



Computer Fundamentals

Complete study notes — how computers work inside, data and number systems, operating systems, files, office tools, the internet, networking, cyber safety and your first steps in programming.

10

Modules

50+

Diagrams & tables

200+

Questions & MCQs



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How to use these notes

Keep a computer or phone beside you while you read. Every module has hands-on activities — try them as you go. This course assumes no prior knowledge: each idea is explained from zero.

Blue box — Key idea. The one thing to remember from that part.

Yellow box — Rule or formula. Facts and conversions to learn.

Green box — Try it. Practical steps and handy tips.

Orange box — Caution. Common mistakes and safety points.

Worked example. Follow the steps, then try it yourself.

Practice.
Questions at the end of every module.

Introduction to Computers

What a computer is, how it processes information, a short history from the abacus to AI, the generations and types of computers, and where computers are used today.

1.1 What is a computer?

A **computer** is an electronic machine that accepts data (**input**), processes it according to a set of instructions called a **program**, stores data and results, and produces useful information (**output**). The word comes from "compute", meaning to calculate — early computers were built mainly to do arithmetic — but modern computers also process text, pictures, sound, video and much more.

Every computer, from a smartwatch to a supercomputer, follows the same basic cycle, called the **IPOS cycle**: **I**ntput → **P**rocess → **O**utput, with **S**torage used throughout.

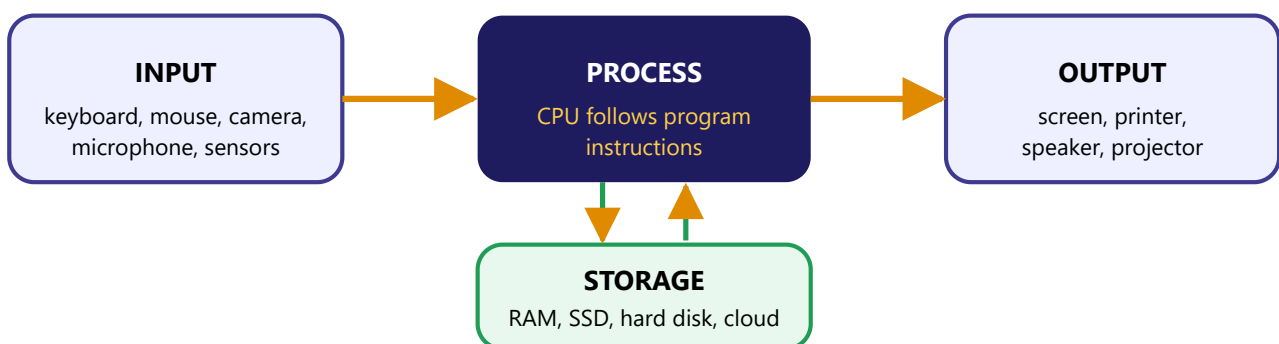


Figure 1.1 — The Input–Process–Output–Storage (IPOS) cycle.

Example — the IPOS cycle at an ATM

Input: you insert your card and type your PIN and the amount. **Process:** the computer checks the PIN, checks your balance with the bank's server, and calculates the new balance. **Storage:** the transaction is recorded in the bank's database. **Output:** cash, a receipt and an SMS.

1.2 Data versus information

Data are raw facts and figures with no context: 72, 85, 91, "Riya". **Information** is data that has been processed and organised so that it is meaningful: "Riya's average score is 82.7 — Grade

A". Computers turn data into information.

1.3 Characteristics of computers

Characteristic	Meaning
Speed	Modern processors perform billions of operations per second (measured in GHz and in FLOPS for scientific work).
Accuracy	Computers do exactly what they are told. Errors almost always come from wrong data or wrong programs — "garbage in, garbage out" (GIGO).
Diligence	They never get tired or bored; the millionth calculation is as accurate as the first.
Storage	They can store huge amounts of data — terabytes on a single drive — and retrieve it in moments.
Versatility	The same machine can write letters, edit photos, play music, run businesses and control robots, just by changing the program.
Automation	Once started, a program runs without human help.

Computers also have **limitations**: they have no common sense, feelings or judgement of their own (even AI systems work from patterns in data); they depend on electricity; and they can only do what they are programmed to do.

1.4 A short history of computing

Period	Development
~2500 BC onwards	Abacus — beads on rods for counting; still used to teach mental arithmetic.
1617	Napier's bones — rods for multiplication (John Napier, also the inventor of logarithms).
1642	Pascaline — Blaise Pascal's mechanical adding machine.
1801	Jacquard loom — used punched cards to control weaving patterns: an early "program".
1822–1837	Charles Babbage designed the Difference Engine and the Analytical Engine , with a "mill" (processor) and "store" (memory). He is called the father of the computer .
1843	Ada Lovelace wrote an algorithm for the Analytical Engine — often called the first computer programmer .

1890	Herman Hollerith's punched-card tabulator processed the US census; his company later became IBM.
1936	Alan Turing described the "Turing machine" — the theory behind all computers. He is called the father of computer science and AI.
1946	ENIAC — one of the first general-purpose electronic computers: 18,000 vacuum tubes, about 27 tonnes.
1947–1960s	Transistors, then integrated circuits (ICs) make computers smaller, faster and cheaper.
1971	Intel 4004 — the first commercial microprocessor (a whole CPU on one chip).
1981–1990s	Personal computers (IBM PC, Apple Macintosh), Windows, the World Wide Web (1989–91).
2007 onwards	Smartphones, cloud computing, social media.
2020s	Artificial intelligence and large language models become everyday tools.

1.5 Generations of computers

Generation	Period (approx.)	Technology	Features	Examples
First	1940–1956	Vacuum tubes	Huge, hot, unreliable, used machine language; punched cards	ENIAC, UNIVAC
Second	1956–1963	Transistors	Smaller, faster, less heat; assembly language, early high-level languages (FORTRAN, COBOL)	IBM 1401
Third	1964–1971	Integrated circuits (ICs)	Keyboards and monitors; operating systems; multiprogramming	IBM System/360
Fourth	1971–present	Microprocessors (VLSI)	Personal computers, GUIs, networks, internet, mobile devices	PCs, laptops, smartphones
Fifth	Present and future	AI, parallel processing, quantum research	Natural-language understanding, machine learning, robotics	AI assistants, self-driving research

1.6 Types of computers

By size and power

Type	Description	Typical use
Supercomputer	The fastest computers, with thousands to millions of processor cores working in parallel	Weather forecasting, climate models, space research, nuclear simulation. India's PARAM series (C-DAC) and systems like Pratyush and Mihir are used for weather and climate.
Mainframe	Very reliable, handles huge numbers of simultaneous transactions	Banks, railway reservations, insurance, airlines
Server	Provides services (websites, email, files, databases) to other computers over a network	Data centres, company networks, cloud services
Workstation	Powerful single-user computer with strong graphics	Engineering design, video editing, 3D animation
Personal computer (PC)	Desktop or laptop for one user	Office, education, home
Mobile devices	Smartphones and tablets — complete computers in a pocket	Communication, apps, payments, photos
Embedded computer	A small computer built into another device, doing one job	Washing machines, cars, ATMs, smart TVs, medical devices

By how they process data

- **Analog computers** work with continuously varying quantities (voltage, pressure).
Examples: old speedometers, analog thermometers.
- **Digital computers** work with discrete values — ultimately 0s and 1s. Almost all modern computers are digital.
- **Hybrid computers** combine both — e.g. hospital ICU machines that measure analog signals (heartbeat) and process them digitally.



Figure 1.2 — From supercomputers to smartphones: all follow the same IPOS cycle.

1.7 Where computers are used

Field	Examples
Education	Online classes, e-books, AI tutors, digital attendance, results portals, virtual labs
Banking & finance	ATMs, net banking, UPI payments, stock trading, fraud detection
Healthcare	Electronic health records, CT/MRI scanners, telemedicine, lab reports, AI-assisted diagnosis
Government (e-governance)	Aadhaar, DigiLocker, online tax filing, e-tendering, land records
Business	Accounting, billing, inventory, e-commerce, digital marketing
Transport	IRCTC ticketing, GPS navigation, air-traffic control, FASTag toll collection
Communication & media	Email, messaging, video calls, social media, news, OTT streaming
Science & engineering	Simulation, CAD design, space missions (ISRO), weather forecasting
Agriculture	Weather advisories, soil-health data, market prices, drones
Entertainment	Games, animation, music production, films

1.8 Hardware, software and people

A working computer system has several parts:

- **Hardware** — the physical parts you can touch: CPU, memory, keyboard, screen (Module 2).
- **Software** — the programs that tell the hardware what to do (Module 4).
- **Data** — the raw material the system processes.
- **People (users)** — who operate, program and maintain it.
- **Procedures** — the rules and steps for using it correctly.

Key idea

Hardware is the body; software is the mind. Neither is useful without the other.

1.9 Starting and shutting down a computer correctly

1. Switch on the mains and the UPS (if any), then press the computer's power button.
2. The computer runs a quick self-check (**POST** — power-on self-test), then loads the operating system from storage into memory. This is called **booting**.
3. Log in with your username and password (or PIN / fingerprint).
4. To switch off: save your work, close programs, then use **Start** → **Power** → **Shut down**.
Never switch off at the wall while the computer is running — you can lose data or damage the operating system.

Try it

Note the difference between **Shut down** (everything closes), **Restart** (shut down and start again — fixes many problems), **Sleep** (low-power pause; resumes instantly) and **Hibernate** (saves memory to disk and powers off).

Module 1 — Summary

- A computer accepts input, processes it by a program, stores it and gives output (IPOS).
- Data = raw facts; information = processed, meaningful data.
- Characteristics: speed, accuracy (GIGO), diligence, storage, versatility, automation.
- History: abacus → Babbage (father of computer) → Ada Lovelace → Turing → ENIAC → microprocessor → PCs → smartphones → AI.
- Generations: vacuum tubes → transistors → ICs → microprocessors → AI.
- Types: supercomputer, mainframe, server, workstation, PC, mobile, embedded; analog/digital/hybrid.

Practice questions — Module 1

1. Define a computer and explain the IPOS cycle with an example of your own.
2. Distinguish between data and information with two examples.
3. What does GIGO mean?
4. Who is called the father of the computer, and why?
5. List the five generations of computers and the main technology of each.
6. Give two uses each of supercomputers, mainframes and embedded computers.
7. What is booting? What is POST?
8. Why should a computer be shut down properly instead of switching off the power?

Computer Hardware: Inside the Machine

The CPU, memory, storage, motherboard and power supply; input and output devices; how the parts work together; and how to read a computer's specification.

2.1 The block diagram of a computer

The basic design used by almost every computer was described by John von Neumann in 1945. A program and its data are both kept in memory; a central processing unit fetches instructions one by one and executes them. The parts are connected by electrical pathways called **buses**.

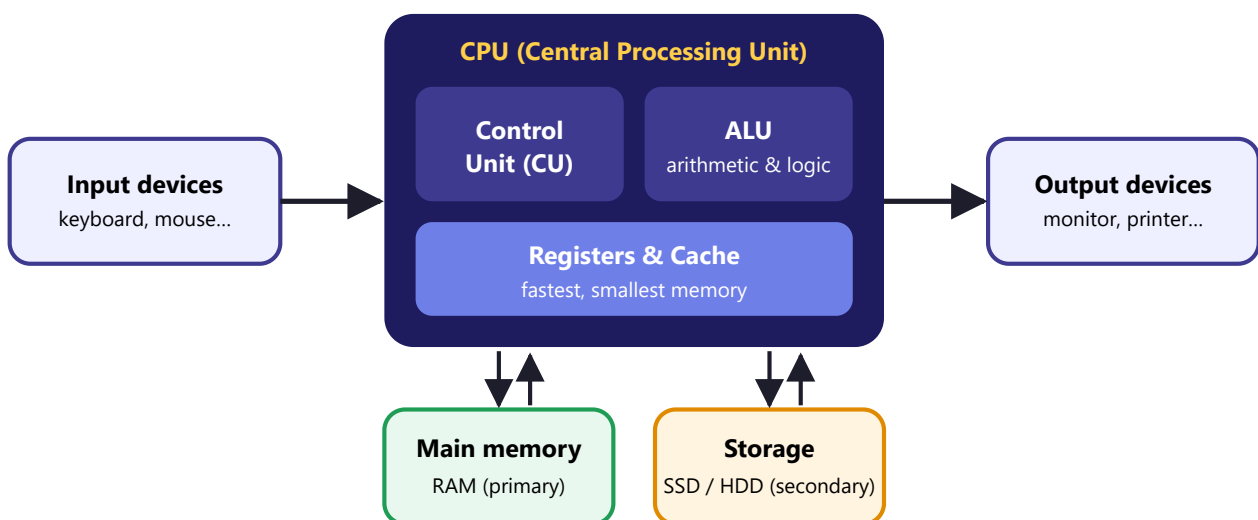


Figure 2.1 — Block diagram of a computer (von Neumann architecture).

2.2 The CPU — the brain

The **Central Processing Unit**, or **processor**, carries out the instructions of programs. Physically, it is a chip about the size of a postage stamp containing billions of transistors. It has three main parts:

- **Control Unit (CU):** fetches instructions from memory, decodes them, and directs the other parts — like a traffic police officer.
- **Arithmetic Logic Unit (ALU):** performs calculations (+, −, ×, ÷) and logical comparisons (greater than, equal to, AND, OR).
- **Registers:** tiny, extremely fast storage locations inside the CPU that hold the instruction and data being worked on right now.

The machine cycle (fetch–decode–execute)

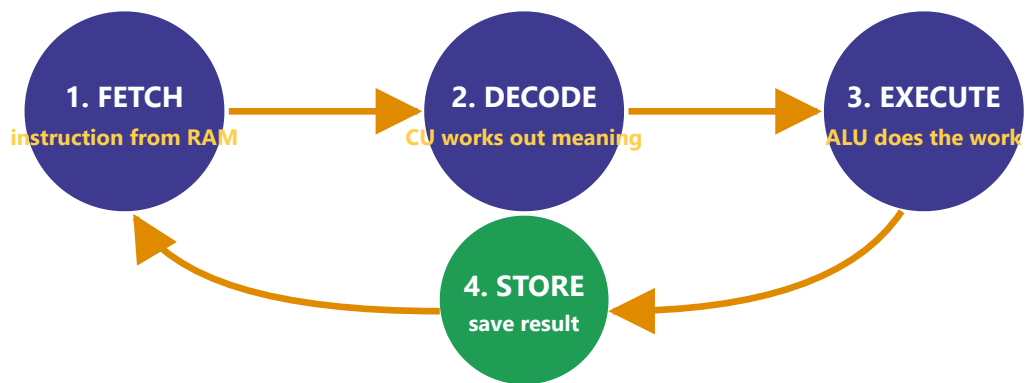


Figure 2.2 — The machine cycle repeats billions of times per second.

What makes a CPU fast?

Feature	Meaning
Clock speed	Cycles per second, in gigahertz (GHz). 3 GHz = 3 billion cycles/second.
Cores	Independent processing units on one chip. A quad-core CPU can run four tasks truly at the same time.
Threads	Many cores can run two instruction streams each (hyper-threading / SMT).
Cache	Small, very fast memory on the CPU (L1, L2, L3) that keeps frequently used data close.
Architecture / generation	Newer designs do more work per cycle. A new 2.5 GHz CPU can beat an old 3.5 GHz one.
Word size	Bits processed at once — modern CPUs are 64-bit.

Common desktop/laptop CPU families include Intel Core (i3/i5/i7/i9, Core Ultra) and AMD Ryzen (3/5/7/9); phones and many new laptops use ARM-based chips (Qualcomm Snapdragon, MediaTek, Apple M-series). A **GPU** (graphics processing unit) has thousands of small cores for graphics, video and AI calculations.

2.3 Memory

Memory is where a computer keeps the data and instructions it is working on. It is organised in a **hierarchy**: the faster the memory, the smaller and more expensive it is.

Faster, costlier,
smaller ↑

Slower, cheaper,
larger ↓

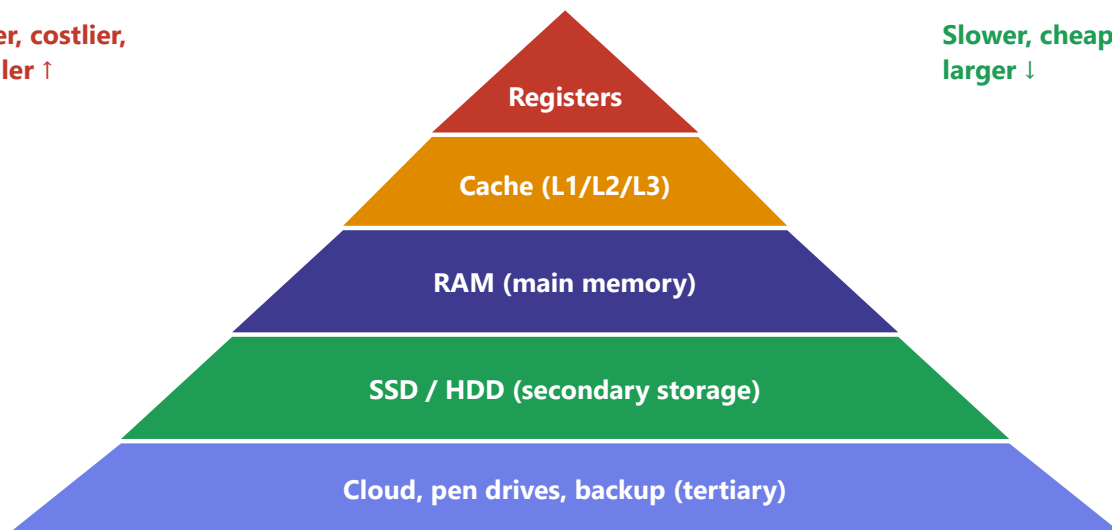


Figure 2.3 — The memory hierarchy.

Primary memory: RAM and ROM

Feature	RAM (Random Access Memory)	ROM (Read-Only Memory)
Purpose	Holds the OS, open programs and data currently in use	Holds permanent start-up instructions (firmware — BIOS/UEFI)
Volatile?	Yes — contents lost when power goes off	No — contents kept without power
Read/write	Read and write	Mainly read (modern flash ROM can be updated)
Size (typical PC)	8–32 GB	A few MB
Types	DRAM (DDR4, DDR5, LPDDR), SRAM (used in cache)	PROM, EPROM, EEPROM, flash

Key idea — why RAM matters

RAM is the computer's "work desk". A bigger desk lets you keep more books open at once. With too little RAM, the computer must keep swapping data to the much slower storage drive, and everything slows down. For everyday use today, 8 GB is the practical minimum and 16 GB is comfortable.

2.4 Secondary storage

Secondary storage keeps programs and files permanently (it is **non-volatile**).

Device	How it stores data	Typical capacity	Pros / cons
Hard disk drive (HDD)	Magnetic coating on spinning platters, read by a moving head	500 GB – 20 TB	Cheap per GB; slower, noisy, sensitive to shocks
Solid-state drive (SSD)	Flash memory chips, no moving parts	256 GB – 8 TB	Many times faster, silent, rugged; costlier per GB. NVMe SSDs are fastest.
Pen drive / USB flash	Flash memory	16 GB – 1 TB	Portable; easy to lose; can carry viruses
Memory card (SD / microSD)	Flash memory	16 GB – 1 TB	Phones, cameras
Optical disc (CD/DVD/Blu-ray)	Laser reads pits on a disc	700 MB / 4.7 GB / 25–100 GB	Now rarely used
Cloud storage	Files stored on remote servers over the internet	Free tiers to many TB	Accessible anywhere; needs internet; privacy considerations

Try it — see your own hardware

On Windows, press **Windows + Pause** (or open **Settings** → **System** → **About**) to see your processor and RAM. Open **Task Manager** (Ctrl + Shift + Esc) → **Performance** to watch CPU, memory and disk usage live.

2.5 The motherboard and other internal parts

- **Motherboard:** the main circuit board that connects everything — it holds the CPU socket, RAM slots, storage connectors (SATA, M.2), expansion slots (PCIe) and ports.
- **Chipset:** controls communication between the CPU, memory and devices.
- **BIOS/UEFI firmware:** start-up software stored on a chip on the motherboard.
- **CMOS battery:** a coin cell that keeps the clock and settings when the PC is unplugged.
- **SMPS (power supply):** converts 230 V AC into the low DC voltages (12 V, 5 V, 3.3 V) the components need.
- **Cooling:** heat sinks and fans (or liquid cooling) remove heat from the CPU and GPU.
- **Graphics card (GPU):** built into the CPU (integrated) or a separate card (dedicated) for gaming, design and AI.

- **Network card:** Ethernet port and/or Wi-Fi and Bluetooth.

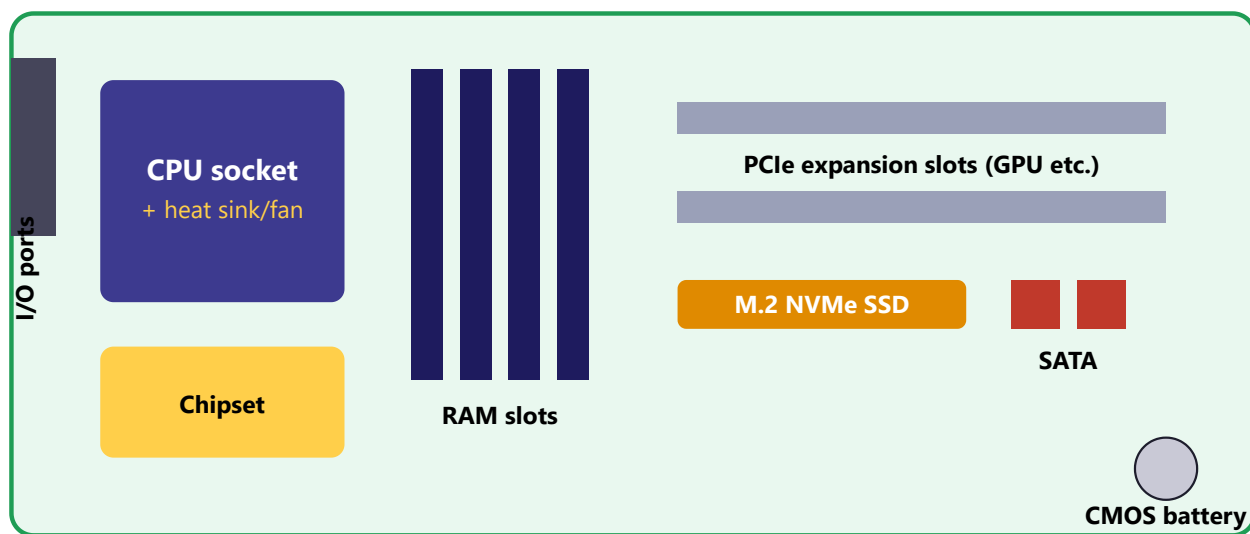


Figure 2.4 — Simplified layout of a desktop motherboard.

2.6 Input devices

Device	Use
Keyboard	Typing text and commands; QWERTY layout; function keys, shortcuts
Mouse / touchpad	Pointing, clicking, dragging, scrolling
Touchscreen	Tap, swipe, pinch on phones, tablets, kiosks
Scanner	Converts paper documents and photos into digital images
Microphone	Voice input, calls, voice typing, voice assistants
Webcam / camera	Video calls, photos, face recognition
Barcode / QR reader	Shops, libraries, warehouses, UPI payments
Biometric scanner	Fingerprint, iris, face — Aadhaar authentication, attendance
OMR / OCR / MICR	Reading exam answer sheets (OMR), converting printed text to editable text (OCR), reading cheque codes (MICR)
Joystick / game controller, graphics tablet, sensors	Games, drawing, measuring temperature, light, motion

2.7 Output devices

Device	Details
Monitor	LCD/LED or OLED. Key specs: size (diagonal, inches), resolution (e.g. 1920 × 1080 Full HD, 3840 × 2160 4K), refresh rate (Hz)
Printer	Inkjet (sprays ink; good for photos), laser (toner and heat; fast, cheap per page), dot-matrix (impact; multi-part forms), thermal (receipts, labels). Speed in pages per minute (ppm); quality in dots per inch (dpi)
3D printer	Builds objects layer by layer from plastic or resin
Speakers / headphones	Sound output
Projector	Large display for classrooms and meetings
Plotter	Large engineering and architectural drawings

Some devices are both input and output: **touchscreens**, **headsets** with microphones, and **multifunction printers** that also scan.

2.8 Ports and connectors

Port	Used for
USB-A / USB-C	Almost everything: drives, keyboards, phones, charging. USB-C is reversible and can carry data, video and power.
HDMI / DisplayPort	Video and audio to monitors, TVs and projectors
Ethernet (RJ-45)	Wired network
3.5 mm audio jack	Headphones and microphones
Card reader	SD / microSD cards

2.9 Reading a computer specification

Worked example 2.1 — decoding a laptop advert

"Intel Core i5 13th Gen, 10 cores, up to 4.6 GHz | 16 GB DDR5 RAM | 512 GB NVMe SSD | 15.6" FHD 144 Hz display | Windows 11 | Wi-Fi 6 | 1.7 kg"

- **CPU:** mid-range, recent generation, 10 cores — good for study, office work, coding and light editing.
- **RAM:** 16 GB DDR5 — comfortable multitasking.
- **Storage:** 512 GB NVMe SSD — very fast start-up and loading; enough for most students (use cloud/external drive for backups).
- **Display:** 15.6-inch, Full HD (1920 × 1080), smooth 144 Hz refresh.
- **Software:** Windows 11 operating system included.
- **Wi-Fi 6** and **1.7 kg** weight — modern wireless and fairly portable.

Buying guide for students (general)

Prioritise an SSD (not HDD) and at least 8 GB RAM (16 GB preferred); a recent mid-range processor is enough unless you do heavy video editing, 3D or gaming. Check battery life, weight, keyboard comfort and warranty/service availability in your town.

2.10 Caring for hardware

- Use a UPS or surge protector — voltage fluctuations and power cuts can damage hardware and corrupt data.
- Keep vents clear; heat shortens component life. Clean dust periodically.
- Don't eat or drink near the keyboard.
- Eject pen drives safely before removing them.
- Handle laptops gently; never lift by the screen.

Module 2 — Summary

- CPU = CU + ALU + registers; runs the fetch–decode–execute cycle; speed from GHz, cores, cache and architecture.
- Memory hierarchy: registers → cache → RAM → storage → cloud.
- RAM is volatile working memory; ROM holds permanent firmware.
- Storage: HDD (cheap, slow), SSD (fast, rugged), flash drives, cloud.
- Motherboard connects all parts; SMPS converts AC to DC.
- Input devices bring data in; output devices present results; ports connect them.

Practice questions — Module 2

1. Draw the block diagram of a computer and explain each part.
2. What are the functions of the CU and the ALU?
3. Explain the fetch–decode–execute cycle.
4. Differentiate RAM and ROM in a table.
5. Why is an SSD faster than an HDD?
6. List five input devices and five output devices with one use each.
7. What do the terms "quad-core" and "3.2 GHz" mean?
8. Decode this specification: Ryzen 5, 8 GB RAM, 256 GB SSD, 14" FHD.

MODULE 03

Data Representation: Bits, Bytes, and Number Systems

Why computers use binary, converting between number systems, units of storage, and how text, images, sound and video are stored as 0s and 1s.

3.1 Why binary?

Inside a computer, every piece of information — a letter, a photo, a song, a program — is stored as a pattern of just two symbols: **0 and 1**. This is the **binary** system. Computers use it because their basic parts are electronic switches (transistors) that have two reliable states:

Physical form	0	1
Transistor switch	OFF	ON
Voltage level	Low (≈ 0 V)	High (e.g. 3.3 V)
Magnetic disk	One magnetic direction	The opposite direction
Optical disc	Land (reflects)	Pit edge (scatters)
Flash memory cell	Charge absent	Charge present

Two states are easy to tell apart even when signals are weak or noisy, so binary is fast, cheap and very reliable.

3.2 Bits and bytes

- A **bit** (binary digit) is a single 0 or 1 — the smallest unit of data.
- A **nibble** is 4 bits.
- A **byte** is **8 bits** — enough to store one character such as "A".
- A **word** is the number of bits a CPU handles at once (32 or 64 bits in modern computers).

Rule — how many patterns?

n bits can represent 2^n different values

1 bit → 2; 4 bits → 16; 8 bits → 256 (0 to 255); 16 bits → 65,536; 32 bits → about 4.3 billion.

3.3 Units of storage

Unit	Size (binary, used for memory)	Approximate	Example
1 Byte (B)	8 bits	—	One letter
1 Kilobyte (KB)	1,024 bytes	≈ one thousand	A short paragraph
1 Megabyte (MB)	1,024 KB	≈ one million	A phone photo ≈ 2–5 MB; a 3-minute MP3 ≈ 3–4 MB
1 Gigabyte (GB)	1,024 MB	≈ one billion	A 1-hour HD video ≈ 1–3 GB
1 Terabyte (TB)	1,024 GB	≈ one trillion	≈ 250,000 photos
1 Petabyte (PB)	1,024 TB	—	Large data centres
1 Exabyte (EB) → Zettabyte (ZB) → Yottabyte (YB)	× 1,024 each	—	Global internet traffic scale

Why does my "1 TB" drive show 931 GB?

Drive makers use decimal units (1 TB = 10^{12} bytes), while operating systems like Windows count in binary units (1 GB = 2^{30} bytes). $10^{12} \div 2^{30} \approx 931$. Nothing is missing — it's two ways of counting. (Strictly, the binary units are called KiB, MiB, GiB, TiB.)

Worked example 3.1 — storage arithmetic

How many 4 MB photos fit on a 64 GB memory card (use 1 GB = 1,024 MB)?

$64 \times 1,024 = 65,536$ MB. $65,536 \div 4 =$ **16,384 photos** (a little fewer in practice, because the file system uses some space).

Rule — bits versus bytes in internet speed

Internet speeds are quoted in **bits** per second (Mbps); file sizes in **bytes** (MB). Divide Mbps by 8 to get MB per second. A 100 Mbps connection downloads at most about 12.5 MB/s.

Worked example 3.2

How long does a 1.5 GB file take on a 50 Mbps connection (ideal)?

1.5 GB = 1,536 MB = $1,536 \times 8 = 12,288$ megabits. Time = $12,288 \div 50 \approx \mathbf{246\ s} \approx \mathbf{4\ minutes}$.

3.4 Number systems

System	Base	Digits used	Where used
Decimal	10	0–9	Everyday life
Binary	2	0, 1	Inside all computers
Octal	8	0–7	File permissions in Linux (e.g. chmod 755)
Hexadecimal	16	0–9, A–F (A = 10 ... F = 15)	Colour codes (#FF5733), memory addresses, MAC addresses

In every system, each position has a **place value** that is a power of the base. In decimal $345 = 3 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$. In binary the place values are 1, 2, 4, 8, 16, 32, 64, 128 ...

128	64	32	16	8	4	2	1
1	0	1	1	0	1	0	1
$128 + 32 + 16 + 4 + 1 = 181$							

Figure 3.1 — Place values of an 8-bit binary number.

3.5 Conversions

Binary → decimal: add the place values of the 1s

Worked example 3.3

$1101\ 0010_2 = 128 + 64 + 16 + 2 = \mathbf{210}$.

Decimal → binary: divide by 2 repeatedly

Worked example 3.4

Convert 156 to binary.

Division	Quotient	Remainder
$156 \div 2$	78	0
$78 \div 2$	39	0
$39 \div 2$	19	1
$19 \div 2$	9	1
$9 \div 2$	4	1
$4 \div 2$	2	0
$2 \div 2$	1	0
$1 \div 2$	0	1

Read the remainders from bottom to top: **1001 1100₂**. Check: $128 + 16 + 8 + 4 = 156$ ✓.

Shortcut (subtraction method): take away the largest place value that fits: $156 - 128 = 28 \rightarrow 28 - 16 = 12 \rightarrow 12 - 8 = 4 \rightarrow 4 - 4 = 0$. Put 1s at 128, 16, 8, 4.

Binary ↔ hexadecimal: group in fours

Worked example 3.5

$1001\ 1100_2 \rightarrow 1001 = 9, 1100 = C \rightarrow \mathbf{9C_{16}}$.

Hex 3F $\rightarrow 0011\ 1111_2 = 63$.

Hex to decimal directly: $2A_{16} = 2 \times 16 + 10 = \mathbf{42}$.

Binary ↔ octal: group in threes

Worked example 3.6

$110\ 101_2 \rightarrow 6\ 5 \rightarrow \mathbf{65_8}$ ($= 6 \times 8 + 5 = 53$ in decimal).

3.6 Binary arithmetic

Binary addition rules

$0 + 0 = 0$ $0 + 1 = 1$ $1 + 1 = 10$ (write 0, carry 1) $1 + 1 + 1 = 11$ (write 1, carry 1)

Worked example 3.7

0110 1011 (107)
+ 0010 0110 (38)
= **1001 0001** (145) ✓

Overflow: if the answer needs more bits than are available (e.g. $200 + 100$ in 8 bits, maximum 255), the extra bit is lost and the result is wrong. Programmers must choose large enough data types.

Negative numbers — two's complement

Computers usually store negative integers using **two's complement**: to get $-N$, invert all the bits of N and add 1. With 8 bits, the range becomes -128 to $+127$.

Worked example 3.8

$+5 = 0000\ 0101 \rightarrow$ invert $\rightarrow 1111\ 1010 \rightarrow$ add 1 $\rightarrow$ **1111 1011** = -5 .
Check: $0000\ 0101 + 1111\ 1011 = (1)\ 0000\ 0000 \rightarrow 0$ ✓ (the carry out is discarded).

3.7 Representing text

Text is stored by giving every character a number (a **character code**):

- **ASCII** (American Standard Code for Information Interchange) uses 7 bits (128 characters): English letters, digits, punctuation and control codes. 'A' = 65, 'a' = 97, '0' = 48, space = 32.
- **Unicode** covers almost every writing system in the world — Hindi, Odia, Tamil, Chinese, Arabic, emojis — with over 140,000 characters. The common encoding **UTF-8** uses 1 byte for English characters and 2–4 bytes for others, and is used by almost all web pages.

Character	ASCII / Unicode (decimal)	Binary
A	65	0100 0001

B	66	0100 0010
a	97	0110 0001
0 (digit)	48	0011 0000
ॐ (Devanagari A)	2309 (U+0905)	3 bytes in UTF-8
😄	128512 (U+1F600)	4 bytes in UTF-8

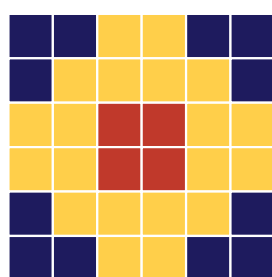
Worked example 3.9

How is "Hi" stored in ASCII? H = 72 = 0100 1000; i = 105 = 0110 1001 → **01001000 01101001** (2 bytes).

3.8 Representing images

A digital image is a grid of tiny dots called **pixels**. Each pixel's colour is stored as a number.

- **Resolution** = number of pixels (width × height), e.g. 1920 × 1080 ≈ 2.07 million pixels (2 megapixels).
- **Colour depth** = bits per pixel. 1 bit → black/white; 8 bits → 256 colours; **24 bits** (8 each for Red, Green, Blue) → about **16.7 million colours** ("true colour").
- In **RGB**, each channel runs from 0 to 255: red = (255, 0, 0) = #FF0000; white = (255, 255, 255); black = (0, 0, 0).



6 × 6 pixel image



One pixel = 3 bytes (24-bit colour)

R = 192 = 1100 0000

G = 57 = 0011 1001

B = 43 = 0010 1011

Hex colour code #C0392B

Figure 3.2 — An image is a grid of pixels; each pixel's colour is stored as numbers.

Formula — uncompressed image size

$$\text{Size (bytes)} = \text{width} \times \text{height} \times (\text{bits per pixel} \div 8)$$

Worked example 3.10

A 1920×1080 image at 24-bit colour: $1920 \times 1080 \times 3 = 6,220,800$ bytes $\approx$ **5.9 MB** uncompressed. Saved as a JPEG it may be only 0.3–1 MB, thanks to compression.

3.9 Representing sound and video

Sound is an analog wave. To store it digitally, a microphone signal is measured (**sampled**) thousands of times per second, and each sample is stored as a number.

- **Sample rate:** samples per second. CD quality = 44,100 Hz (44.1 kHz).
- **Bit depth:** bits per sample. CD quality = 16 bits.
- **Channels:** 1 (mono) or 2 (stereo).

Formula — uncompressed audio size

$$\text{Size (bytes)} = \text{sample rate} \times \text{bit depth} \times \text{channels} \times \text{seconds} \div 8$$

Worked example 3.11

1 minute of CD-quality stereo: $44,100 \times 16 \times 2 \times 60 \div 8 = 10,584,000$ bytes $\approx$ **10.1 MB**.
An MP3 at 128 kbps is only about 0.96 MB per minute.

Video is a sequence of images (**frames**) shown quickly — typically 24, 30 or 60 frames per second (fps) — plus audio. Uncompressed video is enormous, so it is always compressed (e.g. H.264/AVC, H.265/HEVC, AV1).

3.10 Compression

Type	How it works	Examples
Lossless	Removes redundancy; the original can be restored exactly	ZIP, PNG, FLAC, GIF
Lossy	Permanently discards details people barely notice; much smaller files	JPEG, MP3, AAC, MP4 (H.264)

Try it

Right-click a photo on your computer → **Properties** (Windows) → **Details**: see its dimensions (pixels), bit depth and file size. Compare the size with the uncompressed formula above.

Module 3 — Summary

- Computers use binary because switches have two reliable states.
- 8 bits = 1 byte; n bits → 2^n values; KB → MB → GB → TB ($\times 1,024$ each).
- Mbps $\div 8$ = MB/s.
- Conversions: divide by 2 (decimal → binary); add place values (binary → decimal); group 4 bits for hex, 3 bits for octal.
- Text: ASCII (A = 65) and Unicode (UTF-8) for all languages.
- Images: pixels $\times$ colour depth; sound: sample rate $\times$ bit depth $\times$ channels $\times$ time.
- Compression: lossless (ZIP, PNG) vs lossy (JPEG, MP3, MP4).

Practice questions — Module 3

1. How many different values can 10 bits represent? (Ans: 1,024)
2. Convert $1011\ 0111_2$ to decimal and hex. (Ans: 183; B7)
3. Convert 200 to binary. (Ans: 1100 1000)
4. Convert hex 7D to decimal. (Ans: 125)
5. Add $0101\ 0101 + 0011\ 1100$ in binary. (Ans: 1001 0001 = 145)
6. How long does a 700 MB file take on a 20 Mbps link (ideal)? (Ans: $700 \times 8 \div 20 = 280$ s ≈ 4.7 min)
7. Find the uncompressed size of a 1280×720 , 24-bit image. (Ans: ≈ 2.64 MB)
8. Explain the difference between lossy and lossless compression with examples.

Software and Operating Systems

Types of software, what an operating system does, a tour of Windows, Linux, macOS, Android and iOS, installing software safely, and software licences.

4.1 What is software?

Software is a set of programs — instructions written by programmers — that tells the hardware what to do. Without software, a computer is just metal and silicon. Software is usually grouped into two main types:

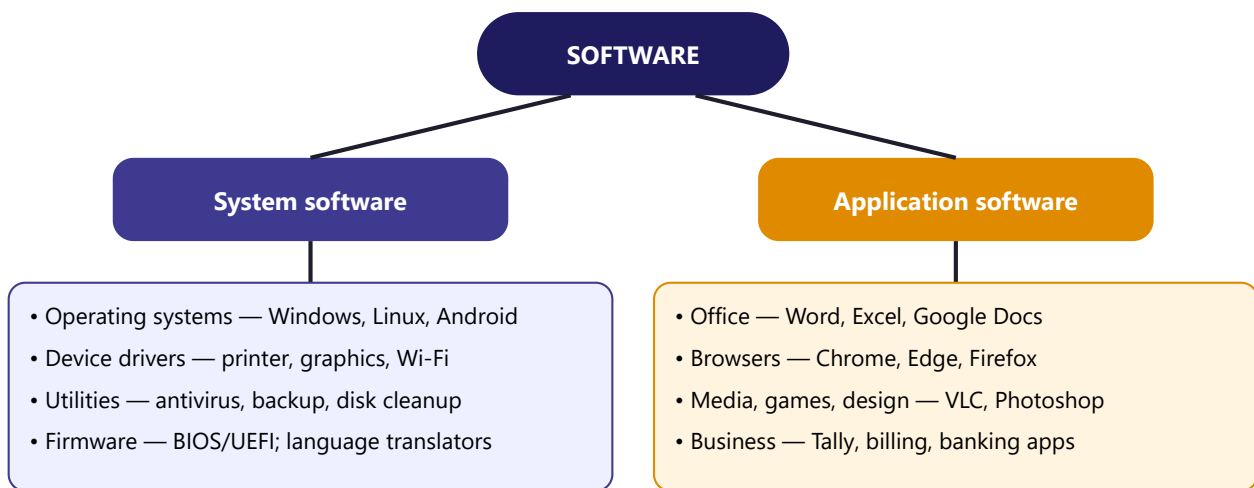


Figure 4.1 — Classification of software.

- **System software** manages the computer itself and provides a platform for other programs.
- **Application software** ("apps") helps users do specific tasks.

4.2 The operating system (OS)

The **operating system** is the most important system software. It is the first program loaded when the computer boots, and it stays in control until shutdown. It acts as a bridge between the user, application programs and the hardware.

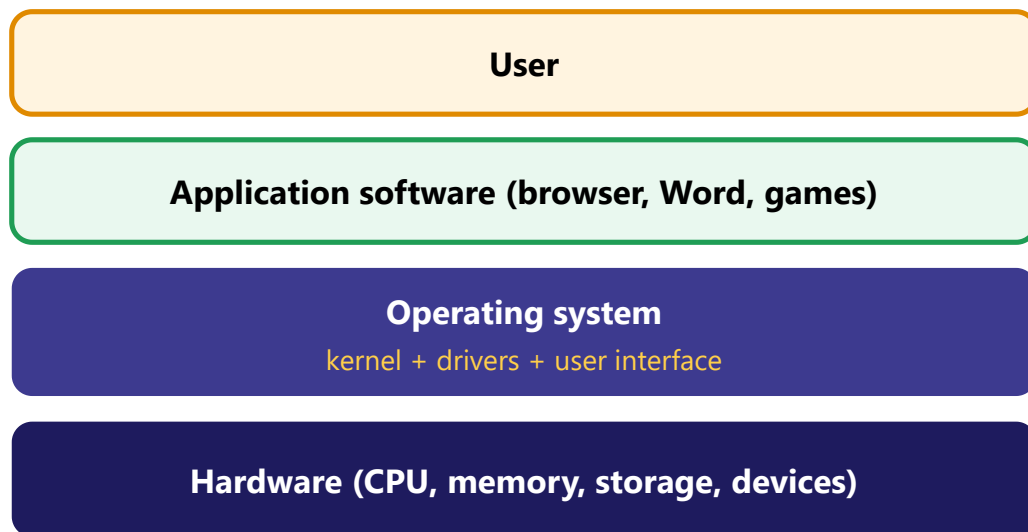


Figure 4.2 — The OS sits between applications and the hardware.

4.3 Functions of an operating system

Function	What it does	Everyday example
Process management	Starts, schedules and stops programs; shares CPU time among them (multitasking)	Listening to music while browsing
Memory management	Allocates RAM to programs, frees it when they close, uses virtual memory when RAM runs out	Opening many browser tabs
File management	Organises data into files and folders; controls reading, writing, deleting	File Explorer, Finder
Device management	Controls hardware through device drivers	Plug-and-play pen drives, printers
User interface	Lets people interact with the computer: GUI (windows, icons, menus, pointer) or CLI (typed commands)	Desktop, Start menu, Terminal
Security & user management	Logins, passwords, permissions, firewall, updates	Windows Hello, separate user accounts
Networking	Connects to Wi-Fi, networks and the internet	Network settings
Error handling	Detects and reports problems	"Program not responding" messages

GUI versus CLI

GUI (Graphical User Interface)	CLI (Command Line Interface)
--------------------------------	------------------------------

How you interact	Pointing and clicking on icons, windows and menus	Typing text commands
Ease of learning	Easy, visual	Needs memorising commands
Power & speed	Good for everyday tasks	Very powerful for automation and repetitive tasks
Examples	Windows desktop, Android home screen	Command Prompt, PowerShell, Linux Terminal

4.4 Types of operating systems

Type	Description	Examples
Single-user, single-task	One user, one program at a time	MS-DOS (historical)
Single-user, multitasking	One user, many programs at once	Windows, macOS
Multi-user	Many users share one computer's resources	Linux/Unix servers
Batch processing	Jobs collected and run in groups without interaction	Payroll, bank statement generation
Real-time OS (RTOS)	Responds within strict time limits	Airbag controllers, industrial robots, medical devices
Distributed / network OS	Manages many connected computers as one system	Server clusters
Mobile OS	Designed for touch, batteries and sensors	Android, iOS
Embedded OS	Small OS inside devices	Smart TVs, routers, smartwatches

4.5 A tour of popular operating systems

OS	Made by	Key features	Where used
Windows (10, 11)	Microsoft	Most widely used desktop OS; huge software and game support; Start menu, File Explorer, Settings	Homes, offices, schools

macOS	Apple	Runs on Mac computers; polished design; strong integration with iPhone	Design, media, developers
Linux (Ubuntu, Fedora, Mint, BOSS)	Open-source community (kernel by Linus Torvalds, 1991)	Free and open-source; secure; highly customisable; powers most web servers and supercomputers	Servers, developers, cloud, embedded devices
Android	Google (based on Linux)	Most-used mobile OS worldwide; Play Store; many manufacturers	Most smartphones in India
iOS / iPadOS	Apple	For iPhone and iPad; App Store; tightly controlled for security	Apple mobile devices
ChromeOS	Google	Lightweight, browser-centred, cloud-based	Chromebooks in schools

India's **BOSS Linux** (Bharat Operating System Solutions), developed by C-DAC, supports many Indian languages and is used in government and education.

4.6 Other system software

- **Device drivers** — small programs that let the OS talk to a particular device. A new printer won't work until its driver is installed (often automatic).
- **Utility software** — maintains and protects the computer: antivirus, backup tools, disk cleanup, defragmenter (for HDDs), file compressors (7-Zip, WinRAR), disk partition tools.
- **Firmware** — software permanently stored on hardware chips (BIOS/UEFI, router firmware).
- **Language translators** — convert programs written by humans into machine code:
 - **Assembler:** assembly language → machine code.
 - **Compiler:** translates the whole program at once into an executable file (C, C++).
 - **Interpreter:** translates and runs one line at a time (Python, JavaScript).

4.7 Application software categories

Category	Examples
Word processing	Microsoft Word, Google Docs, LibreOffice Writer
Spreadsheets	Microsoft Excel, Google Sheets, LibreOffice Calc
Presentations	PowerPoint, Google Slides, Canva
Web browsers	Chrome, Edge, Firefox, Safari

Communication	Gmail, Outlook, WhatsApp, Zoom, Google Meet, Teams
Graphics & multimedia	Photoshop, GIMP, Canva, VLC, Audacity, video editors
Accounting & business	Tally Prime, ERP systems, billing software
Education	Learning apps, virtual labs, AI tutors
Database	MS Access, MySQL, Oracle
Programming tools (IDEs)	VS Code, PyCharm, Arduino IDE

Software can also be classified as **general-purpose** (used by many people for many tasks, like a word processor) or **tailor-made/custom** (written for one organisation's needs, like a school's fee-management system).

4.8 Software licences

Type	Meaning	Examples
Proprietary (commercial)	Owned by a company; you buy a licence to use it; source code is secret	Windows, Microsoft Office, Photoshop
Freeware	Free to use, but source code is not shared	Google Chrome, Adobe Acrobat Reader, Zoom (basic)
Shareware / trial	Free for a trial period or with limited features	WinRAR trial, antivirus trials
Open-source (FOSS)	Source code is public; anyone can study, modify and share it under the licence terms	Linux, LibreOffice, Firefox, GIMP, Python
Subscription (SaaS)	Pay monthly/yearly; often cloud-based	Microsoft 365, Adobe Creative Cloud

Caution — pirated software

Using cracked or pirated software is illegal and risky: it often contains malware, receives no security updates, and can expose your data. Prefer free open-source alternatives (LibreOffice, GIMP) or student licences, which many companies offer at no cost.

4.9 Installing, updating and removing software safely

1. Download only from **official sources**: the developer's website, Microsoft Store, Google Play or Apple App Store.

2. Check system requirements (OS version, RAM, storage).
3. During installation, read each screen — untick unwanted extra toolbars or offers.
4. On phones, check the **permissions** an app asks for. A torch app does not need your contacts.
5. Keep the OS and apps **updated**: updates fix security holes as well as bugs.
6. Uninstall apps you no longer use: Windows **Settings** → **Apps** → **Installed apps**; Android **Settings** → **Apps**.

Try it — tour your operating system (Windows)

- **Task Manager** (Ctrl + Shift + Esc): see running programs (processes), CPU and memory use; end a frozen program.
- **Settings** → **System** → **Storage**: see what is using your disk.
- **Settings** → **Windows Update**: check for updates.
- **Device Manager** (right-click Start): see hardware and drivers.
- Type **cmd** in the Start menu to open the command line; try `ipconfig` or `dir`.

4.10 Virtual memory and multitasking — a closer look

When RAM is full, the OS moves less-used data from RAM to a special file on the storage drive (the **page file** or **swap space**). This is **virtual memory**. It lets more programs run than RAM alone would allow, but because storage is much slower than RAM, heavy use makes the computer sluggish — a sign more RAM is needed.

In **multitasking**, the OS gives each program a tiny time slice of the CPU (a few milliseconds) and switches between them so quickly that they appear to run simultaneously. With multi-core CPUs, several programs genuinely run at the same time.

Module 4 — Summary

- Software = programs. System software runs the computer; application software does user tasks.
- The OS manages processes, memory, files, devices, users, security and networking, and provides the user interface (GUI/CLI).
- Popular OSs: Windows, macOS, Linux, Android, iOS, ChromeOS; BOSS Linux in India.
- Drivers, utilities, firmware and translators (assembler, compiler, interpreter) are system software.
- Licences: proprietary, freeware, shareware, open-source, subscription — avoid piracy.
- Install from official sources, check permissions, keep everything updated.

Practice questions — Module 4

1. Distinguish between system software and application software with three examples each.
2. List and explain six functions of an operating system.
3. Compare GUI and CLI.
4. What is a device driver? Why is it needed?
5. Differentiate compiler and interpreter.
6. What is open-source software? Name three examples.
7. What is virtual memory? Why does too much use of it slow a computer down?
8. List five steps to install software safely.

MODULE 05

Files, Folders, and Storage Management

File types and extensions, organising folders, paths, copying, moving, compressing and backing up files, and using cloud storage wisely.

5.1 Files and folders

A **file** is a named collection of data stored on a drive — a document, photo, song, program or anything else. A **folder** (or **directory**) is a container that holds files and other folders (**subfolders**), so that thousands of files can be kept organised, just like files in a steel almirah are kept in labelled boxes.

Every file has:

- a **name** — e.g. `Physics_Notes_Unit3`;
- an **extension** — the letters after the last dot that tell the OS what type of file it is, e.g. `.pdf`;
- **properties** — size, type, location, date created and modified, and permissions.

5.2 Common file types and extensions

Category	Extensions	Opened with
Documents	.docx, .doc, .odt, .txt, .rtf, .pdf	Word, Google Docs, LibreOffice, Notepad, PDF readers
Spreadsheets	.xlsx, .xls, .ods, .csv	Excel, Google Sheets, LibreOffice Calc
Presentations	.pptx, .ppt, .odp	PowerPoint, Google Slides
Images	.jpg/.jpeg, .png, .gif, .bmp, .webp, .svg, .heic	Photos app, browsers, image editors
Audio	.mp3, .wav, .aac, .m4a, .flac	Media players
Video	.mp4, .mkv, .avi, .mov, .webm	VLC, media players
Compressed archives	.zip, .rar, .7z, .tar.gz	Built-in ZIP support, 7-Zip, WinRAR
Programs & installers	.exe, .msi (Windows), .apk (Android), .dmg (Mac)	The operating system

Caution — hidden extensions and fake files

Windows hides known extensions by default, so a harmful file named `marks.pdf.exe` may appear as `marks.pdf`. Turn on extensions: **File Explorer** → **View** → **Show** → **File name extensions**. Never open unexpected `.exe`, `.apk`, `.scr` or `.bat` files from email or chat.

5.3 Drives, folders and paths

Storage is organised as a **tree**. At the top is a **root** — on Windows, each drive has a letter (c: is usually the system drive); on Linux and macOS there is a single root `/`. Folders branch out below.

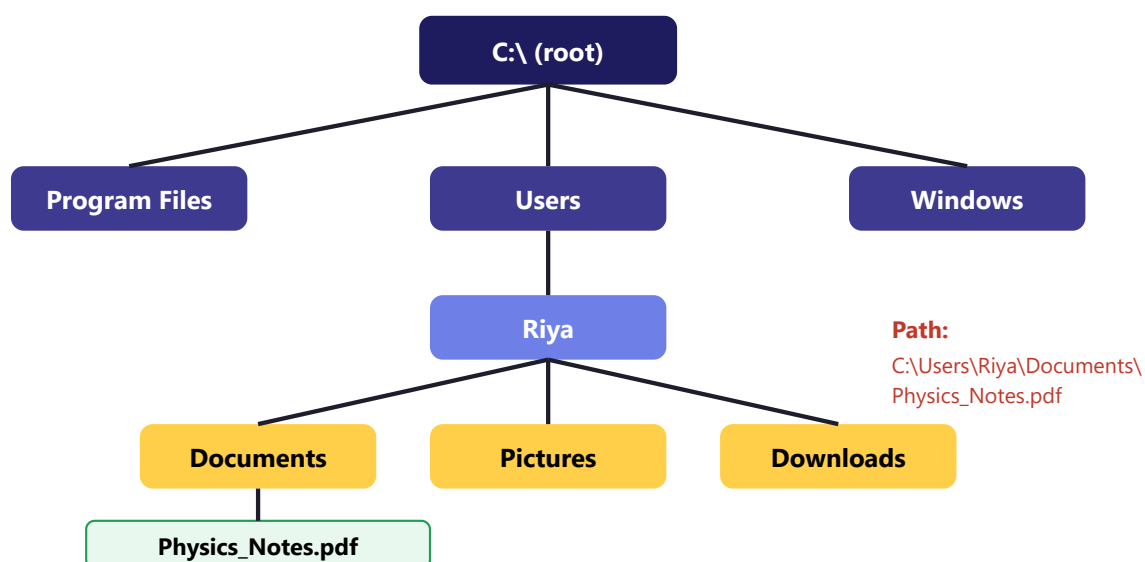


Figure 5.1 — A folder tree. The path lists every folder from the root down to the file.

- An **absolute path** gives the full location from the root:
`C:\Users\Riya\Documents\Physics_Notes.pdf` (Windows uses `\`) or
`/home/riya/Documents/Physics_Notes.pdf` (Linux/macOS use `/`).
- A **relative path** is given from the current folder, e.g. `Documents\Physics_Notes.pdf` when you are already in `C:\Users\Riya`. Web links use relative paths all the time.

5.4 File names — good habits

- Use clear, descriptive names: `2026-09_Electricity_Bill.pdf` beats `scan001.pdf`.
- Put dates in **YYYY-MM-DD** order so files sort correctly.
- Avoid characters that are not allowed or cause problems: `\ / : * ? " < > | .`

- Prefer underscores or hyphens to spaces for files you will share or upload.
- Use version numbers: `Project_Report_v2.docx`, not "final_final_new.docx".

5.5 Organising folders

Example — a student's folder plan

Documents\
 01_College\ → Semester_3\ → Physics\, Maths\, Computer\
 02_Certificates\ (marksheets, ID, course certificates)
 03_Personal\ (bank, bills, forms)
 04_Projects\
 99_Archive\ (old files you don't need often)

Numbering the top folders keeps them in the order you want. Keep the Desktop and Downloads folders clean — move files to their proper place weekly.

5.6 Working with files — essential operations

Task	How (Windows)	Shortcut
Open File Explorer	Taskbar folder icon	Win + E
New folder	Right-click → New → Folder	Ctrl + Shift + N
Rename	Right-click → Rename	F2
Copy	Right-click → Copy	Ctrl + C
Cut (for moving)	Right-click → Cut	Ctrl + X
Paste	Right-click → Paste	Ctrl + V
Undo last action	—	Ctrl + Z
Select all	—	Ctrl + A
Select several files	Ctrl + click (individual), Shift + click (range)	—
Delete to Recycle Bin	Right-click → Delete	Delete
Delete permanently	—	Shift + Delete (careful!)
Search	Search box in File Explorer	Ctrl + F / F3

Key idea — copy versus move

Copy creates a duplicate; the original stays. **Move** (cut and paste) relocates the file; the original location becomes empty. Dragging a file to another folder on the *same* drive moves it; dragging to a *different* drive copies it.

The Recycle Bin

Files deleted normally go to the **Recycle Bin** (Trash on Mac), from where they can be restored (right-click → Restore) until the bin is emptied. Files deleted from pen drives, network drives or with Shift + Delete skip the bin.

Sorting, views and search

File Explorer can show files as icons, a list or details, and sort them by name, date modified, type or size (click the column heading). Search can use wildcards: `*.pdf` finds all PDF files; `report*` finds names starting with "report".

5.7 Compressing files (ZIP)

Compression packs one or more files into a single, smaller archive — useful for emailing many files at once or saving space.

- **Create:** select files → right-click → **Compress to ZIP file** (Windows 11) or **Send to → Compressed (zipped) folder**.
- **Extract:** right-click the ZIP → **Extract All**.
- Text, documents and spreadsheets compress well; JPEG photos and MP4 videos hardly shrink because they are already compressed.

5.8 File systems and formatting

A **file system** is the method an OS uses to organise data on a drive and keep track of where every file is stored.

File system	Used by	Notes
NTFS	Windows system drives	Supports large files, permissions, encryption
FAT32	Older pen drives and cards	Works everywhere, but maximum file size is 4 GB
exFAT	Modern pen drives and SD cards	Works on Windows, Mac, cameras; large files allowed

APFS	macOS / iOS	Apple's modern file system
ext4	Linux, Android internal storage	Standard Linux file system

Caution — formatting erases everything

Formatting prepares a drive with a new file system and deletes its contents. Double-check the drive letter before formatting — formatting the wrong drive is a classic way to lose data.

5.9 Backups — protect what matters

Drives fail, phones get lost or stolen, laptops are dropped, and ransomware can lock files. The only protection is a **backup** — a separate copy.

The 3-2-1 backup rule

3 copies of important data · on 2 different types of storage · with 1 copy off-site (e.g. cloud)

Example: files on your laptop + a copy on an external drive + a copy in Google Drive/OneDrive.

- **Full backup:** copies everything (slow, simple).
- **Incremental backup:** copies only files changed since the last backup (fast; needs the chain to restore).
- Use built-in tools: Windows **File History** / **OneDrive folder backup**; Android and iPhone automatic cloud backup; Google Photos for pictures.
- **Test your backups** occasionally by restoring a file.

5.10 Cloud storage

Cloud storage keeps your files on internet servers run by companies such as Google (Drive), Microsoft (OneDrive), Apple (iCloud) and Dropbox. Government's **DigiLocker** stores official documents such as marksheets and driving licences.

Advantages

- Access from any device, anywhere
- Automatic sync and backup
- Easy sharing with links
- Collaborate on documents in real time
- Safe even if your device is lost

Limitations

- Needs internet to access (offline sync helps)
- Free space is limited (e.g. 15 GB shared on Google)
- Privacy depends on the provider and your account security
- Accidental sharing with "Anyone with the link"

Try it — share safely

In Google Drive, right-click a file → **Share**. Add specific people's email addresses and choose **Viewer**, **Commenter** or **Editor**. Use "Anyone with the link" only for non-private files, and turn it off when no longer needed.

5.11 Keeping storage healthy

- Free up space: **Settings** → **System** → **Storage** → **Temporary files**; uninstall unused apps; clear Downloads.
- Keep at least 10–15% of a drive free for smooth performance.
- Defragment HDDs occasionally (Windows does it automatically); **never** defragment SSDs (Windows runs "TRIM" optimisation instead).
- Scan pen drives with antivirus before opening files.
- Always **eject** removable drives before unplugging.

Module 5 — Summary

- Files have names, extensions and properties; folders organise them in a tree.
- Paths: absolute (from root) and relative (from current folder).
- Know the shortcuts: Ctrl + C/X/V/Z/A, F2, Delete, Shift + Delete.
- Copy duplicates; move relocates. Recycle Bin allows restore.
- ZIP compresses; file systems: NTFS, FAT32, exFAT, ext4, APFS.
- Backups: follow the 3-2-1 rule. Cloud storage: convenient, but share carefully.

Practice questions — Module 5

1. What is a file extension? Give the extensions for a Word document, a photo, a video and an Android app.
2. Write the absolute path of a file named `Resume.docx` in a folder `Jobs` inside `Documents` for user Aman on drive C.
3. Explain the difference between copying and moving a file.
4. Which key combination deletes a file without using the Recycle Bin?
5. Why do JPEG images hardly shrink when zipped?
6. Why can't a 6 GB video be copied to a FAT32 pen drive? How can you fix it?
7. Explain the 3-2-1 backup rule with an example.
8. Give three advantages and two risks of cloud storage.

MODULE 06

Office Tools: Documents, Spreadsheets, and Presentations

Formatting a professional document, building a spreadsheet with formulas such as SUM, AVERAGE and IF, making charts, and designing clear slide presentations.

6.1 The office suite

An **office suite** is a bundle of programs for everyday work. The three most important are a **word processor**, a **spreadsheet** and a **presentation** program.

Task	Microsoft 365	Google Workspace (free, online)	LibreOffice (free, open-source)
Documents	Word (.docx)	Docs	Writer (.odt)
Spreadsheets	Excel (.xlsx)	Sheets	Calc (.ods)
Presentations	PowerPoint (.pptx)	Slides	Impress (.odp)

The skills are almost identical across all three suites. Examples below use Word/Excel/PowerPoint names; Google and LibreOffice menus are similar.

6.2 Word processing

The Word window

- **Ribbon** — tabs (Home, Insert, Layout, References, Review, View) containing groups of commands.
- **Quick Access Toolbar** — Save, Undo, Redo.
- **Document area** with the blinking **cursor** (insertion point).
- **Status bar** — page number, word count, zoom.

Formatting text (character formatting)

Format	Shortcut
Bold	Ctrl + B
<i>Italic</i>	Ctrl + I

<u>Underline</u>	Ctrl + U
Increase / decrease font size	Ctrl +] / Ctrl + [
Font, colour, highlight	Home tab → Font group
Superscript (x ²) / Subscript (H ₂ O)	Ctrl + Shift + = / Ctrl + =
Copy formatting	Format Painter (paintbrush icon)

Formatting paragraphs

- **Alignment:** left (Ctrl + L), centre (Ctrl + E), right (Ctrl + R), justify (Ctrl + J).
- **Line spacing** (1.0, 1.15, 1.5) and **spacing before/after** paragraphs.
- **Indents** — first-line and hanging indents (use the ruler, not spaces).
- **Bullets and numbering** for lists.
- **Borders and shading.**

Styles — the professional's secret

Instead of formatting each heading by hand, apply built-in **styles** (Heading 1, Heading 2, Normal). Styles keep the document consistent, let you change every heading at once, and allow Word to create an automatic **table of contents** (References → Table of Contents).

Page setup and layout

- **Paper size:** A4 (standard in India) or Letter; **orientation:** portrait or landscape; **margins.**
- **Headers and footers** — repeated at the top/bottom of each page; insert **page numbers.**
- **Page break** (Ctrl + Enter) — start a new page properly, instead of pressing Enter many times.
- **Columns** — newsletter style.
- **Section breaks** — different layouts in one document.

Inserting objects

Insert tab: **tables**, **pictures**, shapes, **charts**, SmartArt diagrams, hyperlinks (Ctrl + K), symbols and equations. Set picture **wrap text** (in line, square, tight) to control how text flows around images.

Review tools

- **Spelling and grammar** (F7) — red and blue underlines.
- **Find and Replace** (Ctrl + F / Ctrl + H).
- **Track Changes** and **Comments** — for teachers, reviewers and teamwork.

- **Word count** — status bar or Review tab.

Mail merge

Mail merge creates many personalised letters, certificates or labels from one template and a list of names (e.g. an Excel sheet). Mailings → Start Mail Merge → Select Recipients → Insert Merge Field → Finish & Merge. A school can print 500 certificates with each student's name in minutes.

Try it — a formal letter checklist

A4, 2.5 cm margins; sender's address; date; recipient's address; subject line in bold; salutation; 3–4 short paragraphs, justified, 1.15 spacing; closing; name and signature. Save as .docx, and **File** → **Save As / Export** → **PDF** to send.

6.3 Spreadsheets

A **spreadsheet** is a grid of **cells** arranged in **rows** (numbered 1, 2, 3...) and **columns** (lettered A, B, C...). Each cell has an **address** such as B3 (column B, row 3). A file is a **workbook** containing one or more **worksheets** (tabs). Cells can hold text, numbers, dates or **formulas**.

fx =AVERAGE(B2:D2)					
	A	B	C	D	E
1	Name	Maths	Physics	Chem	Average
2	Riya	85	78	90	84.33
3	Aman	62	70	58	63.33
4	Sara	91	88	95	91.33

Active cell E2 shows the result; the formula bar shows the formula behind it.

Figure 6.1 — A worksheet: columns, rows, cells, the formula bar and a formula result.

Formulas

Every formula starts with =. It can use numbers, cell references and operators: + - * / ^ (power) and & (join text). Excel follows the order of operations (**BODMAS**): brackets first, then powers, then × and ÷, then + and −.

Worked example 6.1

`=B2+C2+D2` → 253 (Riya's total). `=(B2+C2+D2)/3` → 84.33. `=B2+C2+D2/3` would be wrong (85 + 78 + 30 = 193) — brackets matter!

Essential functions

Function	What it does	Example
SUM	Adds a range	<code>=SUM(B2:D2)</code> → 253
AVERAGE	Mean of a range	<code>=AVERAGE(B2:B4)</code> → 79.33
MAX / MIN	Largest / smallest value	<code>=MAX(B2:B4)</code> → 91
COUNT	Counts cells containing numbers	<code>=COUNT(B2:D4)</code> → 9
COUNTA	Counts non-empty cells	<code>=COUNTA(A2:A4)</code> → 3
IF	Chooses a result based on a condition	<code>=IF(E2>=40, "Pass", "Fail")</code>
COUNTIF / SUMIF	Counts / adds cells meeting a condition	<code>=COUNTIF(E2:E4, ">=75")</code> → 2
ROUND	Rounds to given decimals	<code>=ROUND(E2,1)</code> → 84.3
TODAY / NOW	Current date / date and time	<code>=TODAY()</code>
CONCAT / &	Joins text	<code>=A2&" scored "&E2</code>
VLOOKUP / XLOOKUP	Looks up a value in a table	<code>=VLOOKUP("Aman", A2:E4, 5, FALSE)</code> → 63.33
RANK	Position of a value in a list	<code>=RANK(E2, \$E\$2:\$E\$4)</code> → 2

Nested IF — grading

Worked example 6.2

Grade: A for ≥ 80, B for ≥ 60, C for ≥ 40, otherwise F.

`=IF(E2>=80, "A", IF(E2>=60, "B", IF(E2>=40, "C", "F")))`

Riya (84.33) → A; Aman (63.33) → B; Sara (91.33) → A. In newer Excel, `IFS` does the same more readably.

Relative and absolute references

When you copy a formula down or across (drag the **fill handle** — the small square at the cell's corner), Excel adjusts the references: `=B2*C2` in row 2 becomes `=B3*C3` in row 3. These are **relative references**. To keep a reference fixed, make it **absolute** with dollar signs: `=B$1`. Press **F4** to toggle.

Worked example 6.3 — GST calculation

Cell B1 holds the GST rate 18%. Prices are in A3:A10. In B3 type `=A3*$B$1` and drag down. Every row multiplies its own price by the same fixed rate in B1. Without the \$ signs, row 4 would wrongly use B2, row 5 B3, and so on.

Formatting and data tools

- **Number formats:** currency (₹), percentage, date, decimal places.
- **Conditional formatting:** automatically colour cells — e.g. marks below 40 in red.
- **Sort** (A→Z, largest → smallest) and **Filter** (show only rows meeting a condition).
- **Freeze panes** — keep headings visible while scrolling.
- **Data validation** — allow only certain entries (e.g. marks 0–100, or a drop-down list).
- **Pivot tables** — summarise large data quickly (e.g. total sales by region and month).

Charts

Chart	Best for
Column / bar	Comparing categories (marks per subject)
Line	Trends over time (monthly electricity use)
Pie	Parts of a whole (budget share) — use for a few categories only
Scatter	Relationship between two variables (study hours vs marks)

Select the data → Insert → Chart. Always add a clear **title**, **axis titles** and a **legend** where needed.

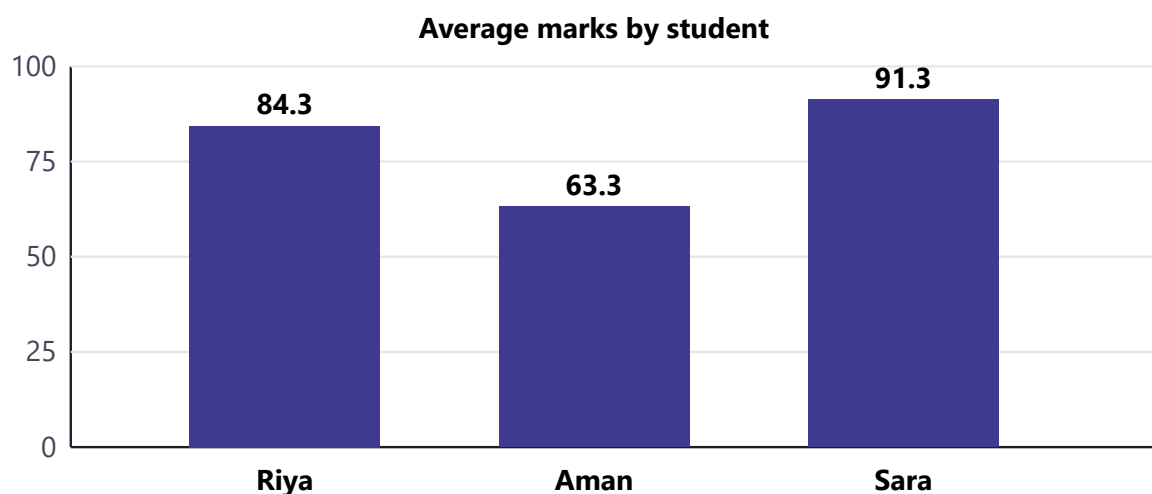


Figure 6.2 — A column chart made from the worksheet in Figure 6.1.

6.4 Presentations

Presentation software builds a sequence of **slides** to support a talk. Good slides help the audience understand and remember; poor slides distract.

Building a presentation

1. Plan first: purpose, audience, 3–5 key messages, a simple structure (introduction → main points → conclusion).
2. Choose a clean **design/theme** (Design tab) with readable fonts and good contrast.
3. Add slides with suitable **layouts** (Title, Title and Content, Two Content, Section Header).
4. Insert pictures, charts, SmartArt, icons, video; keep them relevant.
5. Use **Slide Master** to change fonts, colours and logos on all slides at once.
6. Add **speaker notes** below each slide for what you will say.
7. Rehearse with **Slide Show** (F5 from the start; Shift + F5 from the current slide).

Design rules for clear slides

Do	Don't
One main idea per slide	Paste paragraphs of text
Short bullet points — around 6 lines of about 6 words ("6 × 6 rule")	Read the slides aloud word for word
Large fonts: titles ≥ 32 pt, text ≥ 24 pt	Use tiny fonts or fancy scripts
High contrast (dark text on light background or vice versa)	Place text over busy photos
Consistent colours and fonts	Use a different style on every slide

Meaningful pictures, charts and diagrams	Add clip art "for decoration"
Simple, subtle transitions	Spin, bounce and fly every item in

Try it — a 5-slide project presentation

1. Title (project name, your name). 2. Problem. 3. What you did (with one picture or diagram). 4. Results (one chart). 5. Conclusion and thank you. Keep it under 5 minutes.

6.5 Saving, sharing and printing

- **Save often** (Ctrl + S). Turn on AutoSave when working in OneDrive/Google Drive.
- Use **Save As** (F12) to save a copy with a new name or format.
- Export to **PDF** for sharing — it looks the same on every device and can't be edited accidentally.
- **Print preview** (Ctrl + P) before printing: check page range, copies, orientation, colour, and "fit to page" for spreadsheets.
- Protect sensitive files with a password (File → Info → Protect Document).

Module 6 — Summary

- Word processing: character and paragraph formatting, styles, page setup, tables/images, review tools, mail merge.
- Spreadsheets: cells and addresses; formulas start with =; SUM, AVERAGE, MAX/MIN, COUNT, IF, COUNTIF, VLOOKUP.
- Relative (A1) vs absolute (\$A\$1) references; F4 toggles.
- Charts: column for comparison, line for trends, pie for parts of a whole.
- Presentations: plan, one idea per slide, large fonts, contrast, rehearse.
- Save often, export PDFs, preview before printing.

Practice questions — Module 6

1. List six paragraph-formatting options in a word processor.
2. What are styles, and why are they useful?
3. Explain mail merge with an example.
4. Write formulas to find the total, highest and lowest of marks in B2:B31.
5. Write an IF formula that shows "Eligible" if age in C2 is 18 or more, otherwise "Not eligible".
6. What is the difference between A1 and \$A\$1? Give a situation where \$A\$1 is needed.
7. Which chart would you use to show monthly rainfall over a year? Why?
8. List five rules for designing effective slides.

MODULE 07

The Internet, the Web, and Email

How the internet connects computers, the difference between the internet and the web, browsers and URLs, searching effectively, and sending email properly.

7.1 What is the internet?

The **internet** is a worldwide **network of networks** — billions of computers, phones, servers and devices connected together so that they can exchange data. No single company owns it. It grew from **ARPANET**, a US research network started in 1969. The common language that lets all these different devices communicate is a set of rules called **TCP/IP**.

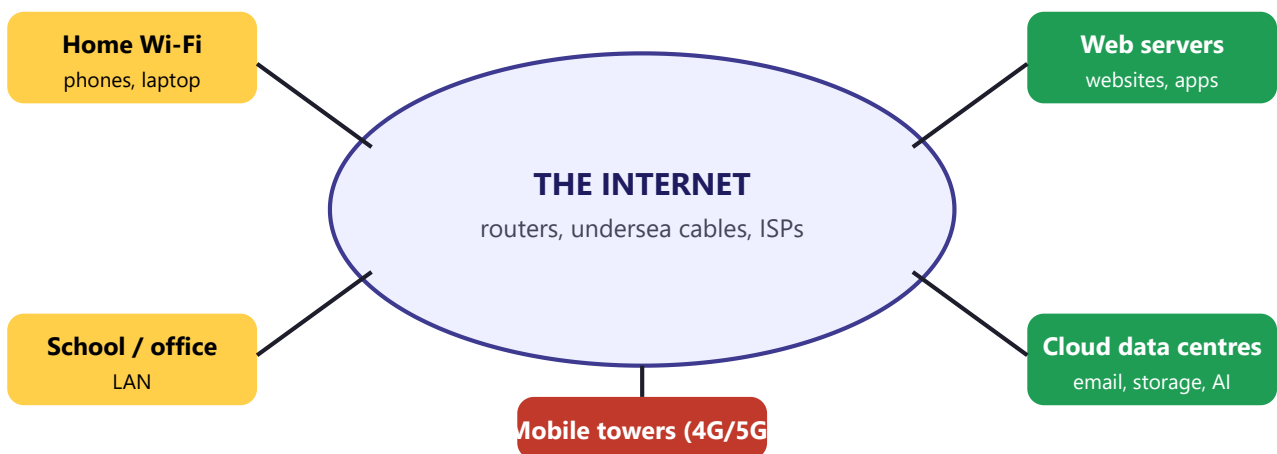
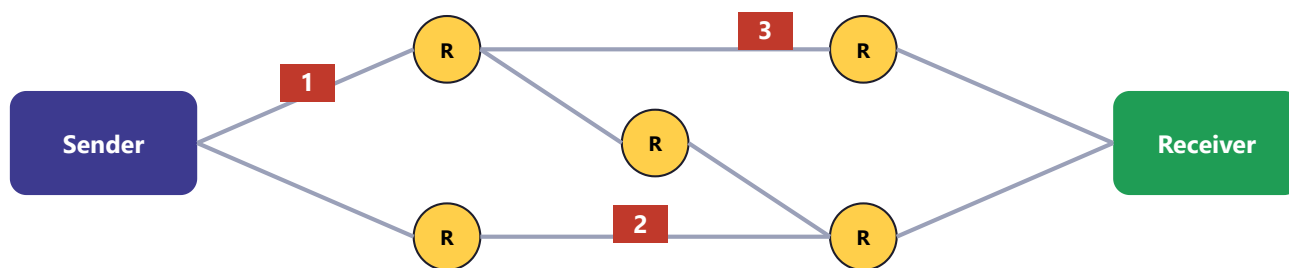


Figure 7.1 — The internet connects many networks through Internet Service Providers and routers.

7.2 How data travels: packets

When you send a photo on WhatsApp or open a web page, the data is broken into small pieces called **packets**. Each packet carries the sender's and receiver's **IP addresses** and a sequence number. Packets may travel by different routes through **routers** across the internet and are put back together in the correct order at the destination. If one is lost, it is sent again.

- **IP (Internet Protocol):** addresses and routes the packets.
- **TCP (Transmission Control Protocol):** makes sure all packets arrive, in order, without errors.



Packets take different routes through routers (R) and are reassembled in order.

Figure 7.2 — Packet switching.

7.3 Connecting to the internet

An **Internet Service Provider (ISP)** — such as BSNL, Jio, Airtel, ACT or a local cable operator — connects you to the internet.

Connection type	Typical speed	Notes
Fibre broadband (FTTH)	30 Mbps – 1 Gbps+	Fast, stable; fibre-optic cable to the home
Mobile data (4G / 5G)	10 – 500+ Mbps	Anywhere with coverage; hotspot for laptops
DSL (telephone line)	2 – 50 Mbps	Older technology
Satellite	Varies	Remote areas; higher delay
Public Wi-Fi	Varies	Convenient but less secure (see Module 9)

Speed terms: **bandwidth** — how much data per second (Mbps); **latency** (ping) — delay in milliseconds; **upload** and **download** speeds. Remember: $\text{Mbps} \div 8 = \text{MB per second}$ (Module 3).

7.4 The internet versus the World Wide Web

People often use these words as if they meant the same thing, but they do not:

The Internet

The physical, global **network** — cables, routers and devices — and the rules (TCP/IP) that move data. It carries many services: the web, email, video calls, online games, file transfer, messaging.

The World Wide Web (WWW)

One **service** that runs on the internet: billions of linked **web pages** viewed with a browser. Invented by **Tim Berners-Lee** at CERN in 1989. It uses **HTTP/HTTPS, URLs** and **HTML**.

7.5 Web pages, websites and browsers

- A **web page** is a document written in **HTML** (structure), styled with **CSS** (appearance), and made interactive with **JavaScript**.
- A **website** is a collection of related web pages under one domain, e.g. `www.aitutorspark.co.in`. Its first page is the **home page**.
- A **web server** is a computer that stores websites and sends pages when asked.
- A **web browser** is the program that requests, receives and displays web pages: Chrome, Edge, Firefox, Safari, Opera.
- **Hyperlinks** connect pages; clicking one loads another page.

Anatomy of a URL

<https://www.aitutorspark.co.in/courses/solar-energy?lang=en>

protocol (secure) **sub-domain** **domain name** **top-level domain** **path to the page** **query**

URL = Uniform Resource Locator — the full address of a resource on the web.

Figure 7.3 — Parts of a URL.

Top-level domain	Meaning
.com	Commercial (most common)
.org	Organisations
.edu / .ac.in	Educational institutions
.gov.in / .nic.in	Government of India
.in / .co.in	India (country code)
.net	Network services

DNS — the internet's phone book

Computers find each other using numeric **IP addresses** (like 142.250.183.4), but people remember names. The **Domain Name System (DNS)** translates a domain name into its IP address. When you type a URL, your computer first asks a DNS server "what is the address of this name?", then connects to that address.

HTTP and HTTPS

HTTP is the protocol browsers use to request pages. **HTTPS** is its secure version: data is **encrypted**, so nobody in between can read or change it, and a certificate proves the site's identity. Always check for **https** (and the padlock icon) before entering passwords or payment details.

7.6 Using a browser well

Feature	Use / shortcut
Address bar	Type URLs or search terms (Ctrl + L to jump there)
Tabs	New tab Ctrl + T; close Ctrl + W; reopen closed tab Ctrl + Shift + T
Back / forward / refresh	Alt + ← / Alt + → / F5
Bookmarks (favourites)	Save a page: Ctrl + D
History	Ctrl + H
Downloads	Ctrl + J
Find on page	Ctrl + F
Zoom	Ctrl + + / Ctrl + - / Ctrl + 0
Private / Incognito window	Ctrl + Shift + N — doesn't save history on your device (you are <i>not</i> invisible to websites or your network)
Cookies and cache	Stored website data; clear them from Settings → Privacy if a site misbehaves
Extensions	Add-ons; install only trusted ones

7.7 Searching effectively

A **search engine** (Google, Bing, DuckDuckGo) indexes billions of pages and returns the most relevant ones for your **keywords**.

Technique	Example	Effect
Use specific keywords	solar panel tilt angle Odisha	Better than "how do I put my solar panel"
Exact phrase	"Ohm's law derivation"	Only pages with that exact phrase

Exclude a word	jaguar speed -car	Removes pages about cars
Search one site	scholarship site:gov.in	Only results from government sites
File type	photosynthesis notes filetype:pdf	Only PDF files
Either word	laptop OR notebook	Results with either term
Tools / filters	Tools → Past year; Images; News	Recent or specific types of results

Is this source reliable? — the checklist

- **Who** wrote it? Official body, expert, reputed organisation?
- **When** was it published or updated?
- **Why** was it written — to inform, or to sell or persuade?
- Can the facts be **confirmed** by two or more independent reliable sources?
- Be careful with forwarded messages, sensational headlines and AI-generated answers — verify important facts.

7.8 Email

Email (electronic mail) sends messages and files over the internet. An email address has the form **username@domain**, e.g. `riya.das@gmail.com`. Popular services: Gmail, Outlook, Yahoo Mail, and organisation email.

Parts of an email

Field	Purpose
To	Main recipient(s) — the people who must act or reply
CC (carbon copy)	People who should be kept informed; all recipients can see CC addresses
BCC (blind carbon copy)	Hidden recipients — others can't see them. Use BCC when emailing many people who don't know each other, to protect their privacy
Subject	A short, clear summary: "Leave application – 12 to 14 Oct"
Body	The message
Attachments	Files sent with the email (size limits apply — e.g. 25 MB on Gmail; share large files as Drive links)
Signature	Name, role, phone — added automatically

Other actions: **Reply** (to the sender only), **Reply all** (to everyone on the email — use carefully), **Forward** (send to someone new), **Archive**, **Labels/folders**, **Spam**.

Worked example 7.1 — a professional email

To: hr@company.com **CC:** (none) **Subject:** Application for Data Entry Operator – Riya Das

Dear Sir/Madam,

I am writing to apply for the Data Entry Operator position advertised on your website. I have completed the Computer Fundamentals certificate course and can type at 40 words per minute in English and Odia. My resume and certificate are attached.

I would be glad to attend an interview at your convenience.

Thank you for your time.

Regards,

Riya Das

+91 9XXXX XXXXX

Attachments: Riya_Das_Resume.pdf, Computer_Fundamentals_Certificate.pdf

Email etiquette

- Write a clear subject; keep the message short and polite.
- Use proper greeting and closing; avoid ALL CAPITALS (it reads as shouting).
- Check spelling, recipients and attachments **before** clicking Send.
- Name attachments sensibly and send PDFs for documents.
- Reply within a reasonable time; don't use "Reply all" unnecessarily.
- Never send passwords, OTPs or bank details by email.

7.9 Other internet services

Service	Examples
Instant messaging	WhatsApp, Telegram, Signal
Video conferencing	Google Meet, Zoom, Microsoft Teams
Social media	YouTube, Instagram, LinkedIn, Facebook, X
E-commerce	Amazon, Flipkart, ONDC-based apps
Digital payments	UPI apps, net banking, wallets

E-governance	DigiLocker, UMANG, income-tax portal, passport seva
E-learning	SWAYAM, NPTEL, DIKSHA, online courses and AI tutors
Cloud computing	Online documents, storage, AI services
Internet of Things (IoT)	Smart bulbs, CCTV, smart meters, fitness bands

Module 7 — Summary

- The internet is a global network of networks using TCP/IP; data travels as packets through routers.
- The web is a service on the internet: web pages (HTML) linked by hyperlinks, viewed in browsers.
- URL = protocol + domain + path; DNS turns names into IP addresses; HTTPS encrypts.
- Search smartly with quotes, minus, site:, filetype;; verify sources.
- Email: To, CC, BCC, subject, attachments; follow etiquette.

Practice questions — Module 7

1. Distinguish between the internet and the World Wide Web.
2. Explain how data travels over the internet in packets.
3. Label the parts of the URL `https://www.example.gov.in/services/apply.html`.
4. What is DNS, and why is it needed?
5. Why should you check for HTTPS before entering a password?
6. Write a Google search to find only PDF files about "photosynthesis" on .edu sites.
7. When should you use BCC instead of CC?
8. Write a short, polite email to your teacher requesting an extension for an assignment.

Networking Basics

LAN, WAN, Wi-Fi, routers, switches and IP addresses explained simply — and step by step, how your device actually reaches a website.

8.1 What is a computer network?

A **network** is two or more devices connected so they can share data and resources. Even a phone connected to a laptop's hotspot is a tiny network.

Why network computers?

- **Share resources:** one printer or internet connection for a whole office.
- **Share files and data:** a common folder or database.
- **Communicate:** email, messaging, video calls.
- **Centralised management:** backups, security and software updates from one place.

8.2 Types of networks by size

Type	Full form	Area	Example
PAN	Personal Area Network	A few metres around a person	Phone + Bluetooth earbuds + smartwatch
LAN	Local Area Network	A home, office, school or building	Computer lab, home Wi-Fi
CAN	Campus Area Network	Several buildings on one campus	University campus
MAN	Metropolitan Area Network	A city	City-wide cable/fibre network, city CCTV
WAN	Wide Area Network	Countries and continents	A bank's branches across India; the internet (largest WAN)

8.3 Network models: client-server and peer-to-peer

Client-server

Powerful central computers (**servers**) provide services — websites, email, files — and ordinary devices (**clients**) request them. Easy to manage and secure; used by most organisations and the web.

Peer-to-peer (P2P)

All computers are equal and share directly with each other, with no central server. Simple and cheap for a few machines (e.g. sharing a folder between two laptops, Nearby Share/AirDrop), but harder to manage as it grows.

8.4 Network topologies

Topology is the layout — how devices are connected.

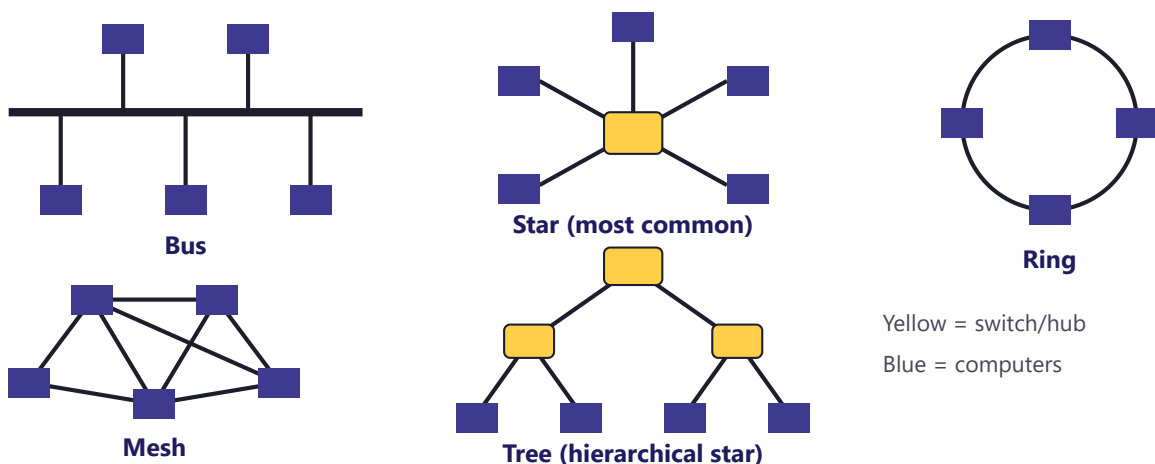


Figure 8.1 — Common network topologies.

Topology	Description	Advantages	Disadvantages
Bus	All devices on one main cable	Cheap, little cable	One break stops everything; slow with many devices (old)
Star	All devices connect to a central switch	Easy to add devices; one cable fault affects only one device	If the switch fails, the network stops
Ring	Each device connects to two neighbours in a loop	Orderly data flow	One failure can break the ring
Mesh	Devices connect to many others	Very reliable, many routes (the internet, mesh Wi-Fi)	Costly, complex

Tree	Stars connected in a hierarchy	Scalable for large buildings	Depends on the main backbone
------	--------------------------------	------------------------------	------------------------------

8.5 Networking hardware

Device	What it does
NIC (network interface card)	Connects a device to a network (Ethernet port or Wi-Fi adapter). Each has a unique MAC address .
Switch	Connects devices within a LAN and sends data only to the device it is meant for (using MAC addresses).
Hub (old)	Like a switch but sends data to all ports — wasteful; now obsolete.
Router	Connects different networks — e.g. your home LAN to the internet — and chooses routes for packets (using IP addresses).
Modem / ONT	Converts signals between your network and the ISP's line (phone line, cable or fibre — for fibre it's called an ONT).
Wireless access point (WAP)	Provides Wi-Fi. A home "Wi-Fi router" combines router + switch + access point (+ often modem).
Repeater / extender, mesh nodes	Extend Wi-Fi coverage.
Firewall	Blocks unauthorised traffic (hardware device or software).

Transmission media

Medium	Details
Twisted-pair cable (Cat 5e / Cat 6)	Ethernet cables with RJ-45 plugs; common in LANs; up to 1–10 Gbps over 100 m
Coaxial cable	Cable TV and older broadband
Optical fibre	Light pulses in glass; very high speed over long distances; immune to electrical interference; used for FTTH and undersea cables
Wireless (radio)	Wi-Fi, Bluetooth, mobile networks (4G/5G), satellite
Infrared	TV remotes (short range, line of sight)

8.6 Wi-Fi

Wi-Fi connects devices to a LAN using radio waves, mainly in the **2.4 GHz** band (longer range, more interference, slower) and the **5 GHz** band (faster, shorter range); newer Wi-Fi 6E/7 also uses 6 GHz.

Generation	Standard	Approx. max speed
Wi-Fi 4	802.11n	up to ~600 Mbps
Wi-Fi 5	802.11ac	up to a few Gbps
Wi-Fi 6 / 6E	802.11ax	up to ~9.6 Gbps (shared)
Wi-Fi 7	802.11be	Higher still

Try it — better home Wi-Fi

- Place the router centrally and high, away from metal cupboards and microwaves.
- Use 5 GHz near the router, 2.4 GHz for far rooms.
- Secure it with **WPA2/WPA3** and a strong password; change the default admin password.
- Restart the router if the internet is slow; update its firmware.

8.7 IP addresses and MAC addresses

Every device on a network needs an address, just as every house needs a postal address.

- **IP address** — a logical address that can change depending on the network. **IPv4** uses 32 bits written as four numbers 0–255, e.g. `192.168.1.15` (about 4.3 billion possible addresses). **IPv6** uses 128 bits written in hex, e.g. `2001:db8::1` — practically unlimited addresses.
- **MAC address** — a permanent 48-bit hardware address burnt into the network card, written in hex, e.g. `3C:52:82:1A:9F:04`.

	IP address	MAC address
Type	Logical (software)	Physical (hardware)
Changes?	Yes, when you change network	Normally fixed
Used for	Routing across networks (internet)	Delivery within a local network
Example	192.168.1.15	3C:52:82:1A:9F:04

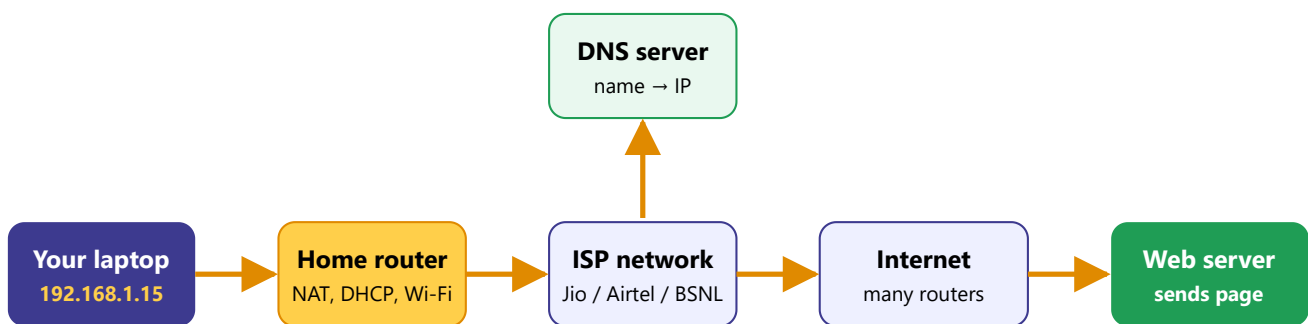
Public and private IP addresses

Your home router gets one **public IP** from the ISP, visible on the internet. Inside your home, devices get **private IPs** such as 192.168.x.x or 10.x.x.x, handed out automatically by the router's **DHCP** service. The router translates between them (**NAT** — Network Address Translation), so many devices share one public address.

Try it — find your addresses

Windows: open Command Prompt and type `ipconfig /all` — look for IPv4 Address, Default Gateway (your router) and Physical Address (MAC). Android: Settings → About phone → Status. Try `ping google.com` to test connectivity and see the delay in milliseconds.

8.8 How your device reaches a website — step by step



1. You type `www.aitutorspark.co.in` and press Enter.
 2. Browser asks a DNS server for the site's IP address.
 3. Laptop sends an HTTPS request (in packets) to the router → ISP → internet routers → web server.
 4. Server sends back the page (HTML, images, scripts) in packets by the reverse path.
 5. TCP puts packets in order; the browser decrypts and renders the page.
- All this typically takes well under a second.

Figure 8.2 — The journey of a web request.

8.9 Protocols — the rules of communication

Protocol	Purpose
TCP / IP	Reliable delivery / addressing and routing of packets
HTTP / HTTPS	Web pages (HTTPS encrypted)
DNS	Domain names → IP addresses
DHCP	Automatically assigns IP addresses to devices

SMTP	Sending email
POP3 / IMAP	Receiving email (IMAP keeps mail synced on the server)
FTP / SFTP	File transfer (SFTP is secure)
SSH	Secure remote login to servers
VoIP	Voice calls over the internet

Engineers describe networking in layers — the 7-layer **OSI model** (Physical, Data Link, Network, Transport, Session, Presentation, Application) and the simpler 4-layer **TCP/IP model** (Link, Internet, Transport, Application). Each layer handles one part of the job, like departments in a courier company.

8.10 Mobile networks and cloud

- **Mobile generations:** 2G (calls, SMS), 3G (basic internet), 4G (fast internet, video), **5G** (very high speed, low latency, many devices — smart cities, IoT).
- **Hotspot / tethering:** sharing a phone's mobile data over Wi-Fi.
- **Cloud computing:** using computing resources (storage, servers, software, AI) over the internet instead of your own machine — e.g. Google Drive, online Office, cloud servers for websites.

8.11 Troubleshooting network problems

Problem	Try
No internet on any device	Restart modem/router (wait 30 s); check ISP status/cable/fibre light; call ISP
Only one device offline	Toggle Wi-Fi/airplane mode; "forget" and rejoin the network; restart the device
Connected but "no internet"	Check DNS (try ping 8.8.8.8 vs ping google.com); restart router
Slow speeds	Move closer to router; switch to 5 GHz; limit heavy downloads; run a speed test
Wrong password errors	Check caps lock; confirm the network name (SSID)

Module 8 — Summary

- Networks share resources and data. Sizes: PAN, LAN, CAN, MAN, WAN.
- Models: client–server and peer-to-peer. Topologies: bus, star, ring, mesh, tree.
- Switches connect devices in a LAN; routers connect networks; modems/ONTs connect to the ISP.
- IP (logical, IPv4/IPv6) vs MAC (physical) addresses; DHCP, NAT, private/public IPs.
- Web request: DNS lookup → packets via router, ISP, internet → server → page back.
- Protocols: TCP/IP, HTTP(S), DNS, DHCP, SMTP, IMAP, FTP, SSH.

Practice questions — Module 8

1. Define LAN, MAN and WAN with an example each.
2. Compare client–server and peer-to-peer networks.
3. Draw a star topology and give two advantages and one disadvantage.
4. What is the difference between a switch and a router?
5. Differentiate IP address and MAC address.
6. What are DHCP and NAT used for in a home network?
7. Describe, step by step, what happens when you type a website address in a browser.
8. Your laptop shows "Connected, no internet". List four things you would check.

MODULE 09

Cyber Safety and Digital Hygiene

Strong passwords and two-factor authentication, spotting phishing and fake websites, malware and antivirus, safe UPI and online banking, protecting personal data, and what to do if something goes wrong.

9.1 Why cyber safety matters

Our money, identity, studies, photos and conversations now live online. Criminals know this. Most cyber attacks on ordinary people do not "hack" computers with clever technology — they **trick people** into giving away passwords, OTPs or money. This is called **social engineering**. The good news: a few simple habits block the vast majority of attacks.

Key idea — the golden rule

No genuine bank, government office, courier company, police officer or tech-support agent will ever ask you for your **OTP, PIN, CVV, password or UPI PIN**, or ask you to install a screen-sharing app. Anyone who asks is a fraudster.

9.2 Passwords

What makes a password strong?

- **Length first:** at least 12 characters — longer is much stronger.
- A **passphrase** of random words is strong and memorable: `Mango-Train-Cloudy-47!`
- Mix upper and lower case, numbers and symbols.
- Avoid names, birthdays, phone numbers, "password", "123456", "qwerty" and your pet's name — these are guessed first.
- **Never reuse** the same password on different sites. If one site is breached, criminals try that password everywhere ("credential stuffing").

Why length matters

With 26 lowercase letters: 8 characters give $26^8 \approx 2 \times 10^{11}$ combinations — fast computers can try them all quickly. 12 characters of mixed characters (about 94 possibilities each) give $94^{12} \approx 4.8 \times 10^{23}$ combinations — far beyond practical guessing.

Password managers

A **password manager** (built into Chrome, Edge, Apple and Android, or dedicated apps like Bitwarden) generates and stores a unique strong password for every site. You only need to remember one strong master password.

9.3 Two-factor authentication (2FA)

2FA (or multi-factor authentication, MFA) requires two different proofs to log in:

1. Something you **know** — password or PIN;
2. Something you **have** — your phone (OTP, authenticator app code, prompt), or a security key;
3. Something you **are** — fingerprint or face.

Even if a criminal steals your password, they cannot log in without the second factor. Turn on 2FA for email, social media, cloud storage and banking. Authenticator apps (Google Authenticator, Microsoft Authenticator) are safer than SMS codes. **WhatsApp two-step verification** (Settings → Account) protects against account takeover.

9.4 Phishing — the most common attack

Phishing is a fake message that pretends to come from a trusted source to trick you into clicking a link, opening an attachment, or giving information. Variants: **smishing** (SMS), **vishing** (voice calls), and phishing on WhatsApp, Telegram and social media.

The figure shows a simulated phishing email. The header is a dark blue bar with white text: "From: Bank Alert <alerts@yourbank-kyc-update.xyz>". The main body is white with a light blue border. It starts with "URGENT!! Your account will be BLOCKED today" in bold. Below is a greeting "Dear Customer," followed by "Your KYC has expired. Update within 2 hours or your account will be suspended." A red button with white text says "Click here: bit.ly/kyc-now". Below the button, it says "Enter your card number, CVV and OTP to verify." and "Regards, Bank Team". To the right of the email body, there are five numbered warning signs in orange circles:

- 1 Odd sender domain (not the bank's)
- 2 Urgency, threats, capitals
- 3 Generic greeting
- 4 Shortened / suspicious link
- 5 Asks for CVV / OTP — never!

Figure 9.1 — Warning signs of a phishing message (an illustrative fake).

Red flags checklist

- **Urgency or fear:** "account blocked", "police case", "last chance", "parcel held".
- **Too good to be true:** lottery wins, huge discounts, "work from home, earn ₹5,000 a day", crypto doubling.
- **Mismatched sender or link:** hover over links (or long-press on phones) to see the real address. Watch for look-alikes: `amaz0n.in`, `bank-online-kyc.com`, `paytm.support-help.net`.
- **Requests for OTP, PIN, CVV, passwords, or screen-sharing apps** (AnyDesk, TeamViewer, "QuickSupport").
- **Unexpected attachments or APK files** — e.g. "Wedding_invitation.apk", "Electricity_bill.apk".
- **Poor spelling and grammar** (though AI now makes some scams well written — don't rely on this alone).

9.5 Common frauds in India — and how to avoid them

Scam	How it works	Protection
UPI "collect request" / QR scam	"I'm sending you money — just enter your PIN / scan this QR". Entering the UPI PIN always sends money.	You never need a PIN or QR scan to receive money.
Fake customer care	Fake helpline numbers on search results or social media; "agent" asks to install a remote-access app	Get numbers only from the official app/website; never install remote-access apps on request
KYC / electricity disconnection SMS	"Update KYC / pay bill now or service cut tonight" with a link or number	Contact the bank/DISCOM through official channels
"Digital arrest" / fake police or courier	Video call from fake officers claiming a parcel with drugs in your name; demand money to "clear" you	Police never arrest or settle cases over video calls. Hang up and report on 1930.
Job and task scams	Paid "like and review" tasks, then "invest to unlock earnings"	Genuine employers never ask you to pay
Fake shopping sites and ads	Very cheap branded goods; money taken, nothing delivered	Buy from known platforms; check reviews and URL; prefer cash on delivery for new sites
SIM swap	Criminal gets a duplicate SIM to receive your OTPs	If your SIM suddenly loses signal, contact your operator immediately

Sextortion / fake profiles	Video call recorded and used for blackmail	Don't accept video calls from strangers; don't pay; report
----------------------------	--	--

9.6 Malware

Malware (malicious software) is any program designed to harm, spy, steal or extort.

Type	What it does
Virus	Attaches to files; spreads when infected files are opened or shared
Worm	Spreads by itself across networks without user action
Trojan	Looks like a useful program (game, "free" software, fake app) but hides harmful code
Ransomware	Encrypts your files and demands payment to unlock them
Spyware / keylogger	Secretly records activity and keystrokes (passwords)
Adware	Floods you with unwanted ads, often bundled with free software
Banking trojans / SMS stealers (Android)	Fake APKs that read your OTP messages and bank apps

Signs of infection

Sudden slowness, strange pop-ups, new toolbars or apps you didn't install, browser homepage changed, friends receiving messages you didn't send, battery draining fast, files that won't open or have strange extensions.

Protection

- Keep the OS, browser and apps **updated** (turn on automatic updates).
- Use **antivirus**: Windows Security (Microsoft Defender) is built in and good; keep it on. On Android, keep Google Play Protect on.
- Install apps only from official stores; **never** install APKs sent over WhatsApp or SMS.
- Scan pen drives; don't open unexpected attachments.
- Keep **offline or cloud backups** (Module 5) — the best defence against ransomware.

9.7 Safe browsing and Wi-Fi

- Check for **https** and the correct domain before logging in or paying.
- Type important addresses yourself or use bookmarks, instead of clicking links in messages.

- Be careful with **public Wi-Fi** (cafés, stations): avoid banking on it, or use mobile data. Turn off auto-join for open networks.
- Log out of shared or public computers; never let browsers save passwords on them.
- Review **app permissions**: does a calculator need your location and contacts?

9.8 Protecting your personal data and privacy

- Think before you post: your address, school, daily routine, boarding passes, and Aadhaar or PAN photos can be misused.
- Use privacy settings on social media — limit who sees your posts and profile details.
- Share Aadhaar using **masked Aadhaar** or offline e-KYC where possible; lock biometrics on the mAadhaar app/UIDAI site when not needed.
- Turn off location tagging on photos you share publicly.
- Remember that what is posted online can remain forever (your **digital footprint**) — future employers and colleges may see it.
- India's **Digital Personal Data Protection Act, 2023** gives people rights over how organisations collect and use their personal data.

9.9 Healthy digital habits (digital wellbeing)

- Follow the **20-20-20 rule** for eyes: every 20 minutes, look 20 feet away for 20 seconds.
- Sit with good posture; keep the screen at eye level; take breaks.
- Use Digital Wellbeing / Screen Time to track and limit usage; avoid screens before sleep.
- Be kind online; report and block **cyberbullying**; don't forward unverified news (misinformation).
- Respect copyright — credit sources; don't use others' work as your own.

9.10 If something goes wrong — act fast

Emergency steps after a fraud or hack

1. **Money lost?** Call the national cyber-crime helpline **1930** immediately and report at **cybercrime.gov.in**. Speed matters — funds can sometimes be frozen if reported within hours.
2. Call your **bank** to block cards/UPI and dispute the transaction.
3. **Change passwords** of the affected account and any account using the same password; turn on 2FA.
4. Log out of all sessions (e.g. Google → Security → Your devices; WhatsApp → Linked devices).
5. Scan devices for malware; uninstall suspicious apps; if needed, factory-reset after backing up photos.
6. Report fraudulent numbers/messages on the government's **Sanchar Saathi / Chakshu** facility and to the platform.
7. Keep screenshots, transaction IDs and phone numbers as evidence.

9.11 Cyber-safety checklist

✓	Habit
☐	Unique, long passwords; password manager
☐	2FA on email, social media, banking; WhatsApp two-step verification
☐	Never share OTP, PIN, CVV; never enter UPI PIN to receive money
☐	Updates and antivirus on; apps only from official stores
☐	Check links and https before logging in or paying
☐	Backups following 3-2-1
☐	Privacy settings reviewed; think before posting
☐	Know 1930 and cybercrime.gov.in

Module 9 — Summary

- Most attacks trick people (social engineering). Never share OTP/PIN/CVV/passwords.
- Long, unique passwords + password manager + 2FA.
- Spot phishing: urgency, odd links/senders, requests for secrets, APKs.
- Malware types: virus, worm, trojan, ransomware, spyware; protect with updates, antivirus, official stores, backups.
- Protect privacy; build healthy digital habits.
- If defrauded: call 1930, report at cybercrime.gov.in, inform the bank, change passwords.

Practice questions — Module 9

1. What is social engineering? Give two examples.
2. List five features of a strong password. Why should passwords never be reused?
3. Explain two-factor authentication with an example.
4. Identify five warning signs of a phishing message.
5. Why do you never need to enter a UPI PIN to receive money?
6. Differentiate a virus, a worm and a trojan.
7. How does keeping backups protect against ransomware?
8. Your friend lost ₹5,000 to a fake customer-care call 30 minutes ago. List, in order, what they should do.

Introduction to Programming and Final Revision

What programs and algorithms are, flowcharts and pseudocode, your first Python programs with variables, decisions and loops, and a one-page revision of the whole course.

10.1 What is programming?

A **program** is a precise sequence of instructions that tells a computer how to do a task. **Programming** (or **coding**) is the skill of writing those instructions in a **programming language** the computer can translate into machine code (Module 4). Every app, website, game and AI system is built from programs.

Computers are fast but literal: they do exactly what the instructions say, nothing more. So the heart of programming is **clear, step-by-step thinking**.

10.2 Algorithms

An **algorithm** is a finite, ordered set of well-defined steps that solves a problem. It is the plan; the program is the plan written in a language.

Example — algorithm to make tea

1. Boil one cup of water.
2. Add tea leaves and sugar; boil for 2 minutes.
3. Add milk; boil for 1 minute.
4. Strain into a cup.
5. Stop.

Good algorithms are **unambiguous** (each step has one meaning), **finite** (they end), have clear **input** and **output**, and are **effective** (each step can actually be done).

Worked example 10.1 — algorithm to find the larger of two numbers

1. Start.
2. Input A and B.
3. If $A > B$, output "A is larger"; otherwise output "B is larger (or equal)".
4. Stop.

10.3 Flowcharts

A **flowchart** is a picture of an algorithm using standard symbols joined by arrows.

Symbol	Name	Meaning
Oval / rounded rectangle	Terminal	Start or Stop
Parallelogram	Input/Output	Read data or display results
Rectangle	Process	A calculation or action
Diamond	Decision	A yes/no question — two exits
Arrow	Flow line	Direction of flow

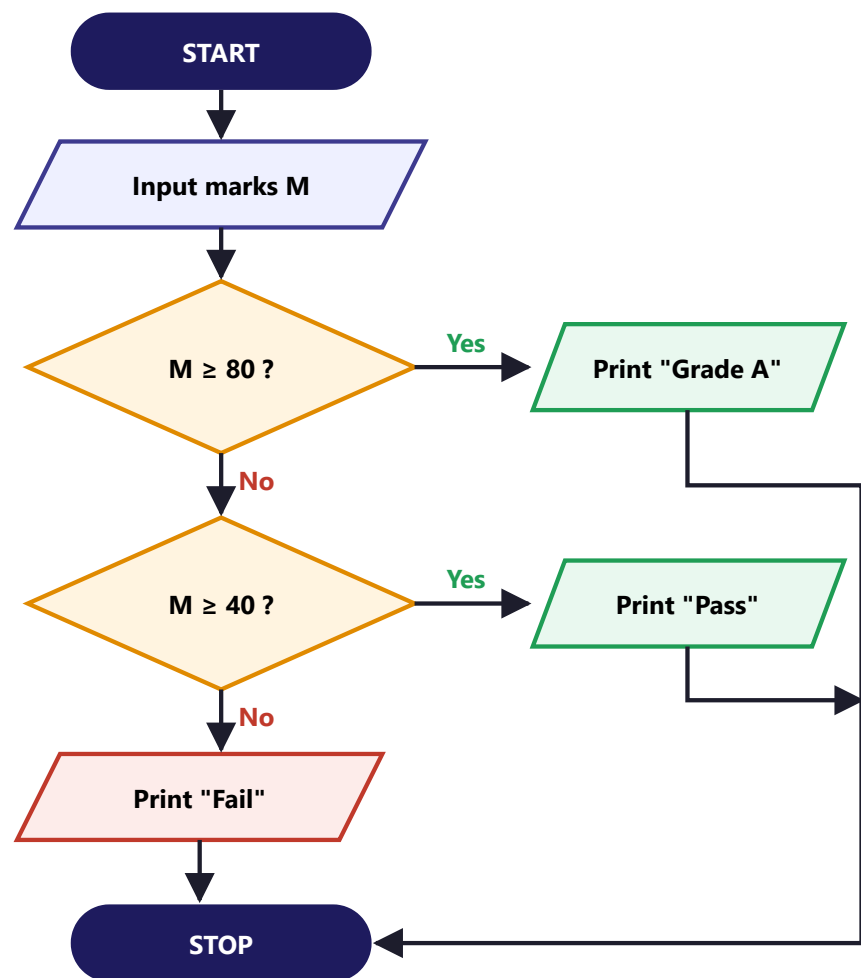


Figure 10.1 — Flowchart: print a grade from marks using decisions.

10.4 Pseudocode

Pseudocode writes an algorithm in structured plain English, close to a real program but without worrying about exact syntax.

```

START
INPUT marks
IF marks >= 80 THEN
    PRINT "Grade A"
ELSE IF marks >= 40 THEN
    PRINT "Pass"
ELSE
    PRINT "Fail"
END IF
STOP
  
```

10.5 Programming languages

Level	Description	Examples
-------	-------------	----------

Machine language	Binary instructions the CPU runs directly	10110000 01100001
Assembly language	Short codes for machine instructions	MOV AL, 61h
High-level languages	Close to English; portable; translated by compilers/interpreters	Python, C, C++, Java, JavaScript

Language	Known for
Python	Easy to read; data science, AI, automation, education — ideal first language
JavaScript	Interactive websites; runs in every browser
C / C++	Speed; operating systems, embedded systems, games
Java / Kotlin	Enterprise software, Android apps
SQL	Querying databases
Scratch	Block-based visual programming for beginners

10.6 Your first Python programs

You can run Python without installing anything by using a free online editor (search for "online Python compiler") or install it from **python.org**. Lines beginning with `#` are comments — notes for humans that the computer ignores.

1. Output

```
# My first program
print("Hello, AI Tutor Spark!")
```

Output: Hello, AI Tutor Spark!

2. Variables and input

A **variable** is a named box that stores a value. `input()` reads text typed by the user; `int()` and `float()` convert it to numbers.

```
name = input("What is your name? ")
age = int(input("How old are you? "))
print("Hello", name)
print("Next year you will be", age + 1)
```

3. Data types and operators

Type	Example	Operators
int (whole number)	25	+ - * / , // (whole division), % (remainder), ** (power)
float (decimal)	3.14	same
str (text)	"Riya"	+ joins, * repeats
bool (true/false)	True , False	and , or , not
Comparisons	== equal, != not equal, < > <= >=	

Worked example 10.2 — simple interest calculator

```
p = float(input("Principal: "))
r = float(input("Rate % per year: "))
t = float(input("Time in years: "))
si = p * r * t / 100
print("Simple interest =", si)
print("Total amount =", p + si)
```

Input 10000, 7, 3 → Simple interest = 2100.0; Total amount = 12100.0

4. Decisions — if / elif / else

Indentation (4 spaces) shows which lines belong inside the `if`. Python is strict about this.

```
marks = int(input("Enter marks: "))
if marks >= 80:
    print("Grade A")
elif marks >= 40:
    print("Pass")
else:
    print("Fail")
```

This is exactly the flowchart in Figure 10.1 written in Python.

5. Loops — repeating work

```
# for loop: print the 7 times table
for i in range(1, 11):
    print(7, "x", i, "=", 7 * i)

# while loop: keep asking until the password is right
password = ""
while password != "spark123":
    password = input("Password: ")
print("Welcome!")
```

`range(1, 11)` gives 1, 2, ..., 10 (the end value is not included).

Worked example 10.3 — sum and average of marks

```
total = 0
n = int(input("How many subjects? "))
for i in range(n):
    m = float(input("Marks: "))
    total = total + m
print("Total =", total)
print("Average =", round(total / n, 2))
```

Input 3 subjects: 85, 78, 90 → Total = 253.0, Average = 84.33 (same as the spreadsheet in Module 6).

6. Lists and functions

```
marks = [85, 78, 90, 62]           # a list
print(max(marks), min(marks))     # 90 62
print(sum(marks) / len(marks))    # 78.75

def grade(m):                      # a reusable function
    if m >= 80:
        return "A"
    elif m >= 40:
        return "Pass"
    return "Fail"

for m in marks:
    print(m, grade(m))
```

10.7 Errors and debugging

Error type	Meaning	Example
Syntax error	Breaks the language's grammar — the program won't run	<code>print("Hi"</code> (missing bracket), wrong indentation
Runtime error	Crashes while running	Dividing by zero; <code>int("abc")</code>
Logic error	Runs, but gives the wrong answer	Using <code>total / 2</code> instead of <code>total / n</code>

Debugging means finding and fixing errors: read the error message (it gives the line number), print intermediate values, test with simple inputs whose answers you know, and fix one thing at a time.

Where to go next

Practise a little every day: small programs (unit converter, bill calculator, quiz game). Try Scratch for visual logic, then Python. Build a simple web page with HTML (the WordPress course on this site is another route to building websites). Ask the AI tutor to explain any error message step by step.

10.8 Course revision — the whole course on one page

Module	Key points
1 Introduction	IPOS cycle; data vs information; characteristics (speed, accuracy/GIGO); history (Babbage, Lovelace, Turing, ENIAC); five generations; types (super, mainframe, server, PC, mobile, embedded)
2 Hardware	CPU = CU + ALU + registers; fetch–decode–execute; GHz, cores, cache; RAM (volatile) vs ROM; HDD vs SSD; motherboard, SMPS; input/output devices; ports
3 Data	Binary; 8 bits = 1 byte; KB→MB→GB→TB (×1,024); conversions; ASCII (A = 65), Unicode; pixels × colour depth; sampling; lossy vs lossless
4 Software	System vs application; OS functions (process, memory, file, device, UI, security); GUI vs CLI; Windows, Linux, Android; compiler vs interpreter; licences
5 Files	Extensions; folder trees and paths; copy vs move; shortcuts; ZIP; NTFS/FAT32/exFAT; 3-2-1 backups; cloud sharing

6 Office	Formatting, styles, mail merge; cells and formulas (=SUM, AVERAGE, IF, COUNTIF, VLOOKUP); \$A\$1; charts; slide design rules
7 Internet	Network of networks; packets; TCP/IP; web vs internet; URL, DNS, HTTPS; search operators; email To/CC/BCC and etiquette
8 Networking	PAN/LAN/MAN/WAN; client-server vs P2P; topologies; switch vs router; IP vs MAC; DHCP, NAT; protocols
9 Cyber safety	Never share OTP/PIN; strong unique passwords + 2FA; phishing signs; malware types; backups; privacy; 1930 & cybercrime.gov.in
10 Programming	Algorithm, flowchart symbols, pseudocode; Python: print, input, variables, if/elif/else, for/while, lists, functions; debugging

Module 10 — Summary

- A program is a precise set of instructions; an algorithm is the step-by-step plan.
- Flowcharts use terminal, input/output, process and decision symbols; pseudocode writes logic in plain English.
- Python basics: variables, input/output, if/elif/else, for and while loops, lists, functions.
- Errors: syntax, runtime, logic — debug methodically.

Practice questions — Module 10

1. Define an algorithm and list four properties of a good algorithm.
2. Draw a flowchart to find the largest of three numbers.
3. Write pseudocode to check whether a number is even or odd.
4. Write a Python program that converts Celsius to Fahrenheit ($F = C \times 9/5 + 32$).
5. Write a Python loop to print the numbers from 10 down to 1.
6. What will `print(17 // 5, 17 % 5)` display? (Ans: 3 2)
7. Identify the error type: a program to average marks divides by 10 instead of the number of subjects.
8. Write a Python function `is_adult(age)` that returns True for age 18 or more.

20 Hands-On Practical Exercises

Do these on a computer (Windows is used in the steps; Linux, Mac and Google tools are similar).
Tick each one when done — together they cover every practical skill in the course.

Part A — Computer basics and files

Lab 1 — Know your computer

1. Open Settings → System → About. Note the processor, RAM and Windows edition.
2. Open Task Manager (Ctrl + Shift + Esc) → Performance. Note CPU speed, number of cores, RAM in use and disk type (SSD/HDD).
3. Write a one-paragraph "specification card" for your computer.

Learning outcome: read real hardware specifications (Module 2).

Lab 2 — Build a folder structure

1. In Documents, create: 01_College → Semester_1 → Physics, Maths, Computer.
2. Create 02_Certificates and 03_Personal.
3. Create a text file in Computer named Lab_Notes.txt and type today's date.
4. Write down the absolute path of Lab_Notes.txt.

Lab 3 — Copy, move, rename, delete, restore

1. Copy Lab_Notes.txt to Maths (Ctrl + C, Ctrl + V).
2. Rename the copy to Lab_Notes_copy.txt (F2).
3. Move it to 03_Personal (Ctrl + X, Ctrl + V).
4. Delete it, then restore it from the Recycle Bin.
5. Turn on "File name extensions" in File Explorer's View menu.

Lab 4 — Compress and extract

1. Select the `01_College` folder → Compress to ZIP.
2. Compare the sizes (right-click → Properties).
3. Extract the ZIP to a new folder and check the contents.

Lab 5 — Back up to the cloud

1. Sign in to Google Drive or OneDrive.
2. Upload `02_Certificates`.
3. Share one file with a friend as **Viewer**; then remove the sharing.
4. Explain in two lines how your setup follows (or doesn't follow) the 3-2-1 rule.

Part B — Number systems

Lab 6 — Conversion drill

Convert without a calculator, then check with the Windows Calculator in **Programmer** mode:

Decimal	Binary	Hex
19		
100		
	1111 0000	
		2F
255		

Answers: 19 = 10011 = 13; 100 = 1100100 = 64; 11110000 = 240 = F0; 2F = 47 = 101111; 255 = 11111111 = FF.

Lab 7 — Your name in ASCII

Write your first name in ASCII decimal and binary (A = 65 ... Z = 90; a = 97 ... z = 122). How many bytes does it take?

Part C — Office tools

Lab 8 — Formal letter

Type a leave application to your principal. Use A4, 2.5 cm margins, a bold subject line, justified paragraphs, 1.15 line spacing, and your signature block. Check spelling (F7). Export as PDF.

Lab 9 — Resume with a table

Create a one-page resume using Heading styles, a two-column table for "Education", bullet points for "Skills", and a header with your name and phone. Insert a page number in the footer.

Lab 10 — Mail merge certificates

Make an Excel list of 5 names. In Word, design a certificate and use Mail Merge to create one certificate per name.

Lab 11 — Marksheet in Excel

1. Enter names and marks of 10 students in 5 subjects.
2. Calculate Total (=SUM), Percentage, and Result (=IF(percentage>=40,"Pass","Fail")).
3. Add Grade with nested IF ($A \geq 80$, $B \geq 60$, $C \geq 40$, else F).
4. Find class topper (=MAX), average (=AVERAGE), and number of passes (=COUNTIF).
5. Apply conditional formatting to show marks below 40 in red.
6. Sort by Total (largest first) and freeze the header row.

Lab 12 — Household budget with a chart

List monthly expenses (rent, food, electricity, travel, mobile, education, savings). Calculate the total and each item's percentage using an absolute reference to the total cell (=B2/\$B\$10). Insert a pie chart with a title and data labels.

Lab 13 — Five-slide presentation

Make a presentation "Cyber Safety Tips for My Family": title slide, three content slides (passwords, phishing, UPI safety) with one image each, and a summary slide. Follow the 6 × 6 rule and fonts ≥ 24 pt. Add speaker notes and rehearse.

Part D — Internet and networking

Lab 14 — Smart searching

Use search operators to find: (a) a PDF syllabus from a government website (`site:gov.in filetype:pdf`); (b) the exact phrase "digital personal data protection act"; (c) information about "python" the programming language but not the snake (`python -snake`). Record the best link for each and judge its reliability (who, when, why).

Lab 15 — Professional email

Send yourself (or your teacher, if asked) an email with a clear subject, polite greeting, 3-line message, closing, signature and a PDF attachment. Then practise CC and BCC with a friend's permission.

Lab 16 — Explore your network

1. Open Command Prompt; run `ipconfig`. Note your IPv4 address and Default Gateway.
2. Run `ping google.com` — note the average time (ms).
3. Run `nslookup aitutorspark.co.in` — see DNS in action.
4. Run a speed test in the browser; convert the download speed from Mbps to MB/s.

Part E — Cyber safety

Lab 17 — Account security check-up

1. Run the Google (or Microsoft) Security Checkup for your account.
2. Turn on 2-Step Verification.
3. Turn on WhatsApp two-step verification (Settings → Account).
4. Review devices signed in to your account and remove any you don't recognise.

Lab 18 — Spot the scam

Collect three suspicious SMS/WhatsApp messages you or your family received (hide personal details). For each, list the red flags from Module 9 and write the correct safe action.

Part F — Programming

Lab 19 — Flowchart and pseudocode

Draw a flowchart and write pseudocode for: "Input three numbers and print the largest."
Test it by hand with (4, 9, 2), (7, 7, 1) and (−3, −8, −1).

Lab 20 — Python mini-programs

1. Electricity bill: input units; charge ₹5/unit up to 100 units and ₹7/unit above; print the bill.
2. Multiplication table of any number using a for loop.
3. Number-guessing game: the program stores a secret number; the user guesses until correct, with "higher/lower" hints (while loop).

```
# Starter for the electricity bill
units = int(input("Units used: "))
if units <= 100:
    bill = units * 5
else:
    bill = 100 * 5 + (units - 100) * 7
print("Bill = Rs", bill)
```

Test: 80 units → ₹400; 150 units → 500 + 350 = ₹850.

Model Question Paper — Computer Fundamentals

Time: 2 hours · Maximum marks: 70 · Attempt all sections.

Section A — Very short answers ($10 \times 1 = 10$)

1. Expand CPU and RAM.
2. What is the binary equivalent of 12?
3. Name one open-source operating system.
4. What is the extension of an Excel workbook?
5. Which key combination undoes the last action?
6. Expand URL.
7. Which device connects a LAN to the internet?
8. What is the national cyber-crime helpline number?
9. Which flowchart symbol represents a decision?
10. How many bits make a byte?

Section B — Short answers ($8 \times 3 = 24$)

11. Explain the IPOS cycle with an example.
12. Differentiate RAM and ROM (any three points).
13. Convert $1101\ 1011_2$ to decimal and hexadecimal.
14. List three functions of an operating system.
15. Differentiate copy and move. Give the shortcuts.
16. Write a spreadsheet formula to show "Pass" when marks in C2 are 33 or more, otherwise "Fail".
17. What is the difference between the internet and the World Wide Web?
18. List three warning signs of a phishing message.

Section C — Long answers ($4 \times 9 = 36$)

19. Draw a labelled block diagram of a computer and explain the fetch–decode–execute cycle.
20. Explain the types of computer networks (PAN, LAN, MAN, WAN) and draw any two topologies.

21. Describe step by step what happens when you type a web address into a browser, mentioning DNS, IP addresses, packets and HTTPS.
22. Draw a flowchart and write a Python program to calculate the average of marks in five subjects and print the grade ($A \geq 80$, $B \geq 60$, $C \geq 40$, otherwise F).

Hints for Section A: 1. Central Processing Unit, Random Access Memory · 2. 1100 · 3. Linux · 4. .xlsx · 5. Ctrl + Z · 6. Uniform Resource Locator · 7. Router · 8. 1930 · 9. Diamond · 10. 8. Q13: 219 = DB.

BONUS

Keyboard Shortcuts, Troubleshooting and Careers

The shortcuts that save hours, typing skills, fixing common computer problems yourself, and jobs and courses that build on computer fundamentals.

B.1 Keyboard shortcuts everyone should know (Windows)

Shortcut	Action	Shortcut	Action
Ctrl + C	Copy	Ctrl + X	Cut
Ctrl + V	Paste	Ctrl + Z	Undo
Ctrl + Y	Redo	Ctrl + A	Select all
Ctrl + S	Save	Ctrl + P	Print
Ctrl + F	Find	Ctrl + N	New document/window
Alt + Tab	Switch between open windows	Alt + F4	Close the current window
Win	Open Start menu	Win + D	Show desktop
Win + E	Open File Explorer	Win + L	Lock the computer
Win + I	Open Settings	Win + V	Clipboard history
Win + Shift + S	Screenshot of an area	PrtScn	Screenshot of the screen
Win + ← / →	Snap window to half screen	Win + . (period)	Emoji and symbols panel
Ctrl + Shift + Esc	Task Manager	Ctrl + Alt + Del	Security options
F2	Rename file	F5	Refresh
Ctrl + ← / →	Move cursor word by word	Shift + arrows	Select text
Home / End	Start / end of line	Ctrl + Home / End	Start / end of document

On a Mac, most shortcuts use **Cmd** instead of Ctrl (Cmd + C, Cmd + V...). Phones: long-press text for copy/paste; take screenshots with Power + Volume Down on most Android phones.

B.2 Typing skills

Touch typing — typing without looking at the keys, using all ten fingers — is one of the most valuable computer skills for exams, jobs (data entry, office work) and programming.



Figure B.1 — The home row: left fingers on A S D F, right fingers on J K L ;, thumbs on the space bar.

- Practise 15 minutes daily with free typing tutors; accuracy first, then speed.
- Targets: 30 words per minute (wpm) is good for everyday work; many data-entry jobs ask for 30–40 wpm; typists 50+ wpm.
- Indian-language typing: Windows and Android support Hindi, Odia, Bengali, Tamil and other keyboards (Settings → Time & language → Language). Google's and Microsoft's Indic input tools let you type phonetically.

B.3 Fixing common problems yourself

Problem	First things to try
Computer is very slow	Restart; close unused tabs/apps (Task Manager); uninstall unused programs; disable start-up apps (Task Manager → Startup); free disk space; scan for malware; consider more RAM or an SSD
A program is frozen	Wait a minute; then Ctrl + Shift + Esc → select it → End task
Computer won't turn on	Check power cable, socket, UPS; for laptops, charge for 30 minutes; hold power button 15–30 seconds; check the charger light
No sound	Check volume and mute; correct output device (speaker icon); headphones plugged in; update/reinstall audio driver
Printer not printing	Is it on, with paper and ink/toner? Clear the print queue; restart printer and PC; check it is set as default; reinstall driver

Pen drive not showing	Try another USB port; check Disk Management; scan for errors; try on another computer
Wi-Fi problems	See Module 8.11: restart router; forget and rejoin network; check airplane mode
Phone storage full	Delete WhatsApp media/forwards; move photos to cloud; clear app cache; uninstall unused apps
Forgot a website password	Use "Forgot password" on the official site — never on a link from a message
Blue screen / repeated crashes	Note the error code; install updates; check recently installed hardware or drivers; run memory and disk checks; get professional help if it continues

Key idea — the universal first step

Restarting fixes a surprising number of problems, because it clears memory and restarts every program and driver in a clean state. Save your work, then restart before trying anything complicated.

B.4 Accessibility features

Computers can be made easier for everyone — people with low vision, hearing difficulties, or limited movement:

- **Magnifier** (Win + +), large text, high-contrast themes, dark mode.
- **Narrator** / screen readers (NVDA is free; TalkBack on Android; VoiceOver on Apple) read the screen aloud.
- **Voice typing** (Win + H) and live captions.
- **Sticky keys** for one-handed shortcuts; on-screen keyboard.

B.5 Careers that start with computer fundamentals

Role	What you do	Next skills to learn
Data entry operator / computer operator	Enter and manage records in offices, banks, hospitals	Fast accurate typing, Excel, Indic typing
Office assistant / back-office executive	Documents, spreadsheets, email, reports	Advanced Word/Excel, email etiquette
Digital services centre (CSC) operator	Help citizens with online forms, bills, certificates	E-governance portals, customer service

IT support / hardware & networking technician	Install, repair and maintain computers and networks	Hardware, OS installation, networking (CCNA-level basics)
Accounts assistant	Billing, GST, bookkeeping	Tally Prime, Excel
Graphic designer / content creator	Posters, social media, videos	Canva, Photoshop/GIMP, video editing
Web developer	Build websites	HTML, CSS, JavaScript, WordPress (see our WordPress course)
Programmer / software developer	Write software and apps	Python, data structures, databases, Git
AI / data roles	Work with data and AI tools	Excel → Python → data analysis; our Generative AI course

Government exams (SSC, banking, railways, state PSCs) and many private jobs test computer awareness — the topics in this course cover most of that syllabus. Recognised courses such as NIELIT's CCC, O-Level or equivalent certificates can support job applications.

B.6 Glossary of common abbreviations

Short	Full form	Short	Full form
CPU	Central Processing Unit	GPU	Graphics Processing Unit
RAM	Random Access Memory	ROM	Read-Only Memory
HDD / SSD	Hard Disk Drive / Solid-State Drive	USB	Universal Serial Bus
BIOS / UEFI	Basic Input Output System / Unified Extensible Firmware Interface	OS	Operating System
GUI / CLI	Graphical / Command Line Interface	ALU / CU	Arithmetic Logic Unit / Control Unit
LAN / WAN	Local / Wide Area Network	ISP	Internet Service Provider
URL	Uniform Resource Locator	HTML	HyperText Markup Language
HTTP(S)	HyperText Transfer Protocol (Secure)	DNS	Domain Name System
IP	Internet Protocol	TCP	Transmission Control Protocol

MAC	Media Access Control	DHCP	Dynamic Host Configuration Protocol
Wi-Fi	Wireless networking (IEEE 802.11)	SMTP	Simple Mail Transfer Protocol
PDF	Portable Document Format	ASCII	American Standard Code for Information Interchange
OTP	One-Time Password	2FA / MFA	Two-/Multi-Factor Authentication
AI	Artificial Intelligence	IoT	Internet of Things

REVISION

100 Multiple-Choice Questions

Test yourself on all ten modules. The answer key follows the questions.

1. A computer processes data according to a set of instructions called a:
(a) file (b) program (c) folder (d) port
2. The correct order of the IPOS cycle is:
(a) Output–Input–Process (b) Input–Process–Output (with Storage) (c) Process–Input–Storage (d) Storage–Output–Input
3. Raw facts without context are called:
(a) information (b) data (c) knowledge (d) software
4. GIGO stands for:
(a) Garbage In, Garbage Out (b) Good Input, Good Output (c) General Input General Output (d) Gigabyte In Gigabyte Out
5. Who is called the father of the computer?
(a) Alan Turing (b) Charles Babbage (c) Blaise Pascal (d) Bill Gates
6. Who is often called the first computer programmer?
(a) Ada Lovelace (b) Marie Curie (c) Grace Hopper (d) Tim Berners-Lee
7. ENIAC used which technology?
(a) transistors (b) vacuum tubes (c) microprocessors (d) ICs
8. The first commercial microprocessor was the:
(a) Intel 4004 (b) Pentium (c) ENIAC (d) IBM PC
9. Third-generation computers used:
(a) vacuum tubes (b) transistors (c) integrated circuits (d) AI chips
10. Weather forecasting mainly uses:
(a) embedded computers (b) supercomputers (c) smartwatches (d) calculators
11. A computer inside a washing machine is:
(a) a mainframe (b) an embedded computer (c) a server (d) a workstation
12. Loading the operating system when a computer starts is called:
(a) booting (b) formatting (c) compiling (d) zipping
13. The ALU performs:
(a) storage (b) arithmetic and logic operations (c) printing (d) networking
14. The control unit:
(a) stores files permanently (b) directs and coordinates operations (c) displays output (d) converts AC to DC
15. The CPU cycle is:
(a) input–output (b) fetch–decode–execute (c) save–load–print (d) copy–paste

16. Clock speed is measured in:
(a) GB (b) GHz (c) Mbps (d) dpi
17. Which memory is volatile?
(a) ROM (b) RAM (c) SSD (d) HDD
18. The fastest memory in a computer is:
(a) RAM (b) registers (c) hard disk (d) cloud
19. BIOS/UEFI firmware is stored in:
(a) RAM (b) ROM/flash on the motherboard (c) the monitor (d) the keyboard
20. Compared with an HDD, an SSD is:
(a) slower and noisier (b) faster with no moving parts (c) only for CDs (d) volatile
21. The main circuit board of a computer is the:
(a) motherboard (b) NIC (c) SMPS (d) monitor
22. The SMPS:
(a) processes data (b) converts AC mains to low-voltage DC (c) stores files (d) connects to Wi-Fi
23. Which is an input device?
(a) printer (b) scanner (c) speaker (d) projector
24. Which is an output device?
(a) microphone (b) keyboard (c) monitor (d) webcam
25. Exam answer sheets with filled bubbles are read by:
(a) OCR (b) OMR (c) MICR (d) GPS
26. Monitor resolution 1920×1080 is called:
(a) HD Ready (b) Full HD (c) 4K (d) 8K
27. One byte equals:
(a) 4 bits (b) 8 bits (c) 16 bits (d) 1,024 bits
28. 1 KB equals:
(a) 1,000 bits (b) 1,024 bytes (c) 1,024 KB (d) 8 bytes
29. 8 bits can represent how many values?
(a) 8 (b) 16 (c) 256 (d) 1,024
30. Binary 1010 equals decimal:
(a) 8 (b) 10 (c) 12 (d) 5
31. Decimal 25 in binary is:
(a) 11001 (b) 10101 (c) 11100 (d) 10011
32. Hexadecimal uses digits:
(a) 0–7 (b) 0–9 only (c) 0–9 and A–F (d) 0–1
33. Hex A equals decimal:
(a) 1 (b) 10 (c) 11 (d) 16
34. Binary $1 + 1$ equals:
(a) 2 (b) 11 (c) 10 (d) 01
35. ASCII code of 'A' is:
(a) 1 (b) 32 (c) 65 (d) 97
36. The encoding that covers almost all world languages is:
(a) ASCII (b) Unicode (UTF-8) (c) EBCDIC (d) Morse
37. A 100 Mbps connection downloads at most about:
(a) 100 MB/s (b) 12.5 MB/s (c) 800 MB/s (d) 1 MB/s
38. True colour images use how many bits per pixel?
(a) 1 (b) 8 (c) 24 (d) 64

39. JPEG and MP3 use:
(a) lossless compression (b) lossy compression (c) no compression (d) encryption
40. Which is system software?
(a) Microsoft Word (b) Windows (c) Chrome (d) VLC
41. Which is application software?
(a) Linux (b) device driver (c) Excel (d) BIOS
42. A device driver lets the OS:
(a) browse the web (b) communicate with a hardware device (c) edit photos (d) send email
43. GUI stands for:
(a) General User Input (b) Graphical User Interface (c) Global Unit Interface (d) Graphics Utility Installer
44. Which is an open-source OS?
(a) Windows (b) macOS (c) Linux (d) iOS
45. Android is based on:
(a) Windows (b) Linux (c) macOS (d) DOS
46. A compiler:
(a) translates the whole program at once (b) runs one line at a time (c) is a virus (d) is an input device
47. Python is usually run by:
(a) an interpreter (b) an assembler (c) a scanner (d) a modem
48. An OS that must respond within strict time limits is:
(a) batch (b) real-time (c) single-task (d) network
49. Virtual memory uses:
(a) extra RAM chips (b) storage drive space as extra memory (c) the cloud (d) the monitor
50. Software that is free and whose source code is public is:
(a) shareware (b) open-source (c) proprietary (d) pirated
51. The extension of a Word document is:
(a) .xlsx (b) .docx (c) .pptx (d) .exe
52. Which is an image file?
(a) .mp3 (b) .png (c) .docx (d) .zip
53. An Android app installer has the extension:
(a) .exe (b) .apk (c) .dmg (d) .pdf
54. The shortcut to copy is:
(a) Ctrl + V (b) Ctrl + C (c) Ctrl + X (d) Ctrl + Z
55. The shortcut to undo is:
(a) Ctrl + Y (b) Ctrl + U (c) Ctrl + Z (d) Ctrl + A
56. Shift + Delete:
(a) moves a file to the Recycle Bin (b) deletes permanently (c) copies a file (d) renames a file
57. Cut and paste a file:
(a) duplicates it (b) moves it (c) deletes it (d) zips it
58. Which file system limits single files to 4 GB?
(a) NTFS (b) exFAT (c) FAT32 (d) ext4
59. In the 3-2-1 backup rule, the "1" means:
(a) one password (b) one copy off-site (c) one drive only (d) one backup per year

50. C:\Users\Riya\Documents\a.pdf is an example of:
(a) a URL (b) an absolute path (c) an IP address (d) an email
51. Every spreadsheet formula starts with:
(a) + (b) # (c) = (d) @
52. The cell in column C, row 5 is:
(a) 5C (b) C5 (c) R5C3 (d) CC5
53. =SUM(A1:A3) where A1=2, A2=3, A3=5 gives:
(a) 5 (b) 10 (c) 30 (d) 2
54. =AVERAGE(4,6,8) gives:
(a) 6 (b) 18 (c) 8 (d) 4
55. =IF(50>=40,"Pass","Fail") gives:
(a) Fail (b) Pass (c) 50 (d) TRUE
56. An absolute reference looks like:
(a) A1 (b) \$A\$1 (c) A:1 (d) #A1
57. The best chart for a trend over time is:
(a) pie (b) line (c) scatter only (d) none
58. Mail merge is used to:
(a) merge two emails (b) create many personalised letters from a list (c) merge cells (d) compress files
59. A good rule for slides is:
(a) full paragraphs (b) one main idea per slide (c) tiny fonts (d) many animations
70. The internet is:
(a) one big computer (b) a global network of networks (c) the same as Google (d) a browser
71. The World Wide Web was invented by:
(a) Tim Berners-Lee (b) Charles Babbage (c) Linus Torvalds (d) Alan Turing
72. Data sent over the internet is split into:
(a) folders (b) packets (c) pixels (d) bytes only
73. DNS converts:
(a) IP to MAC (b) domain names to IP addresses (c) text to binary (d) HTTP to HTTPS
74. In https://www.example.gov.in, "https" is the:
(a) domain (b) protocol (c) path (d) query
75. HTTPS means the connection is:
(a) faster (b) encrypted (c) offline (d) free
76. A program used to view web pages is a:
(a) compiler (b) browser (c) router (d) spreadsheet
77. To search an exact phrase, use:
(a) brackets (b) quotation marks (c) a minus sign (d) site:
78. To hide email recipients from each other, use:
(a) To (b) CC (c) BCC (d) Subject
79. A network in one building is a:
(a) WAN (b) LAN (c) MAN (d) PAN
80. The largest WAN is:
(a) a school LAN (b) the internet (c) Bluetooth (d) a hotspot
81. In a star topology, all devices connect to a:
(a) ring (b) central switch (c) single cable (d) satellite

32. The device that connects a home network to the internet is a:
(a) router (b) monitor (c) scanner (d) printer
33. A switch sends data using:
(a) IP addresses only (b) MAC addresses (c) phone numbers (d) URLs
34. Which is an IPv4 address?
(a) 192.168.1.10 (b) 3C:52:82:1A:9F:04 (c) www.site.com (d) 2001:db8::1
35. DHCP:
(a) encrypts data (b) automatically assigns IP addresses (c) translates names (d) sends email
36. Which cable uses light?
(a) twisted pair (b) coaxial (c) optical fibre (d) power cable
37. Secure your home Wi-Fi with:
(a) no password (b) WEP (c) WPA2/WPA3 (d) the default password
38. A fake message that tricks you into giving details is:
(a) spam filter (b) phishing (c) firewall (d) backup
39. Which should you NEVER share?
(a) your email address (b) your OTP (c) your city (d) your hobbies
30. To receive money on UPI you need to:
(a) enter your UPI PIN (b) scan the sender's QR (c) do nothing — no PIN is needed (d) share your OTP
91. Malware that locks files and demands payment is:
(a) adware (b) ransomware (c) worm (d) cookie
92. A program that looks useful but hides harmful code is a:
(a) worm (b) trojan (c) driver (d) patch
93. Two-factor authentication adds:
(a) a second proof such as an OTP (b) a second screen (c) a second keyboard (d) a second browser
94. The national cyber-crime helpline number in India is:
(a) 100 (b) 108 (c) 1930 (d) 112
95. A strong password is:
(a) your birthday (b) 123456 (c) long and unique (d) your name
96. An algorithm is:
(a) a programming language (b) a step-by-step method to solve a problem (c) a type of virus (d) a hardware part
97. In a flowchart, a decision is shown by a:
(a) rectangle (b) diamond (c) oval (d) parallelogram
98. In a flowchart, start and stop are shown by a:
(a) oval (terminal) (b) diamond (c) rectangle (d) arrow
99. In Python, `print(17 % 5)` displays:
(a) 3 (b) 2 (c) 3.4 (d) 85

30. A mistake that breaks the language rules is
a:
(a) logic error (b) syntax error (c) runtime
error (d) hardware error

ANSWERS

MCQ Answer Key

If you got a question wrong, go back to the module it came from and re-read that section.

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	b	21	a	41	c	61	c	81	b
2	b	22	b	42	b	62	b	82	a
3	b	23	b	43	b	63	b	83	b
4	a	24	c	44	c	64	a	84	a
5	b	25	b	45	b	65	b	85	b
6	a	26	b	46	a	66	b	86	c
7	b	27	b	47	a	67	b	87	c
8	a	28	b	48	b	68	b	88	b
9	c	29	c	49	b	69	b	89	b
10	b	30	b	50	b	70	b	90	c
11	b	31	a	51	b	71	a	91	b
12	a	32	c	52	b	72	b	92	b
13	b	33	b	53	b	73	b	93	a
14	b	34	c	54	b	74	b	94	c
15	b	35	c	55	c	75	b	95	c
16	b	36	b	56	b	76	b	96	b
17	b	37	b	57	b	77	b	97	b
18	b	38	c	58	c	78	c	98	a
19	b	39	b	59	b	79	b	99	b
20	b	40	b	60	b	80	b	100	b

Short-answer exam questions (2–3 marks)

1. Define a computer. What is the IPO cycle?
2. Differentiate data and information.
3. What is booting?
4. State three functions of the CPU's control unit.
5. Differentiate RAM and ROM.
6. Why do computers use the binary system?
7. Convert 45 to binary and 1111_2 to decimal.
8. What is a device driver?
9. Differentiate compiler and interpreter.
10. What is a file extension? Give two examples.
11. What is the difference between CC and BCC?
12. What is DNS?
13. Differentiate IP address and MAC address.
14. What is phishing?
15. Define an algorithm.

Long-answer exam questions (5–10 marks)

1. Describe the five generations of computers with the technology and features of each.
2. Draw the block diagram of a computer and explain the function of each unit.
3. Explain the memory hierarchy. Compare RAM, ROM, HDD and SSD.
4. Explain number systems (binary, octal, decimal, hexadecimal) with conversion examples.
5. Explain the functions of an operating system and compare Windows, Linux and Android.
6. Explain file management: files, folders, paths, copy/move, compression and backups.
7. Describe the main features of word processors, spreadsheets and presentation software with examples of formulas.
8. Explain how the internet works and describe what happens when you open a website.
9. Explain network types, topologies and devices with diagrams.
10. Explain common cyber threats and the steps to stay safe online, including what to do after a fraud.

REFERENCE

Glossary of Terms

Key words used throughout these notes, in alphabetical order.

Algorithm

Step-by-step method to solve a problem.

Antivirus

Software that detects and removes malware.

Application software

Programs for user tasks (Word, browsers, games).

Backup

A separate copy of data kept for recovery.

Bandwidth

Data transfer capacity, e.g. Mbps.

Binary

Base-2 number system of 0s and 1s.

Bit / Byte

Single binary digit / group of 8 bits.

Booting

Starting a computer and loading the OS.

Browser

Program for viewing web pages.

Cache

Small, fast memory holding frequently used data.

Cloud computing

Using storage and services over the internet.

Compiler

Translates a whole program into machine code.

Cookie

Small data file a website stores in your browser.

CPU

Central Processing Unit — executes instructions.

Cyber crime

Crime committed using computers or the internet.

Data

Raw facts and figures.

DHCP

Automatically assigns IP addresses.

DNS

Translates domain names to IP addresses.

Domain name

Human-readable website name, e.g. example.in.

Driver

Software that lets the OS control a device.

Email

Electronic messages sent over the internet.

Embedded system

Computer built into another device.

Encryption

Scrambling data so only authorised parties can read it.

File extension

Letters after the dot showing file type.

File system

Method of organising data on a drive (NTFS, exFAT).

Firewall

Blocks unauthorised network traffic.

Firmware

Software stored permanently on hardware chips.

Flowchart

Diagram of an algorithm using standard symbols.

GUI

Graphical user interface.

Hardware

Physical parts of a computer.

Hexadecimal

Base-16 number system (0–9, A–F).

HTTPS

Secure, encrypted web protocol.

Information

Processed, meaningful data.

Internet

Global network of networks.

Interpreter

Runs a program line by line.

IP address

Logical network address of a device.

ISP

Internet Service Provider.

LAN / WAN

Local / wide area network.

MAC address

Hardware address of a network card.

Malware

Harmful software: virus, worm, trojan, ransomware.

Motherboard

Main circuit board connecting components.

Operating system

System software managing hardware and programs.

Packet

Small unit of data sent over a network.

Password manager

Tool that creates and stores strong passwords.

Path

Location of a file in the folder tree.

Phishing

Fraudulent message designed to steal information.

Pixel

Smallest dot of a digital image.

Program

Set of instructions for a computer.

Protocol

Set of rules for communication.

RAM

Volatile working memory.

Ransomware

Malware that locks files for ransom.

Resolution

Number of pixels in an image or screen.

ROM

Non-volatile memory for firmware.

Router

Connects networks and routes packets.

Search engine

Service that finds web pages by keywords.

Server

Computer that provides services to clients.

Software

Programs that run on hardware.

Spreadsheet

Grid of cells for calculations and data.

SSD / HDD

Flash-based / magnetic storage drive.

Switch

Connects devices within a LAN.

TCP/IP

Core protocols of the internet.

Topology

Layout of a network.

Trojan

Malware disguised as a useful program.

Two-factor authentication

Login needing two different proofs.

Unicode

Character code covering world languages.

URL

Full address of a web resource.

Utility software

Maintenance tools: antivirus, backup, cleanup.

Virtual memory

Disk space used as extra RAM.

Virus

Malware that spreads through infected files.

Web page / website

HTML document / collection of related pages.

Wi-Fi

Wireless local networking.

Worm

Self-spreading malware.

Keep learning

Use the AI tutor on www.aitutorspark.co.in to ask any question from these notes — it explains step by step. Complete the course quiz to earn your certificate. All the best!