Disk Drive (HDD): Magnetic storage for long-term data retention.

HDD (It is mechanical, slower, cost effective for bulk storage)

- Solid State Drive (SSD): Faster, non-volatile storage with no moving parts.

SDD (It is faster, silent, durable (no moving parts))

5. Power Supply Unit (PSU): Converts AC power to DC power for the computer.

- Converts AC power to DC power.
- Provides different voltage levels (e.g., 3.3V, 5V, 12V) to components.
- Wattage and efficiency ratings (e.g., 80 Plus certification).

6. Cooling systems.

Air cooling: It is composed on fans + heat sinks (common, affordable)

Liquid cooling: It is composed of pumps + radiators (efficient for high performance setups)

Activity:

- Calculate the power requirements for a given computer build.
- Design a cooling solution for a high-performance gaming PC.

7. Peripherals

Input devices (keyboard, mouse, microphone, scanner, and digital camera) and output devices (monitor, printer, projector).

Interface via USB, Bluetooth, or dedicated ports for example HDMI for monitors.

8. Networking hardware

NIC (Network Interface Card). It enables wired/wireless connectivity (Ethernet/Wi-Fi).

Routers/modems for internet access; PCIe cards for high speed LAN.

9. Expansion Cards:

- Graphics Processing Unit (GPU): Handles rendering of images and video.
- Network Interface Card (NIC): Enables network connectivity.

- Sound Card: Enhances audio output.

Activity:

- Label a diagram of a motherboard with its key components.
- Research and present on the role of a specific expansion card (e.g., GPU).

Activity:

- Differentiate between RAM and storage devices.
- Explain the importance of memory hierarchy in a computer system.

Key Concepts:

- Primary memory (main memory)
- Secondary memory (storage)
- Volatile and non-volatile

1. Primary Memory (Main Memory)

Primary memory is divided into (RAM and ROM) as discussed below;

- RAM (Random Access Memory)
 - Volatile: RAM loses data when power is off.
 - RAM stores active data/applications for quick CPU access.
- **Types RAM:**
 - DRAM (Dynamic RAM): Common in system memory (e.g., DDR4, DDR5).
 - SRAM (Static RAM): Faster, used for CPU cache (L1, L2, L3).
- ROM (Read-Only Memory)

- Non-volatile: ROM retains data without power.

- **Types ROM:**

- PROM (Programmable ROM): One-time write (e.g., firmware).
- EPROM (Erasable PROM): UV light-eraseable.
- EEPROM (Electrically Erasable PROM): Rewritable (e.g., BIOS/UEFI).

2. Secondary Memory (Storage)

- Non-volatile, long-term data storage. Below are some examples of storage devices;
- HDD (Hard Disk Drive): Magnetic storage; slow but high-capacity.
- SSD (Solid State Drive): Flash-based; faster, durable (e.g., NVMe SSDs).
- Optical Discs: CDs, DVDs (laser-read, portable).
- Flash Memory: USB drives, SD cards (portable, NAND-based).

3. Cache Memory

- Built into CPU or close to it (e.g., L1, L2, L3).
- Faster than RAM; stores frequently used instructions for rapid CPU access.

4. Virtual Memory

- OS-managed extension of RAM using disk space.
- Prevents slowdowns when physical RAM is full (uses "page files").

5. Volatile vs. Non-Volatile

- Volatile: Temporary (RAM, Cache).

- Non-Volatile: Permanent (ROM, HDD/SSD, Flash).

- **Memory Hierarchy:**

- Registers >> Cache >> RAM >> Storage (HDD/SSD).

Activity:

- Create a table comparing RAM, HDD, and SSD in terms of speed, capacity, and cost.

- Explain the concept of memory hierarchy with examples.

- **Input/Output Devices:**

NB: (Refer to the first topic to read more about input and output devices)

- Input Devices: Keyboard, mouse, scanner, etc.

- Output Devices: Monitor, printer, speakers, etc.

Activity 1:

- Using a laboratory setup, draw and label a diagram of a computer system with its main components.

- Explain the function of each component in a written or oral presentation.

Activity 2:

- a. Brainstorm, in a think pair session, and report on the importance of each of the hardware tools.

- b. In pairs classify, a list of hardware devices as Input, output, storage, communication and processing tools into their respective categories.

- c. In groups, learners play a game matching hardware device names to their categories and functions using flashcards or an online tool.

- d. In groups, learners explore how modern devices (e.g., touchscreens or VR headsets) can belong to multiple categories (input/output) and explain their dual functions.

Activity 3:

- a. In groups, provide learners with common external hardware components (mouse, Keyboard, Projector, monitor, cables, etc.) and guide them in identifying each part and understanding its purpose and how it connects to the system's unit.
- b. In groups, learners use a computer assembly simulation software or an interactive online tool where learners can virtually assemble/connect a computer system.
- c. Pair learners and provide them with a set of hardware components to assemble under supervision. Supply a checklist of steps to follow.
- d. In pairs, learners will use system diagnostic tools (e.g., Task Manager, System Information, or third-party software) to analyze system specifications and match each component to its identified purpose.

Hardware maintenance

Key Concepts:

- Common Hardware Issues:

- Overheating.
- Power supply failures.
- RAM or storage device failures.

- Maintenance Tasks:

- Cleaning dust from components.
- Updating firmware and drivers.
- Replacing worn-out parts (e.g., fans, thermal paste).

Activity:

- Troubleshoot a simulated hardware problem and propose a solution.

- Create a maintenance checklist for a desktop computer.

Activity 5:

- a. Divide learners into groups and provide each group with hardware components and safety tools (e.g., anti-static wristbands). Task them with researching and demonstrating proper handling techniques
 - b. Pair discuss safety measures, such as turning off power before working on components.
 - c. Present a non-functional computer and allow students to collaboratively identify, troubleshoot, and resolve hardware issues.
- D. Group students as they demonstrate how to clean internal and external components, such as removing dust from fans, heat sinks, and power supplies.
- c. Assess learners' troubleshooting process and cleanliness demonstrations for effectiveness, accuracy, and safety in maintaining and resolving hardware issues.

S.5 Term 2

TOPIC 4: Computer Software (30 Periods)

TOPIC COMPETENCY:

The learner performs routine services on computer software to ensure optimal functionality and performance.

1. Definition and Types of Software

Software refers to a collection of instructions, programs, and data that enable a computer or electronic device to perform specific tasks.

Unlike hardware (physical components like the CPU or keyboard), software is intangible and acts as the "brain" of the computer, directing how hardware operates.

Key Characteristics:

- Non-physical: Stored electronically (e.g., on hard drives, cloud storage).
- User Interaction: Allows users to communicate with hardware (e.g., via apps or OS interfaces).
- Updatable: Can be modified or upgraded without changing physical components.

- Key Concepts:

- System Software: Operating systems, device drivers, utilities.
- Application Software: Word processors, spreadsheets, databases, web browsers.

Types of system software

- System Software
- Application Software

A. System Software

This is responsible for managing hardware and provides a platform for running application software. System software works a foundation for all other programs to run.

1. Operating Systems (OS):

The operating system controls hardware resources (CPU, memory, storage) and provides services to applications.

- Examples:

- Windows (Microsoft)
- MacOS (Apple)
- Linux (open-source).

2. Device Drivers:

Device drivers are responsible for enabling communication between hardware (e.g., printers, graphics cards) and the OS.

- Examples: The list is not limited to what is mentioned below;

- Printer drivers (e.g., HP LaserJet drivers). These enable your computer to communicate with the printer connected to the computer system.
- GPU drivers (e.g., NVIDIA GeForce Experience). These enable your computer to communicate with the graphics card
- Sound card drivers. These are drivers for sound cards, such as realtek or creative sound blaster that enable audio output.
- Network card drivers. These are drivers for Ethernet or Wi-Fi network cards, such as intel or Broadcom, that enable network connectivity.
- USB drivers. These are drivers for USB devices, such as flash drives or external hard drives that enable your computer to recognize and interact with the device.

3. Utility Software:

Utility software maintains, optimizes, and secures the system.

- Examples: The list is not limited to what is mentioned below;

- Antivirus (e.g., Norton, McAfee). It protects against malware viruses, and other online threats.
- Disk Cleanup Tools (e.g., CCleaner). It removes temporary files, system files, and other items that can be safely deleted.
- Backup Software (e.g., Acronis). It creates copies of files and data.
- Disk defragmentation. It rearranges files on a hard drive to improve performance, such as defraggler.
- File compression tools. It is responsible for reducing the size of a file. There are offline and online tools available for use.
- System monitoring tools. It monitors system performance, temperature, and other metrics, such as CPU-Z or GPU-Z.
- Password manager. This software securely stores and generates passwords, such as LastPass or 1Password.
- Registry cleaner. It removes invalid entries from the windows registry, such as CCleaner.

4. Firmware:

This is an embedded software on hardware devices (e.g., BIOS in motherboards). It provides the necessary instructions for the device to perform its internal functions.

- Examples: The list is not limited to what is mentioned below;

- BIOS/UEFI firmware for booting a computer.
- Smart TV firmware.
- Router firmware
- Smartphone firmware
- Printer firmware
- Gaming console firmware

2. Functions of an Operating System

- Key Concepts:

- Process management, memory management, file system management, security.

3. Types of Operating Systems

- **Key Concepts:**

- Windows, macOS, Linux, mobile OS (Android, iOS).

4. Software Installation

- **Key Concepts:**

- Installation procedures, system requirements, licensing.

Activity:

- In small groups, learners analyze hardware specifications and identify suitable operating systems and applications, presenting their findings and justifications to the class
- In groups, learners follow provided manuals and step-by-step guides to install an operating system and a software application on a computer, ensuring all installations are compatible with the hardware.
- Working individually or in pairs, learners configure advanced software settings such as user preferences, network options, and security protocols, based on specific real-world scenarios provided by the instructor.

5. Productivity Software

- **Key Concepts:**

- Word processing (e.g., Microsoft Word, Google Docs).
- Spreadsheets (e.g., Microsoft Excel, Google Sheets).
- Presentation software (e.g., Microsoft PowerPoint, Google Slides).

B. Application Software

Application software is designed to help users perform specific tasks.

It is also known as apps. These programs run on top of the system software (operating system) and utilize computer hardware to execute tasks.

1. General-Purpose Software:

These software are used for common and wide range of tasks across industries.

- Examples:

- Microsoft Office Suite (Word, Excel, PowerPoint).
- Web Browsers (Chrome, Firefox).
- Text editors
- Media players
- File managers

2. Custom Software:

Tailored for specific organizational, business or individual needs.

- Examples:

- Inventory management systems for retail stores.
- Hospital patient record systems.
- Point of sale systems

3. Web-Based Applications:

These are software that are accessed via web browsers or mobile apps; no local installation required.

- Examples:

- Google Workspace (Docs, Sheets).

- Salesforce e.g. CRM (Customer Relationship Management) tool.
- Email services such as Gmail, Yahoo mail etc.
- Online banking and finance
- Ecommerce platforms such as Amazon, Jumia, Alibaba
- Learning management systems such as Canva, Moodle
- Project management tools such as Asana.

4. Mobile Apps:

These are designed for smartphones/tablets. Mobile apps is the short form for mobile applications. These apps provide users with a wide range of functionality, from basic entertainment, and productivity to educations and communication.

- Examples:

- Social media apps (WhatsApp (messaging), X, instagram, Facebook etc.).
- Productivity apps (Adobe Lightroom (photo editing), Google drive etc.).
- Education apps (Coursera, Alison etc.)

C. Programming Software

Tools for developers to create, debug, and maintain software.

1. Integrated Development Environments (IDEs):

These are software that combine code editors, compilers, and debuggers.

- Examples:

- Visual Studio (created by Microsoft).
- PyCharm (for Python).

2. Compilers & Interpreters:

A compiler translates code into machine-readable instructions, and translates and executes the source code line by line, without generating an executable file.

- Examples:

- GCC (C/C++ compiler).
- Python Interpreter.

3. Version Control Systems:

These are tools that help manage changes to code, documents, or other digital content over time. They go a further to support collaboration with others, and maintaining a record of all modifications.

- Examples:

- Git (with platforms like GitHub).
- Subversion (SVN)
- Mercurial

Activity:

- a. Learners in pairs or small groups classify a list of provided software into system, application, or utility categories. They also describe the primary purpose of each software type in managing or enhancing computer functionality.
- b. In groups, learners analyze case studies detailing user requirements (e.g., for a business, school, or personal use) and compare different software options, considering system capabilities. Each group presents their recommendations and explains their choices.
- c. In groups, learners use multiple software applications (e.g., antivirus programs, office suites, or system optimizers) in a lab environment. They evaluate performance, user interface, and compatibility with the provided hardware and system.

d. Learners act as IT consultants in a role-playing **Activity** where a "client" provides specific needs (e.g., needing software for document management or system maintenance). The learners recommend software solutions, explaining how they align with the client's requirements and the system's capabilities.

e. In groups, learners debate which type of software (system, application, or utility) is most critical in specific scenarios, such as managing a business, maintaining a personal computer, or running a school system.

6. Software Updates and Maintenance

- Key Concepts:

- Patch management, version control, troubleshooting techniques.

NB: For details on version control, check the previous sub topic

1. Patch Management

Definition:

Patch management is the process of acquiring, testing, and installing updates (patches) to software, operating systems, or applications to fix vulnerabilities, improve performance, or add features.

Importance:

- Security: Protects against cyber-attacks by closing vulnerabilities (e.g., ransomware exploits).
- Stability: Fixes bugs that cause crashes or errors.
- Compliance: Meets legal/regulatory requirements (e.g., GDPR).

Types of Patches:

1. Security Patches: Address critical vulnerabilities.
2. Feature Updates: Add new functionalities (e.g., Windows 11 updates).

3. Bug Fixes: Resolve software glitches (e.g., app freezing).

Patch Management Process:

1. Identify: Scan systems to detect missing patches.
2. Evaluate: Prioritize patches based on severity (e.g., critical vs. optional).
3. Test: Deploy patches in a controlled environment first.
4. Deploy: Roll out patches to all systems.
5. Verify: Confirm successful installation and functionality.

Tools for Patch Management:

- Windows Update: For OS and Microsoft software.
- Third-party Tools: ManageEngine, SolarWinds Patch Manager. And many others

Class Activity 1: Patch Prioritization Simulation

- Scenario: A school's network has 50 unpatched computers. Students receive a list of 10 patches (mix of security, feature, and bug fixes).

- Task:

1. Categorize patches by type.
2. Prioritize them based on urgency (e.g., security first).
3. Present a deployment timeline.

2. Troubleshooting Techniques

Definition:

Troubleshooting is the systematic identification and resolution of technical issues in hardware, software, or networks.

Systematic Approach:

1. Identify the Problem: Gather details (e.g., error messages, user reports).
2. Reproduce the Issue: Confirm the problem occurs consistently.
3. Hypothesize Causes: Use logic (e.g., "Is the network cable unplugged?").
4. Test Solutions: Apply fixes one at a time (e.g., restart the device).
5. Implement & Verify: Apply the fix and confirm resolution.
6. Document: Record the issue and solution for future reference.

Common Techniques:

- Divide and Conquer: Isolate components (e.g., test internet connectivity before blaming the server).
- Check Physical Connections: Cables, power supply, peripherals.
- Use Diagnostic Tools:
 - Ping/Traceroute: Test network connectivity.
 - Event Viewer: Check system logs for errors (Windows).
 - Safe Mode: Boot OS with minimal drivers to identify conflicts.
- Update/Rollback Software: Install updates or revert to a previous version.

Class Activity 2: Troubleshooting Role-Play

- **Scenario:** Students split into "IT Support" and "Users."
- User Roles: Report issues (e.g., "My PC won't connect to Wi-Fi," "App crashes on startup").
- **IT Support Task:**

1. Ask clarifying questions.
2. Use troubleshooting techniques to diagnose and resolve the issue.
3. Document the solution.

Activity:

1. Name two tools used for patch management.
 2. What is the first step in the troubleshooting process?
7. Understanding Software Vulnerabilities

- Key Concepts:

- Malware, viruses, phishing, SQL injection.

1. Malware

Definition:

Malware (malicious software) is any program designed to harm, exploit, or steal data from devices or networks.

Types of Malware:

- Ransomware (e.g., WannaCry): Encrypts files and demands payment.
- Spyware (e.g., Pegasus): Secretly monitors user **activity**.
- Trojans: Disguised as legitimate software (e.g., fake game installers).
- Worms: Self-replicate across networks (e.g., Stuxnet).

Prevention:

- Install antivirus software (e.g., Malwarebytes).
- Avoid downloading files from untrusted sources.
- Regularly update software.

Class **Activity** 1: Malware Analysis

Students analyze screenshots of fake pop-ups/emails (e.g., "Your PC is infected! Click here to scan").

2. Computer Viruses

A self-replicating program that attaches to clean files and spreads, corrupting systems.

Examples:

- ILOVEYOU Virus (2000): Spread via email, overwrote files.
- Melissa Virus (1999): Disguised as a Word document.

Signs of Infection:

- Slow performance, unexpected pop-ups, missing files.

Activity:

Investigate how we can avoid virus infection on our computers at home.

3. Phishing

Fraudulent attempts to steal sensitive data (e.g., passwords, credit card numbers) via deceptive emails, SMS (smishing), or calls (vishing).

Common Tactics:

- Urgent requests (e.g., "Your account will be suspended!").

- Fake links (e.g., "Click here to verify your PayPal account").
- Impersonation of trusted brands (e.g., Netflix, banks).

Activity:

Investigate the techniques that can be employed to overcome the vice of phishing.

4. SQL Injection

A cyberattack where hackers inject malicious SQL code into web forms or URLs to manipulate databases and steal sensitive data.

Example:

Entering `` OR 1=1 --` into a login form to bypass authentication.

Impact:

- Data breaches (e.g., usernames, credit card info).
- Unauthorized database deletions.

Activity:

Investigate the techniques that can be employed against SQL injection.

How to spot phishing emails.

- Writing SQL queries to "patch" a database.
- Identifying malware types from clues.
- Goal: Reinforce concepts through gamification.

Homework/Assessment:

1. Research Task: Find a recent news article about a cyber-attack and classify the threat (malware/phishing/SQL injection).

8. Implementing Security Measures

- Key Concepts:

- Encryption, firewalls, antivirus software, secure coding practices.

1. Patch Management

Definition:

Patch management is the process of acquiring, testing, and installing updates (patches) to software, operating systems, or applications to fix vulnerabilities, improve performance, or add features.

Importance:

- Security: Protects against cyber-attacks by closing vulnerabilities (e.g., ransomware exploits).
- Stability: Fixes bugs that cause crashes or errors.
- Compliance: Meets legal/regulatory requirements (e.g., GDPR).

Types of Patches:

1. Security Patches: Address critical vulnerabilities.
2. Feature Updates: Add new functionalities (e.g., Windows 11 updates).
3. Bug Fixes: Resolve software glitches (e.g., app freezing).

Patch Management Process:

1. Identify: Scan systems to detect missing patches.

2. Evaluate: Prioritize patches based on severity (e.g., critical vs. optional).
3. Test: Deploy patches in a controlled environment first.
4. Deploy: Roll out patches to all systems.
5. Verify: Confirm successful installation and functionality.

Tools for Patch Management:

- Windows Update: For OS and Microsoft software.
- Third-party Tools: ManageEngine, SolarWinds Patch Manager. And many others

Class Activity 1: Patch Prioritization Simulation

- Scenario: A school's network has 50 unpatched computers. Students receive a list of 10 patches (mix of security, feature, and bug fixes).

- Task:

1. Categorize patches by type.
2. Prioritize them based on urgency (e.g., security first).
3. Present a deployment timeline.

2. Troubleshooting Techniques

Definition:

Troubleshooting is the systematic identification and resolution of technical issues in hardware, software, or networks.

Systematic Approach:

1. Identify the Problem: Gather details (e.g., error messages, user reports).

2. Reproduce the Issue: Confirm the problem occurs consistently.
3. Hypothesize Causes: Use logic (e.g., "Is the network cable unplugged?").
4. Test Solutions: Apply fixes one at a time (e.g., restart the device).
5. Implement & Verify: Apply the fix and confirm resolution.
6. Document: Record the issue and solution for future reference.

Common Techniques:

- Divide and Conquer: Isolate components (e.g., test internet connectivity before blaming the server).
- Check Physical Connections: Cables, power supply, peripherals.
- Use Diagnostic Tools:
 - Ping/Traceroute: Test network connectivity.
 - Event Viewer: Check system logs for errors (Windows).
 - Safe Mode: Boot OS with minimal drivers to identify conflicts.
- Update/Rollback Software: Install updates or revert to a previous version.

Class Activity 2: Troubleshooting Role-Play

- **Scenario:** Students split into "IT Support" and "Users."
- **User Roles:** Report issues (e.g., "My PC won't connect to Wi-Fi," "App crashes on startup").
- **IT Support Task:**

1. Ask clarifying questions.

2. Use troubleshooting techniques to diagnose and resolve the issue.
3. Document the solution.

Activity:

1. Name two tools used for patch management.
2. What is the first step in the troubleshooting process?

Activity:

- a. In pairs, Learners are provided with computers or virtual environments pre-configured with common software issues (e.g., crashes, errors, or compatibility problems). They use diagnostic tools (e.g., Event Viewer, Task Manager) to identify and resolve the issues systematically
- b. In small groups, learners explore and practice using diagnostic tools like system logs, compatibility checkers, or antivirus programs. They document how each tool can be applied to troubleshoot specific software malfunctions.
- c. Learners analyze real-world case studies of software malfunctions (e.g., an office experiencing application crashes). They identify the root causes, propose solutions, and discuss how their strategies minimize downtime.
- d. In groups, learners take turns playing the roles of an IT technician and a client. The "client" describes a software issue, while the "technician" systematically identifies the problem using diagnostic strategies and proposes solutions to resolve it effectively.
- e. Learners individually present their software installation and configuration process to the class, highlighting key steps and challenges, and receive feedback from peers to refine their skills

S.5 Term 3

TOPIC 5: Electronic Word Processing (30 Periods)

TOPIC COMPETENCY:

The learner designs and formats professional word-processed documents with advanced features to effectively communicate and share information

Key Concepts:

- Definition of Electronic Word Processing: The creation, editing, formatting, and printing of text documents using software.
- Common Word Processing Software: Microsoft Word, Google Docs, LibreOffice Writer, etc.
- Key Features:
 - Text entry and editing.
 - Formatting tools (e.g., font styles, sizes, colors).
 - Spell check and grammar check.
 - Document saving and sharing.

Activity:

- Create a simple document (e.g., a letter) using basic text entry and formatting tools.
- Explain the purpose of electronic word processing in a written or oral presentation.

Key Concepts:

- Document Creation:
 - Starting a new document.

- Saving and naming files.
- Formatting Tools:
 - Font styles, sizes, and colors.
 - Paragraph alignment (left, right, center, justify).
 - Line spacing and indentation.
 - Bullet points and numbered lists.
- Styles and Themes:
 - Applying pre-designed styles for headings, titles, and body text.
 - Using themes to ensure consistent design.

Activity:

- Create a formatted document (e.g., a resume or report) using headings, bullet points, and consistent styles.
- Demonstrate the use of themes to enhance document design.

Key Concepts:

- Editing Tools:
 - Cut, copy, paste, and undo/redo.
 - Find and replace text.
 - Track changes and comments for collaborative editing.
- Proofreading:
 - Spell check and grammar check.

- Manual proofreading for context and clarity.
- Using readability statistics to improve document flow.

Activity:

- Edit a provided document using track changes and comments.
- Proofread and correct errors in a sample document.

Activity:

- a. Learners explore different word processing software (e.g., Microsoft Word, Google Docs, and LibreOffice Writer) and practice opening and creating a new document.
- b. In groups, learners analyze key features such as menus, toolbars, and document templates
- c. In small groups, Learners create a document by layout elements such as margins, page orientation, and spacing.
- d. In groups, learners will collaboratively edit and review a document by utilizing the full range of tools and features available in word processing software.
- e. In groups, Learners apply various formatting tools in a Word document, including font styles, paragraph alignment, page setup, and heading styles, to enhance document presentation.
- f. In small groups, Learners practice importing external data such as tables from Excel, charts from Google Sheets, or images from the web into a document.
- g. In small groups, learners adjust the size and format of the imported elements to ensure they integrate smoothly with the document layout.
- h. In small groups, Learners practice saving documents in different formats (e.g., .docx, .pdf) and export documents for printing or sharing.
- i. In groups, Learners exchange documents with a peer for review to provide constructive feedback on formatting, layout, and content organization.

Key Concepts:

- Tables:

- Inserting and deleting tables.
- Adjusting row height, column width, and cell alignment.
- Applying table styles and borders.

- Graphics:

- Inserting images, shapes, and icons.
- Resizing, cropping, and positioning graphics.
- Adding captions and alt text for accessibility.

- Charts:

- Creating and formatting charts (e.g., bar, pie, line).
- Linking charts to external data sources.

Activity:

- Create a document with a formatted table and at least one graphic.
- Design a report with a chart and explain its relevance to the content.

Key Concepts:

- Advanced Formatting:
 - Headers and footers.
 - Page numbers and section breaks.
 - Columns and text boxes.

- Watermarks and page borders.
- Templates:
 - Using pre-designed templates for resumes, letters, reports, etc.
 - Creating and saving custom templates.
- Master Documents:
 - Combining multiple documents into a single master document.
 - Managing large documents with table of contents and indexes.

Activity:

- Create a multi-page document with headers, footers, and page numbers.
- Design a custom template for a specific type of document (e.g., a newsletter).

Activity:

- a. In groups, learners explore different word processor objects (tables, shapes, charts, SmartArt, WordArt, and clip art).
- b. In groups, learners discuss how each can be used to enhance document presentation and share ideas on their best uses.
- c. In pairs, learners create a table to organize data in a document.
- d. In pairs, learners apply different formatting styles such as borders, shading, and font adjustments to enhance the table's appearance and readability.
- e. In groups, learners create smart art based on provided data and format it to ensure clarity of the content.
- f. In pairs, learners insert and manipulate various shapes (e.g., rectangles, arrows, circles) in a document to create simple diagrams.

g. In pairs, learners apply WordArt to create stylized headings or emphasis text. They experiment with different styles, colors, and effects to make the text stand out.

h. In groups, learners search for and insert appropriate clip art or images into a document. They practice resizing, positioning, and formatting the visuals to support the document's content.

i. In pairs, learners exchange documents and provide feedback on the use of visual elements. They focus on how well the tables, charts, and other objects support the document's overall structure and readability.

Key Concepts:

- Collaboration Tools:

- Track changes and comments.
- Real-time co-authoring (e.g., Google Docs, Microsoft Word Online).
- Version history and document recovery.

- Sharing Documents:

- Exporting documents in different formats (e.g., PDF, DOCX).
- Sharing via email, cloud storage, or collaboration platforms.
- Setting permissions (e.g., view-only, edit access).

Activity:

- Collaborate with a peer to edit a document using track changes and comments.
- Share a document in PDF format and explain the benefits of using PDFs.

Key Concepts:

- Mail Merge:

- Setting up a data source (e.g., Excel spreadsheet, Outlook contacts).
- Creating a main document and inserting merge fields.
- Previewing and completing the merge to generate personalized documents.

Activity:

- Record and run a macro to automate a repetitive task (e.g., formatting headings).
- Perform a mail merge to create personalized letters or labels.

Key Concepts:

- Document Security:
 - Password protection for opening and editing documents.
 - Restricting permissions for specific users.
 - Removing sensitive information (e.g., using Document Inspector in Word).
- Accessibility:
 - Using alt text for images and graphics.
 - Ensuring proper heading structure for screen readers.
 - Checking accessibility with built-in tools (e.g., Accessibility Checker in Word).

Activity:

- Apply password protection to a document and share it with a peer.
- Create an accessible document and test it using an accessibility checker.

Key Concepts:

- Common Issues:

- Formatting inconsistencies.
- Corrupted files.
- Compatibility issues between different software versions.

- Optimization Tips:

- Using keyboard shortcuts.
- Customizing the toolbar and ribbon.
- Managing large documents with navigation tools (e.g., headings, bookmarks)

Activity:

- Troubleshoot and fix formatting issues in a provided document.
- Demonstrate the use of keyboard shortcuts to improve workflow efficiency.

Key Concepts:

- Advanced Features:

- Creating and managing bibliographies and citations.
- Using cross-references, endnotes and footnotes.
- Embedding multimedia (e.g., videos, audio).
- Creating forms and surveys.

- Integration with Other Tools:

- Linking word processing documents with spreadsheets or databases.

- Using add-ins and extensions to enhance functionality.

- a. In groups, learners explore the advanced features of word processing software, such as referencing tools (e.g., citations, footnotes, endnotes) and mail merging.
- b. In groups, learners collaborate to create a research document that includes citations and a bibliography using referencing tools. They apply various citation styles (APA, MLA, etc.) and generate a reference list automatically.
- c. In groups, learners practice using the mail merge function by creating a template document (e.g., a letter or invitation) and merging it with a data source (e.g., a spreadsheet of names and addresses) to produce personalized documents.
- d. In pairs or small groups, learners work together online using cloud-based word processing software (e.g., Google Docs or Microsoft Word Online) to create a shared document. They collaborate in real-time, using features like comments, track changes, and suggestions to refine the document.
- e. Individually, learners share their documents with peers via cloud storage or email, requesting feedback. They review the feedback, make necessary changes, and apply advanced features like automated formatting or indexing to finalize the document.
- f. Individually or in groups, learners create a comprehensive document (e.g., research paper, newsletter, or business letter) that incorporates referencing tools, mail merging, and collaborative features. They apply automation for efficient content management and finalize the document for sharing.

S.5 Term 3

TOPIC 6: Electronic Spreadsheet (30 Periods)

TOPIC COMPETENCY:

The learner organizes and visualizes data to draw insights in data for data-driven decision-making

Key Concepts:

- Definition of Electronic Spreadsheets: Software tools used to organize, analyze, and store data in tabular form.
- Common Spreadsheet Software: Microsoft Excel, Google Sheets, LibreOffice Calc, etc.
- Key Features:
 - Rows, columns, and cells.
 - Data entry and formatting.
 - Basic formulas and functions.
 - Charts and graphs.

Activity:

- Create a simple spreadsheet with data entry and basic formatting.
- Explain the purpose of electronic spreadsheets in a written or oral presentation.

Key Concepts:

- Spreadsheet Creation:
 - Starting a new spreadsheet.
 - Saving and naming files.

- Formatting Tools:

- Cell formatting (e.g., font styles, sizes, colors).
- Number formatting (e.g., currency, percentages, dates).
- Alignment and text wrapping.
- Borders and shading.

- Styles and Themes:

- Applying pre-designed styles for tables and data.
- Using themes to ensure consistent design.
- Create a formatted spreadsheet (e.g., a budget or inventory list) using headings, borders, and consistent styles.
- Demonstrate the use of themes to enhance spreadsheet design.

Activity:

- a. In groups, learners explore spreadsheet programs (e.g., Microsoft Excel or Google Sheets) and analyse their basic functions.
- b. In groups learners create a new worksheet, and navigate through cells, rows, and columns and enter data.
- c. In pairs, learners create a simple budget worksheet. They enter data (e.g., expenses and income), format the worksheet by adjusting column widths, applying number formatting (e.g., currency, percentage), and changing font styles for better readability.
- d. In small groups, students are given a dataset and practice sorting it based on different criteria (e.g., alphabetical, numerical, date).
- e. In groups, learners use filters to display only relevant data based on specified conditions (e.g., filtering by date range or category).
- f. In pairs, learners create a report based on a dataset (e.g., sales data) and adjust the page layout by setting print areas, adding headers/footers, adjusting margins, and ensuring that the worksheet is appropriately organized for presentation.

Key Concepts:

- Basic Formulas:
 - Arithmetic operations (e.g., addition, subtraction, multiplication, division).
 - Cell references (e.g., relative, absolute).
- Common Functions:
 - SUM, AVERAGE, MIN, MAX.
 - COUNT, COUNTA, COUNTIF.
 - IF statements for conditional logic.
- Formula Auditing:
 - Tracing precedents and dependents.
 - Error checking and correction.

Activity:

- Create a spreadsheet that uses basic formulas and functions to calculate totals, averages, and conditional results.
 - a. In groups, learners explore and apply the basic formulas and functions in spreadsheet software, such as SUM, SUMIF, AVERAGE, AVERAGEIF, MIN, MAX, COUNT and COUNTIF functions to perform simple calculations and manipulation on a sample dataset.
 - b. In groups, learners use RANK, IF, VLOOKUP or HLOOKUP functions to retrieve insights from a large dataset.
 - c. In groups, learners will collaboratively consolidate data from multiple worksheets into a single worksheet using appropriate functions (e.g., SUM, AVERAGE) and tools like PivotTables.
 - d. In groups, learners exchange their spreadsheets with a peer for feedback.

Explain the purpose of each formula and function used.

Key Concepts:

- Data Organization:
 - Sorting and filtering data.
 - Using tables for structured data.
- Data Validation:
 - Setting validation rules (e.g., drop-down lists, number ranges).
 - Preventing invalid data entry.
- Data Import/Export:
 - Importing data from external sources (e.g., CSV files, databases).
 - Exporting data to different formats (e.g., PDF, CSV).

Activity:

- Organize a dataset using sorting, filtering, and tables.
- Apply data validation rules to a spreadsheet and test their effectiveness.

Key Concepts:

- Chart Types:
 - Bar, column, line, pie, and scatter charts.
 - Combo charts and secondary axes.
- Chart Formatting:

- Adding titles, labels, and legends.
- Adjusting colors, styles, and data points.
- Data Visualization Best Practices:
 - Choosing the right chart for the data.
 - Ensuring clarity and accuracy in visual representation.

Activity:

- Create a spreadsheet with at least two different types of charts.
- Explain why each chart type was chosen for the specific data set.

Key Concepts:

- Advanced Functions:
 - VLOOKUP, HLOOKUP, INDEX, MATCH.
 - IF, AND, OR for complex conditional logic.
 - Text functions (e.g., CONCATENATE, LEFT, RIGHT, MID).
 - Date and time functions (e.g., TODAY, NOW, DATEDIF).
- Array Formulas:
 - Performing multiple calculations with a single formula.
 - Using array constants and functions.

Activity:

- Create a spreadsheet that uses advanced formulas and functions to solve a complex problem (e.g., sales analysis, project tracking).

- Explain the purpose and logic behind each advanced formula used.

Activity:

- a. In groups, learners explore the different types of charts available in spreadsheet software (e.g., bar charts, line graphs, pie charts).
- b. In pairs, learners select data from their worksheet to create different types of charts (e.g., bar chart, line graph, pie chart) for visual representation. They format the charts by adjusting colors, labels, and titles for clarity and impact.
- c. In groups, learners customize the chart by modifying elements such as the title, axis labels, legends, data labels, and colors to improve clarity and presentation.
- d. In pairs, learners create a combination chart (e.g., a bar and line chart together) to compare two different types of data in one visualization. They customize each data series, adjusting colors and axis scales, to ensure the comparison is clear.
- e. In groups, learners analyze a complex dataset (e.g., customer feedback, survey results) and organize it using appropriate spreadsheet functions. They present their findings with formatted charts and a well- structured worksheet for efficient data interpretation.

S.6 Term 1

TOPIC 7: The Internet and Digital Communications (30 Periods)

TOPIC COMPETENCY:

The learner responsibly utilizes the internet and digital communication tools to safely and ethically exchange information.

Activity:

- a. In pairs, learners connect two devices via Bluetooth, USB etc. and transfer files. They discuss the steps taken, potential challenges, and how to ensure data security during the transfer.
- b. In groups, Learners remotely collaborate and share data using sharing methods, including screen mirroring, remote desktop access, and collaborative tools like AnyDesk and TeamViewer etc.
- c. In groups, learners are given specific scenarios (e.g., sharing large files with limited internet access). They identify and implement the best method for sharing data, such as using external storage or direct cable connection.
- d. In small groups, learners act as IT specialists who need to guide "clients" on how to share data between devices. They provide step-by-step instructions and explain the pros and cons of each method.

Key Concepts:

- Definition of the Internet: A global network of interconnected computers and servers that communicate using standardized protocols.
- Key Components:
 - Servers and Clients: Servers store and deliver data; clients request and display data.
 - Routers and Switches: Devices that direct data traffic between networks.
 - IP Addresses and DNS: IP addresses identify devices; DNS translates domain names to IP addresses.

- ISPs (Internet Service Providers): Companies that provide internet access to users.

Activity:

- Create a diagram illustrating the key components of the internet.
- Explain the role of each component in a written or oral presentation.

Key Concepts:

- Web Browsers: Software applications used to access and view websites (e.g., Chrome, Firefox, and Safari).
- URL Structure: Components of a URL (e.g., protocol, domain, path, and query).
- Navigation Tools:
 - Bookmarks and favorites.
 - History and cache.
 - Tabs and windows.

Activity:

- Demonstrate the use of a web browser to navigate to specific websites.
- Explain the structure of a given URL and its components.
 - a. In small groups, learners research and discuss the difference between the Internet and the WWW. They create a comparison chart that outlines the key functions and technologies of each, and present their findings to the class.
 - b. In small groups, learners use a web browser to search for specific information on the Internet. They identify and discuss the different types of web resources (e.g., websites, blogs, and online databases) and explain how they can be used for academic or professional purposes.

c. In small groups, learners perform a series of tasks using a search engine (e.g., Google). They explore advanced search techniques such as Boolean operators, filters, and quotation marks to refine their searches and find more relevant information.

Key Concepts:

- Email: Sending, receiving, and managing emails; understanding email etiquette.
- Instant Messaging: Real-time text communication (e.g., WhatsApp, Slack).
- Video Conferencing: Tools for virtual meetings (e.g., Zoom, Microsoft Teams).
- Social Media: Platforms for sharing information and networking (e.g., Facebook, LinkedIn, Twitter).

Activity:

- Send and receive emails using proper etiquette.
- Participate in a video conference and demonstrate effective communication skills.

Activity:

- a. In small groups, learners create an email account (if they don't have one) or use their existing account to organize their inbox using folders, filters, and labels. They demonstrate how to compose, send, and respond to emails professionally.
- b. In pairs, learners exchange emails on a given topic (e.g., applying for a job or requesting information). They practice using proper email etiquette, including subject lines, greetings, and concise messaging.
- c. In small groups, learners set up or review a professional social media profile on platforms like LinkedIn. They complete key sections, including the profile pICTure, bio, and professional summary, emphasizing appropriate and respectful communication.
- d. In small groups, learners role-play scenarios such as resolving a customer service issue via email or responding to negative comments on a social media post. They discuss the best practices for maintaining a professional tone and avoiding conflICTs.
- e. In groups, learners design a simple social media campaign for a fICTIONal cause or product. They create posts, schedule those using social media management tools, and discuss how to engage audiences effectively.

f. Individually, learners compose an email with attachments (e.g., documents, images) and practice formatting text (e.g., bold, italics, bullet points). They ensure the attachments are appropriately named and formatted for clarity.

g. In groups, learners analyze a real-world case study on the positive or negative effects of email or social media communication in a business or personal context. They present their findings and recommendations to the class.

Key Concepts:

- E-commerce:

- Definition and types (e.g., B2B, B2C, C2C).

- Key components (e.g., online stores, payment gateways, shopping carts).

- Online Transactions:

- Secure payment methods (e.g., credit cards, PayPal, cryptocurrencies).

- Understanding SSL/TLS encryption for secure transactions.

- Consumer Protection:

- Recognizing and avoiding online scams.

- Understanding return policies and buyer protection programs.

Activity:

- Create a list of secure online payment methods and explain their benefits.

- Demonstrate how to identify a secure e-commerce website.

Activity:

- d. In small groups, learners research popular e-commerce platforms (e.g., Amazon, eBay, Jumia) and identify the steps involved in purchasing products or services online. Each group presents their findings, focusing on features like product search, cart management, and checkout.
- e. Individually, learners navigate a trial e-commerce platform to simulate making an online purchase. They add items to the cart, enter trial payment details, and complete the transaction, ensuring all required fields are filled out correctly.
- f. In pairs, learners set up a demo account for a digital wallet (e.g., PayPal, or mobile money services). They practice transferring funds, making payments, and checking transaction histories.
- g. In groups, learners explore topics such as encryption, two-factor authentication, and secure payment gateways and create a poster or infographic explaining how these technologies work.

Online Collaboration Tools:

- Document sharing and co-editing (e.g., Google Docs, Microsoft Office Online).
- Project management tools (e.g., Trello, Asana).
- Communication and collaboration platforms (e.g., Slack, Microsoft Teams).

Activity:

- a. In pairs, learners explore popular virtual meeting platforms (e.g., Zoom, Microsoft Teams, and Google Meet) and create a comparison chart highlighting features like screen sharing, breakout rooms, and chat functions.
- b. Individually, learners schedule a mock virtual meeting, send invites using a calendar tool, and customize settings (e.g., enabling a waiting room, setting time limits).
- c. In groups, learners conduct a simulated virtual meeting with assigned roles (e.g., host, note-taker, and participant). They practice sharing their screen, managing time, and addressing technical issues.

d. In groups, learners participate in a troubleshooting **Activity** where they identify and resolve common virtual meeting issues (e.g., poor audio, frozen video, connectivity problems).

Key Concepts:

- Common Threats:
 - Malware, phishing, and ransomware.
 - Identity theft and fraud.
- Protection Measures:
 - Using strong passwords and two-factor authentication.
 - Installing and updating antivirus software.
 - Recognizing and avoiding suspicious links and emails.
- Privacy and Data Protection:
 - Understanding privacy settings on social media and other platforms.
 - Encrypting sensitive data.

Activity:

- Create a list of best practices for online safety and security.
- Demonstrate how to set up two-factor authentication on a given platform.

Activity:

a. In groups, learners analyze real-life scenarios involving **ICT** ethics, such as data breaches or intellectual property violations. Each group discusses the ethical dilemmas and proposes solutions, presenting their findings to the class.

- b. Learners take on roles (e.g., IT manager, employee, and consumer) in a trial (imaginary) situation where ethical decisions must be made (e.g., handling user data). They debate the options and explain the ethical implications of their choices.
- c. In groups, learners simulate responding to a cyber-security breach (e.g., compromised email account). They draft a response plan and present how they would mitigate risks and prevent future incidents.
- d. Individually, learners research common cyber threats (e.g., phishing, malware, ransom ware). They create a short presentation or infographic explaining the threat, its impact, and how to prevent it
- e. Learners participate in a hands-on **Activity** where they adjust the privacy settings of their social media accounts to enhance security.
- f. Learners analyze real-life examples of online transaction scams (e.g., phishing, fake websites). In small groups, they create a list of warning signs and develop strategies to avoid becoming a v**ICT**im of online fraud.

S.6 Term 1

TOPIC 8: Electronic Publication (30 Periods)

TOPIC COMPETENCY:

The learner develops professional electronic publications to effectively convey information and ideas.

1. Electronic Publishing Software

- Adobe InDesign: Industry-standard for professional layouts (e.g., brochures, magazines).
- Microsoft Publisher: User-friendly for small businesses/educators (flyers, newsletters).
- Canva: Web-based tool with drag-and-drop templates for quick designs.
- Scribus: Free, open-source software for basic to intermediate projects.
- QuarkXPress: Advanced features for print/digital publishing.

2. Microsoft Publisher Interface

- Ribbon Tabs: Home (basic formatting), Insert (shapes/images), Page Design (themes/templates).
- Backstage View (File tab): Save, export, print, and adjust settings.
- Workspace: Central canvas for designing pages.
- Rulers/Guides: Align objects precisely.
- Status Bar: Zoom, page navigation, and view options.

3. Designing Templates for Flyers/Brochures

- Step 1: Select a pre-built template (File > New) or start blank.
- Step 2: Modify placeholders (text/images) and branding (colors/fonts).

- Step 3: Save as a template (.pub file) for reuse.

4. Page Size Adjustments

- Page Setup (Page Design tab): Choose preset sizes (A4, letter) or customize.
- Orientation: Portrait (vertical) vs. Landscape (horizontal).
- Margins: Adjust under "Page Design" > "Margins."

5. Working with Shapes

- Insert Tab: Add rectangles, arrows, or icons.
- Formatting: Adjust fill color, outline, shadows (Shape Format tab).
- Alignment: Use guides or "Align" tools for precision.

6. Working with Images

- Insert Tab: Upload images from files/online sources.
- Adjustments: Crop, resize, apply filters.
- Text Wrapping: Choose "Wrap Text" options (e.g., square, tight).

7. Text Formatting

- Font Tools (Home tab): Change size, color, style (bold/italic).
- Paragraph Settings: Alignment, line spacing, bullets.
- Text Boxes: Create/resize using Insert > Text Box.

8. Layout Tools

- Grids/Guides: Enable under "View" tab for alignment.

- Grouping: Select multiple objects > right-click > Group.
- Layers: Right-click objects to arrange (Bring Forward/Send Backward).

Activity:

- a. In groups, learners explore the interface of various electronic publishing software (e.g., Microsoft Publisher, Adobe InDesign, Canva).
- b. In groups, learners create a new document and identify basic layout options, page size settings, and margin configuration tools.
- c. In pairs, learners apply appropriate predefined templates to create a flyer or brochure for an event.
- d. In groups, learners adjust the page size (e.g., A4, letter size, custom size) and the page orientation (portrait/landscape) to match the document's requirements (e.g., a report, flyer, or poster).
- e. In groups, learners explore the key features of electronic publishing software (e.g., text formatting, image insertion, shapes, and layout tools) by opening a new document and experimenting with these features to create a simple digital publication (e.g., flyer or newsletter).

In groups, learners exchange their documents with peers and provide feedback on the layout and formatting, focusing on whether the page size, orientation, margins, and overall design are appropriate for the document's purpose.

1. Creating Multi-Page Brochures/Catalogs

- Add Pages: Insert > Page (choose blank or duplicate existing).
- Master Pages (View > Master Page): Design headers/footers, logos, or page numbers for consistency.
- Sections: Divide documents into parts (e.g., catalog categories).

2. Applying Themes & Layout Features

- Themes (Page Design tab): Apply predefined color/font schemes.
- Style Sets: Save custom themes for reuse.

- Layout Guides: Set columns/grids under "Page Design" > Guides.

3. Cross-Page Consistency

- Repeating Elements: Use master pages for logos, contact info.
- Page Numbers: Insert > Page Number (auto-updates).
- Content Flow: Link text boxes across pages for long text (Format > Connect Text Boxes).

4. Catalog Design Tips

- Consistent Formatting: Use the same font sizes/image styles.
- Hierarchy: Highlight key sections with headings/color blocks.
- White Space: Avoid clutter; balance text and visuals.

5. Exporting & Printing

- Export as PDF: File > Export > PDF for digital sharing.
- Bleed Settings: Extend images beyond page edges for professional printing.
- Preview: Check print layout under File > Print

Activity:

- a. In pairs, learners create a promotional flyer for a **fICTIONal** event or business using the software's built-in templates.
- b. In pairs, learners create a digital poster for a school event or community initiative, integrating images, shapes, and other visual elements like icons or borders.
- c. In pairs, learners create a multi-page document (e.g., a brochure or catalog) by applying consistent styles, themes, and layout features across pages.

d. In groups, learners exchange their digital publications with a peer for review. They provide feedback on the design elements used (e.g., layout, colors, text formatting, images), focusing on whether the design effectively communicates the intended message and is visually appealing.

In groups, learners present their final digital publication to the class, explaining the design choices made, the message they aimed to communicate, and how they used the software's features to enhance their publication.

S.6 Term 2

TOPIC 9: Electronic Databases (48 Periods)

TOPIC COMPETENCY:

The learner designs, creates, and manages electronic databases to ensure efficient data organization, storage, and retrieval.

1. Introduction to Electronic Databases

- Definition: An electronic database is a structured collection of data stored and accessed electronically.
- Types of Databases:
 - Relational (e.g., MySQL, PostgreSQL)
 - NoSQL (e.g., MongoDB, Cassandra)
 - Graph (e.g., Neo4j)
 - Object-Oriented (e.g., db4o)
- Importance: Databases are critical for data storage, retrieval, and analysis in industries like healthcare, finance, e-commerce, and education.
- 2.1. Understanding Database Concepts
 - Data models (relational, hierarchical, network, object-oriented).
 - Database objects
 - Database schemas (conceptual, logical, and physical).
 - Keys (primary, foreign, composite) and indexing.

Activity:

- a. In small groups, learners find information and compare popular database management software (e.g., PostgreSQL, Microsoft Access, MySQL, and SQLite).
- b. In groups, learners analyze scenarios (e.g., managing school records, tracking inventory) and select the most suitable database management software.
- c. In pairs, learners navigate a database management program to identify key objects.
- d. In groups, learners create a new flat database incorporating all database objects.

1. Creating a Simple Database

- Define Tables:

- Use database software (e.g., Microsoft Access, LibreOffice Base).
- Create tables with fields (columns) for data categories (e.g., 'CustomerID', 'Name', 'Email').

- Assign Data Types:

- Choose appropriate types (e.g., Text, Number, Date/Time, Boolean) for each field.
- Example: Use 'Number' for prices, 'Date' for order dates.

- Set Primary Key:

- Designate a unique identifier (e.g., 'EmployeeID') to prevent duplicate records.

2. Entering, Updating, and Retrieving Records

- Data Entry:

- Input records directly into table rows.
- Use forms for user-friendly data entry (see §6).

- Updating Records:

- Edit existing entries via tables or forms.
- Use Update Queries to modify multiple records at once.

- Retrieving Records:

- Apply filters (e.g., sort by date, filter by category).
- Use simple SELECT queries to fetch specific data (e.g., `'SELECT * FROM Customers WHERE City="London"'`).

3. Importing Data from External Sources

- File Formats: Import from Excel, CSV, or text files.

- Steps:

1. Use Import Wizard (e.g., in Access: `*External Data > Import*`).
2. Map source columns to database fields.
3. Validate data types post-import.

4. Validating Data Accuracy and Integrity

- Validation Rules:

- Set field constraints (e.g., `'Price > 0'`, `'Email LIKE "*"@*.*"'`).
- Use input masks (e.g., phone numbers: `'() -'`).

- Review Practices:

- Check for duplicates (e.g., using Find Duplicates Query).
- Verify consistency (e.g., dates in `'MM/DD/YYYY'` format).

5. Creating and Running Simple Queries

- Query Types:

- Select Query: Retrieve data (e.g., `SELECT ProductName, Price FROM Products`).
- Parameter Query: Prompt users for input (e.g., `Enter Start Date:`).
- Criteria: Use operators (`=`, `>`, `AND`, `OR`) to filter results.

6. Designing Data Entry Forms

- Form Wizard: Auto-generate forms from tables.
- Customization:
 - Add labels, buttons, and dropdowns.
 - Set form properties (e.g., default values, input validation).

7. Generating Simple Reports

- Report Wizard: Create summaries (e.g., sales by region).
- Formatting:
 - Group data (e.g., by category or date).
 - Add totals, headers, and footers.

Activity:

- Individually, learners follow a guided tutorial to create a new database using a database management program (e.g., Microsoft Access, LibreOffice Base).
- In pairs, learners accurately design a database table for given data (e.g., learner's records, product inventory) with appropriate data types.

- c. In pairs, learners design an interface for data entry for the designed database table.
- d. In small groups, learners review and validate data to ensure the database maintains accuracy and integrity.
- e. In pairs, learners populate a database table with the given data.
- f. In pairs, learners import data from external sources.
- g. In pairs, learners are given a scenario where specific records in the database need to be updated (e.g., correcting errors, updating prices, or changing contact details).
- h. In groups, learners create and run simple queries to retrieve specific data.
- i. In groups, learners generate simple reports.
- j. In groups, Learners exchange their databases with a peer and review each other's work.
- k. Individually, learners present their completed database to the class, demonstrating how they created, updated, retrieved, and organized records.

1. Creating and Managing Relationships

- Types of Relationships:

- One-to-Many: A customer (one) can place multiple orders (many).
- Many-to-Many: Use a junction table (e.g., `Orders\_Products`).

- Steps:

1. Open Relationships Window (Access: *Database Tools > Relationships*).
2. Drag and drop keys to link tables.
3. Enforce referential integrity (cascade update/delete if needed).

2. Primary Key and Foreign Key

- Primary Key: Unique identifier in a table (e.g., `ProductID`).
- Foreign Key: Field in one table linking to a primary key in another (e.g., `CustomerID` in `Orders` links to `CustomerID` in `Customers`).

Activity:

- a. In pairs, learners explore a pre-designed database with multiple related tables. They identify how tables are connected through primary and foreign keys and discuss the purpose of these relationships.
- b. In groups, learners create a new table in a database.
- c. In small groups, learners create two or more related tables in a database (e.g., "Students" and "Courses").
- d. In groups, learners establish table relationships visually.
- e. In pairs, learners analyze different types of relationships (e.g., one-to-one, one-to-many, and many-to-many) by creating examples in a database.
- f. In small groups, learners create queries that retrieve data from multiple related tables (e.g., retrieving student names and their enrolled courses).
- g. In groups, learners exchange their relational databases with a peer for review.
- h. In groups, learners present their relational database designs to the class, explaining the purpose of each table, the primary and foreign keys used, and how the relationships facilitate efficient data management.

S.6 Term 3

TOPIC 10: AI and Related Emerging Technologies (30 Periods)

TOPIC COMPETENCY:

The learner applies artificial intelligence and emerging technologies to develop innovative solutions for everyday challenges

1. Introduction to AI and Emerging Technologies

- Definition: Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions.
- Emerging Technologies:
 - Machine Learning (ML), Deep Learning (DL).
 - Natural Language Processing (NLP).
 - Computer Vision.
 - Internet of Things (IoT).
 - Blockchain, Quantum Computing.
- Importance: AI and emerging technologies are transforming industries like healthcare, finance, transportation, and education by enabling automation, predictive analytics, and intelligent decision-making.

2. Core Competencies

- 2.1. Foundations of AI
 - Understanding AI concepts (e.g., supervised, unsupervised, and reinforcement learning).
 - Overview of algorithms (e.g., linear regression, decision trees, neural networks).

- 2.3. Natural Language Processing (NLP)

- Text preprocessing, sentiment analysis, and language translation.
- Tools like NLTK, SpaCy, and Hugging Face Transformers.

- 2.4. Computer Vision

- Image classification, object detection, and facial recognition.
- Frameworks like OpenCV and YOLO.

- 2.5. Integration with Emerging Technologies

- Combining AI with IoT for smart systems.
- Using blockchain for secure AI applications.

3. Integration Activities

Integration activities help students apply AI and emerging technologies in real-world scenarios, connecting theory to practice.

3.3. **Activity:** Smart Home System with IoT and AI

- Objective: Develop a smart home system using IoT and AI.
- Steps:
 1. Set up IoT devices (e.g., sensors, cameras) using platforms like Arduino or Raspberry Pi.
 2. Collect data from sensors (e.g., temperature, motion).
 3. Use AI to analyze data and make decisions (e.g., adjust thermostat, detect intruders).
- Integration:
 - Connect IoT devices to a cloud platform (e.g., AWS IoT, Google Cloud IoT).

- Use AI models to process data and send commands back to devices.

3.4. **Activity:** Image Recognition with Computer Vision

- Objective: Build an image recognition system.
- Steps:
 1. Collect and preprocess image data (e.g., resize, normalize).
 2. Train a convolutional neural network (CNN) using TensorFlow or PyTorch.
 3. Deploy the model to classify images in real-time.
- Integration:
 - Use OpenCV to capture live video feed from a webcam.
 - Integrate the model into a mobile app using TensorFlow Lite.

3.5. **Activity:** Blockchain for Secure AI Applications

- Objective: Use blockchain to secure AI model training and data sharing.
- Steps:
 1. Set up a blockchain network using Ethereum or Hyperledger.
 2. Store AI model weights or data hashes on the blockchain.
 3. Use smart contracts to manage access and updates.
- Integration:
 - Combine with an AI application (e.g., pred**ICT**ive model) to ensure data integrity and transparency.

Activity:

- a. In small groups, learners research and present applications of AI, such as machine learning, natural language processing (NLP), and computer vision.
- b. In groups, learners explore AI-powered tools (e.g., Chatbot, facial recognition apps) and identify how machine learning, NLP, or computer vision is used in these tools.
- c. In pairs, learners debate the ethical considerations of AI in specific contexts (e.g., surveillance, hiring algorithms).
- d. In small groups, learners analyze case studies of organizations that have implemented AI technologies. They identify which AI concepts were used, the benefits achieved, and the challenges faced.
- e. In groups, learners role-play as AI developers, users, or critics. They discuss a scenario (e.g., deploying AI in healthcare) and evaluate its applications, benefits, limitations, and ethical considerations.
- f. Individually, learners propose a hypothetical AI application addressing a specific problem (e.g., language barriers, object detection). They explain which AI concepts would be used, their benefits, and potential ethical challenges.
- g. Learners interact with AI simulation tools (e.g., TensorFlow Playground, AI-based games) to visualize how machine learning and other AI concepts work in practice. They reflect on how adjustments in parameters impact results.
- h. Learners test the limitations of an AI application (e.g., image recognition software or language translation tools). They document instances where the AI fails or produces errors and propose potential improvements.
- i. In groups, learners draft ethical guidelines for the use of AI in a chosen field (e.g., education, healthcare, or business). They discuss potential risks and propose solutions to address them responsibly.

Activity:

- a. Individually, learners interact with generative AI platforms (e.g., ChatGPT, DALL·E, MidJourney) to explore their capabilities. They experiment with generating text, images, or other content and document their observations about the quality and limitations of the outputs.

- b. In pairs, learners create and test different prompts for generating specific outputs (e.g., a story, a technical explanation, or a unique image). They compare results to identify what makes prompts effective or ineffective.
- c. In groups, learner's research and present real-world use cases of generative AI, such as in marketing, education, or healthcare. They evaluate the benefits, limitations, and ethical implications of these applications.
- d. Individually, learners identify a real-world problem (e.g., automating report writing or generating personalized learning materials) and develop a solution using generative AI. They test and refine prompts to optimize outputs
- e. In small groups, learners intentionally challenge a generative AI system by providing ambiguous, misleading, or complex prompts. They analyze the system's failures or limitations and discuss how these might impact its practical use.
- f. In groups, learners debate ethical concerns around generative AI, such as copyright issues, misinformation, and biases. They propose guidelines for the responsible use of generative AI in professional and personal contexts.
- g. Learners analyze a case study of an organization or project that used generative AI innovatively. They identify the strategies used for prompt creation, evaluate the outcomes, and discuss what could be improved.
- h. In groups, learners collaboratively create a project (e.g., an AI-generated magazine or a marketing campaign) using generative AI. They document their workflow, including prompt strategies and iterations, and present their final outputs.
- i. Learners participate in a challenge where they are given a specific output goal (e.g., generating a high-quality image or a cohesive story). They compete to create the most effective prompt and explain their strategies.
- j. Facilitated by the instructor, learners discuss the strengths and weaknesses of generative AI outputs they've created. They reflect on what worked well, what didn't, and how their prompt strategies evolved during the process.
- k. In groups, learners craft prompts to create diverse texts, videos and images using generative AI tools like ChatGPT, MidJourney and MetaAI.

Activity:

- a. Individually, learners research one of the emerging technologies (e.g., blockchain, IoT, quantum computing, AR/VR) and prepare a detailed report on how it is currently impacting or could impact a specific industry (e.g., healthcare, finance, education).
- b. In groups, learners select an industry (e.g., agriculture, entertainment, retail) and analyze how emerging technologies such as IoT or AR/VR could transform that industry.
- c. Learners participate in a debate on the ethical implications of emerging technologies.
- d. Individually or in pairs, learners conduct a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) for one of the emerging technologies.
- e. Learners analyze case studies of companies or organizations that have implemented emerging technologies (e.g., Amazon using IoT for logistics or healthcare using AR/VR for patient care). They evaluate the success or failure of these implementations and present their analysis to the class.
- f. Learners are given a specific industry challenge (e.g., supply chain inefficiencies, energy waste in manufacturing) and tasked with proposing a solution using one or more emerging technologies. They present their solutions and justify their technological choices.
- g. Learners simulate the implementation of an emerging technology in a chosen industry (e.g., implementing blockchain in finance for secure transactions). They role-play different stakeholders (e.g., business owners, consumers, regulators) and discuss the benefits and challenges of adoption.