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EXPERT COMPUTER COURSE

BASIC COMPUTER HARDWARE

Topics Covered:

#	Topic
1	Introduction to PC Hardware Support
2	Getting Started with PC Hardware Support
3	Electricity and Power Systems
4	CPUs and Motherboards
5	Basic Input/Output System (BIOS)
6	Memory Systems
7	Bus Structures
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9	Expansion Cards, Ports, Connectors & Cables
10	Data Storage Devices
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SECTION 1: INTRODUCTION TO PC HARDWARE SUPPORT

1.1 What is PC Hardware?

> *PC Hardware refers to all the physical, tangible components of a computer system that you can see and touch. Hardware support means maintaining, troubleshooting, repairing, and upgrading these physical components.*

Category	Components	Examples
Input Devices	Devices that send data into the computer	Keyboard, Mouse, Scanner, Microphone, Webcam
Output Devices	Devices that present processed data to user	Monitor, Printer, Speaker, Projector
Processing Unit	Where all calculations happen	CPU (Processor), GPU
Memory/Storage	Where data is stored temporarily or permanently	RAM, ROM, HDD, SSD, Optical Drives
Motherboard	Main circuit board connecting all components	PCB with sockets for CPU, RAM, expansion cards
Power Supply	Converts AC power to DC for internal components	SMPS (Switched Mode Power Supply)
Expansion Cards	Add-on cards for extra functionality	Graphics Card, Sound Card, Network Card
Ports & Connectors	Interfaces for connecting peripherals	USB, HDMI, VGA, RJ45, 3.5mm audio

1.2 Inside a Desktop Computer

- Case/Cabinet: The outer metal/plastic enclosure that houses all internal components
- Motherboard: Main PCB (Printed Circuit Board) — everything connects to it
- CPU: The processor mounted on the motherboard in a CPU socket
- RAM Sticks: Inserted in DIMM slots on the motherboard
- Hard Disk / SSD: Connected via SATA or NVMe cables/slots
- Power Supply Unit (PSU/SMPS): Usually at top or bottom of case, has fan
- Optical Drive: CD/DVD drive in front bay (optional in modern PCs)
- Expansion Cards: Graphics card, sound card in PCIe slots on motherboard
- Cooling System: CPU fan, case fans, heat sinks for temperature management

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SECTION 2: ELECTRICITY AND POWER SYSTEMS

2.1 Basic Electricity Concepts

> *Computers run on Direct Current (DC) power at low voltages. The power from the wall socket is Alternating Current (AC) at high voltage, so it must be converted before use.*

Term	Full Form / Meaning	Relevance to Computers
Voltage (V)	Electric potential difference; measured in Volts	PC components run on 3.3V, 5V, 12V DC
Current (A)	Flow of electric charge; measured in Amperes	Each component draws a certain amount of current
Power (W)	Rate of energy use: P = V × I; measured in Watts	PSU rated in Watts (e.g., 500W, 650W)
AC (Alternating Current)	Current that reverses direction periodically	Wall socket power (230V AC in India)
DC (Direct Current)	Current that flows in one direction only	What PC components actually need
Frequency	AC cycles per second; measured in Hertz (Hz)	India = 50Hz; USA = 60Hz
Grounding / Earthing	Safety connection to earth to prevent shock	Prevents static and shock damage to PC

2.2 SMPS – Switched Mode Power Supply

> *SMPS (Switched Mode Power Supply) is the power supply unit inside a desktop PC. It converts AC mains power (230V in India) to the DC voltages required by PC components.*

Output Rail	Voltage	Powers
+12V Rail	12 Volts DC	CPU, GPU (graphics card), HDD motors, fans
+5V Rail	5 Volts DC	USB ports, older drives, some logic circuits
+3.3V Rail	3.3 Volts DC	RAM, modern processors, PCIe cards
-12V Rail	-12 Volts DC	Some serial port circuits (rare today)
+5V Standby	5V always-on	Allows PC to wake from sleep / power button to work

- PSU is rated in Watts — e.g., 500W, 650W, 800W. Choose PSU based on total system power requirement
- 80 PLUS Certification — efficiency rating: 80 PLUS Bronze, Silver, Gold, Platinum, Titanium
- Modular PSU — only connect cables you need, reducing cable clutter inside case

> **Exam Tip:** SMPS = Switched Mode Power Supply. Converts AC (230V) to DC (3.3V, 5V, 12V). If PC doesn't turn on, check SMPS first.

2.3 UPS – Uninterruptible Power Supply

> *A UPS provides backup battery power when the main electricity fails. It gives time to save work and shut down safely, preventing data loss.*

Type	Description	Use Case
Offline / Standby UPS	Switches to battery only when power fails (small delay)	Home computers, basic protection
Line-Interactive UPS	Regulates voltage fluctuations; switches to battery on failure	Small offices, servers
Online / Double Conversion UPS	Always runs on battery (fully isolated from mains) — zero switchover time	Critical servers, data centers

- VA Rating: UPS capacity measured in Volt-Amperes (VA) or Watts — e.g., 600VA, 1000VA
- Battery Backup Time: How long UPS can power equipment after power cut (typically 10-30 minutes)
- Surge Protection: UPS also protects against voltage spikes and surges

2.4 ESD – Electrostatic Discharge

> *ESD (Electrostatic Discharge) is the sudden flow of static electricity between two objects. It can permanently damage sensitive computer components.*

- Always wear an Anti-Static Wrist Strap when handling PC components
- Touch the metal PC case before touching any component to discharge static
- Work on anti-static mat and keep components in anti-static bags when not installed
- Avoid working on carpet; humidity helps reduce static buildup
- Never touch the gold contacts/pins on CPUs, RAM, and expansion cards

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SECTION 3: CPUS AND MOTHERBOARDS

3.1 CPU – Central Processing Unit

> *The CPU is the brain of the computer. It fetches, decodes, and executes instructions. Modern CPUs are microprocessors — entire processing unit on a single chip.*

Component	Description
ALU (Arithmetic Logic Unit)	Performs arithmetic (+,-,*,/) and logical (AND, OR, NOT, compare) operations
CU (Control Unit)	Fetches instructions from memory, decodes and executes them; coordinates all CPU activities
Registers	Ultra-fast, tiny memory inside CPU (Accumulator, Program Counter, Instruction Register)
L1 Cache	Fastest cache, smallest, inside CPU core — stores most recently used instructions
L2 Cache	Slightly larger/slower than L1 — per core or shared between cores
L3 Cache	Largest, slowest cache — shared among all CPU cores
Clock Generator	Produces timing pulses; speed = GHz (1 GHz = 1 billion cycles/second)

CPU Specifications and Terms

Term	Meaning	Example
Clock Speed	How many instruction cycles per second; higher = faster	3.5 GHz, 4.8 GHz (Turbo Boost)
Cores	Independent processing units inside one CPU chip	Dual-core, Quad-core, 8-core, 16-core
Threads	Virtual cores; allows one core to do two tasks simultaneously (Hyper-Threading)	4 cores / 8 threads
TDP (Thermal Design Power)	Maximum heat CPU generates; determines cooling needed	65W, 95W, 125W
Architecture	CPU design type; affects efficiency	Intel: 12th Gen Alder Lake; AMD: Zen 4
Socket Type	Physical slot on motherboard where CPU is installed	Intel LGA1700; AMD AM5
Lithography/Process Node	Manufacturing size; smaller = more efficient, faster	7nm, 5nm, 3nm
64-bit vs 32-bit	Maximum memory addressable; 64-bit can use more than 4GB RAM	All modern CPUs are 64-bit

Major CPU Manufacturers

Manufacturer	Popular Series	Socket	Notes
Intel	Core i3, i5, i7, i9; Xeon (servers)	LGA1700 (13th/14th Gen)	Widely used in laptops, desktops, servers
AMD	Ryzen 3, 5, 7, 9; EPYC (servers)	AM5 (Ryzen 7000)	Known for multi-core performance, good value
Qualcomm / ARM	Snapdragon	Custom	Used in smartphones, tablets, some laptops
Apple	M1, M2, M3 (Apple Silicon)	Custom (soldered)	ARM-based; used in MacBooks and iPads

3.2 Motherboard

> *The Motherboard (also called the Main Board or System Board) is the primary circuit board in a computer. It connects all components together and allows them to communicate with each other.*

Component on Motherboard	Description
CPU Socket	Physical slot where the processor is installed. Intel uses LGA (Land Grid Array); AMD uses PGA (Pin Grid Array) or LGA
RAM Slots (DIMM)	Slots for memory modules. Usually 2-4 slots; support DDR4 or DDR5
PCIe Slots	PCI Express slots for graphics cards, NVMe SSDs, network cards. Full-size (x16) and half-size (x1, x4) slots
SATA Connectors	Serial ATA ports for connecting HDDs, SSDs, and optical drives. Usually 4-8 ports
M.2 Slot	Small form-factor slot for ultra-fast NVMe SSDs. Much faster than SATA
Chipset	Controller hub that manages communication between CPU, RAM, and peripherals. Intel: Z790, B760; AMD: X670, B650
BIOS/UEFI Chip	ROM chip containing firmware that starts the computer and initializes hardware
Power Connectors	24-pin ATX main power connector + 8-pin CPU power connector from SMPS
USB Headers	Internal pins on motherboard for front-panel USB ports on the case
Audio Header	Pins for front-panel headphone/mic jacks
Fan Headers (PWM)	Connectors for CPU fan and case fans; PWM allows speed control
CMOS Battery	Small coin battery (CR2032) that powers the BIOS chip to retain settings and clock when PC is off

Motherboard Form Factors

Form Factor	Size	Use Case
ATX (Standard)	305mm × 244mm	Full-size desktop towers — most expansion slots

Form Factor	Size	Use Case
Micro-ATX (mATX)	244mm × 244mm	Mid-size cases — fewer slots but still full-featured
Mini-ITX	170mm × 170mm	Small form factor (SFF) PCs — compact builds
E-ATX (Extended ATX)	305mm × 330mm+	High-end workstations and servers — maximum expansion

> **Exam Tip:** Motherboard connects ALL components. CMOS battery stores BIOS settings. CPU socket type must match CPU brand/generation.

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SECTION 4: BASIC INPUT/OUTPUT SYSTEM (BIOS)

4.1 What is BIOS?

> *BIOS (Basic Input/Output System) is firmware stored on a ROM chip on the motherboard. It is the first program that runs when you power on a computer. It initializes hardware and loads the Operating System.*

Function	Description
POST (Power-On Self Test)	First task of BIOS — tests CPU, RAM, keyboard, drives before OS loads. Beep codes indicate errors.
Bootstrap Loader	Finds and loads the OS from the boot device (HDD, SSD, USB) into RAM
CMOS Setup	Allows user to configure hardware settings — boot order, date/time, passwords, voltages
Hardware Initialization	Detects and initializes all connected hardware components
Interrupt Handling	Manages hardware interrupts and provides basic I/O services to OS

BIOS vs UEFI

Feature	Traditional BIOS	UEFI (Unified Extensible Firmware Interface)
Interface	Text-only, keyboard navigation	Graphical interface with mouse support
Storage Support	Max 2.2 TB hard drive (MBR)	Supports drives larger than 2.2 TB (GPT)
Boot Speed	Slower boot	Faster boot with Fast Boot feature
Security	No secure boot	Secure Boot prevents malware at startup
Architecture	16-bit, limited	32/64-bit, modern and extensible
Modern Usage	Old systems (pre-2012)	All modern motherboards use UEFI

4.2 BIOS Settings

- Access BIOS: Press Del, F2, F10, or F12 during startup (key varies by motherboard brand)
- Boot Order: Set which device boots first — HDD, USB, DVD — important for OS installation
- Date & Time: Set system clock (stored in CMOS, maintained by coin battery)
- CPU Settings: View CPU speed, enable/disable Hyper-Threading, set Turbo Boost
- RAM Settings: View installed RAM; enable XMP/DOCP profile for RAM to run at rated speed
- Secure Boot: Enable to prevent unauthorized OS/malware from loading during boot
- Fast Boot: Skips some POST checks for faster startup
- BIOS Password: Set Admin/User password to prevent unauthorized BIOS changes or system boot

- Reset BIOS: Remove CMOS battery for 30 seconds OR use CLEAR CMOS jumper on motherboard

BIOS Beep Codes (Award BIOS)

Beep Pattern	Meaning
1 Short Beep	POST successful — normal startup
1 Long + 2 Short	Video card / Graphics card problem
1 Long + 3 Short	Video memory failure
Continuous Long Beeps	RAM problem — not properly seated or faulty
No Beep + No Display	CPU not installed, no power, or motherboard dead
3 Long Beeps	Keyboard error (AMI BIOS)

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SECTION 5: MEMORY SYSTEMS

5.1 Types of Memory

> *Memory in a computer is where data and instructions are stored. There are different types based on speed, volatility, and purpose.*

Memory Type	Full Form	Description	Volatile?
RAM	Random Access Memory	Primary working memory. CPU reads/writes here during operation. Fast but temporary.	Yes
ROM	Read Only Memory	Permanent memory for BIOS/firmware. Written at factory, cannot be changed by user.	No
Cache	—	Ultra-fast memory inside/near CPU. L1 (fastest), L2, L3 (largest). Holds frequently accessed data.	Yes
Registers	—	Tiny memory units inside CPU itself. Fastest of all. Holds data being actively processed.	Yes
Virtual Memory	—	Hard disk space used as temporary RAM when actual RAM is full. Much slower than RAM.	No
Flash Memory	—	Non-volatile semiconductor memory used in SSDs, USB drives, SD cards.	No

5.2 RAM Types

RAM Type	Full Name	Description	Transfer Rate
SDRAM	Synchronous DRAM	Early standard; syncs with CPU clock. Obsolete now.	~100-133 MHz
DDR	Double Data Rate	Transfers data on both rising and falling clock edge. 2x faster than SDRAM.	200-400 MT/s
DDR2	DDR 2nd Generation	Higher clock speed, lower voltage (1.8V) than DDR.	400-1066 MT/s
DDR3	DDR 3rd Generation	Lower voltage (1.5V), higher speeds than DDR2. Common in older PCs.	800-2133 MT/s
DDR4	DDR 4th Generation	1.2V, higher bandwidth. Standard for most modern PCs (2014-present).	1600-3200 MT/s
DDR5	DDR 5th Generation	Latest standard. Higher bandwidth, lower voltage (1.1V). For Intel 12th Gen+ / AMD Ryzen 7000+.	3200-8400 MT/s

- RAM Form Factors: DIMM (full-size desktop), SO-DIMM (laptop/small PCs), Micro-DIMM (embedded)
- Dual Channel: Install RAM in pairs for double bandwidth — e.g., 2×8GB = 16GB dual channel

- ECC RAM: Error Correcting Code RAM — used in servers to detect and fix memory errors

> **Exam Tip:** DDR5 > DDR4 > DDR3 > DDR2 > DDR. Each generation is NOT backward compatible. Check motherboard specs for supported RAM type.

5.3 ROM Types

ROM Type	Full Form	Description
ROM	Read Only Memory	Written at factory. Cannot be changed. Stores BIOS in old systems.
PROM	Programmable ROM	Can be programmed ONCE by user using a special PROM programmer device.
EPROM	Erasable Programmable ROM	Can be erased by exposing to ultraviolet (UV) light, then reprogrammed.
EEPROM	Electrically Erasable PROM	Can be erased and rewritten electrically without removing the chip. Basis of Flash memory.
Flash ROM	Flash Memory ROM	Modern evolution of EEPROM. Used for BIOS chips, USB drives, SSDs. Fast and reliable.

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SECTION 6: BUS STRUCTURES

6.1 What is a Bus?

> *A bus is a communication pathway (set of wires/traces on the motherboard) that transfers data between the CPU, memory, and other components. It is like a highway for data inside the computer.*

Bus Type	Purpose	Details
Data Bus	Carries actual data being transferred	Width = 8, 16, 32, or 64 bits; wider = more data per transfer
Address Bus	Carries memory addresses (locations) that CPU wants to access	Width determines maximum addressable memory (32-bit = 4GB max, 64-bit = 16 exabytes)
Control Bus	Carries control signals (read/write commands, clock, interrupts)	Coordinates all bus operations between components

6.2 Types of Buses

Bus Name	Full Form	Speed/Details	Use
FSB	Front Side Bus	Older; connected CPU to memory/chipset. Now replaced by QPI/DMI.	CPU to RAM (old Intel)
PCIe	PCI Express	Current standard. x1, x4, x8, x16 lanes. PCIe 4.0 = ~16 GB/s (x16)	GPU, NVMe SSD, expansion cards
SATA	Serial ATA	SATA III = 6 Gbps. For HDDs, SSDs, optical drives.	Storage devices
USB	Universal Serial Bus	USB 2.0=480Mbps, USB 3.0=5Gbps, USB 3.2=20Gbps, USB4=40Gbps	External peripherals
DMI	Direct Media Interface	Intel: connects CPU to PCH chipset. AMD uses similar Infinity Fabric.	CPU to chipset communication
HyperTransport	—	AMD technology connecting CPU to chipset. High bandwidth, low latency.	AMD CPU to chipset
I2C / SMBus	Inter-Integrated Circuit	Low-speed bus for sensors, EEPROM, small peripherals.	Motherboard sensors, SPD chips on RAM

SECTION 7: NETWORK CABLE COLOR COMBINATIONS

7.1 Ethernet Cable (RJ45) Wiring Standards

> *Ethernet cables (Cat5e, Cat6, Cat6a) use 8 wires (4 twisted pairs) inside. The wire order at the RJ45 connector must follow a standard wiring scheme. Two standards exist: T568A and T568B.*

T568B Standard (Most Common in India/Offices)

Pin	Wire Color	Function
Pin 1	Orange-White (striped)	TX+ (Transmit Data +)
Pin 2	Orange (solid)	TX- (Transmit Data -)
Pin 3	Green-White (striped)	RX+ (Receive Data +)
Pin 4	Blue (solid)	Not used in 100Mbps
Pin 5	Blue-White (striped)	Not used in 100Mbps
Pin 6	Green (solid)	RX- (Receive Data -)
Pin 7	Brown-White (striped)	Not used in 100Mbps
Pin 8	Brown (solid)	Not used in 100Mbps

T568A Standard

Pin	Wire Color	Function
Pin 1	Green-White (striped)	TX+
Pin 2	Green (solid)	TX-
Pin 3	Orange-White (striped)	RX+
Pin 4	Blue (solid)	Unused (100Mbps)
Pin 5	Blue-White (striped)	Unused (100Mbps)
Pin 6	Orange (solid)	RX-
Pin 7	Brown-White (striped)	Unused (100Mbps)
Pin 8	Brown (solid)	Unused (100Mbps)

7.2 Cable Types

Cable Type	Both Ends	Used For
Straight-Through Cable	Both ends T568B (or both T568A)	PC to Switch, PC to Hub, Router to Switch (different devices)
Crossover Cable	One end T568A, other end T568B	PC to PC directly, Switch to Switch (same type devices) — older systems
Rollover / Console Cable	Reversed wiring end-to-end	Connecting PC to Cisco router/switch console port

> **Memory Trick for T568B:** Orange-White, Orange, Green-White, Blue, Blue-White, Green, Brown-White, Brown. Remember: OO GBBg BB (O=Orange, G=Green, B=Blue, Br=Brown)

7.3 Ethernet Cable Categories

Category	Speed	Max Distance	Use
Cat5	100 Mbps	100 metres	Old standard, largely replaced
Cat5e	1 Gbps (Gigabit)	100 metres	Home and small office — most common
Cat6	1 Gbps (10 Gbps short range)	100m / 55m at 10G	Office buildings, better interference protection
Cat6a	10 Gbps	100 metres	Data centers, enterprise networks
Cat7	10 Gbps	100 metres	High shielding; used in data centers
Cat8	25-40 Gbps	30 metres	Data center backbone connections

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SECTION 8: EXPANSION CARDS, PORTS, CONNECTORS AND CABLES

8.1 Expansion Cards

> *Expansion cards are circuit boards inserted into expansion slots on the motherboard to add extra functionality to a computer.*

Card Type	Purpose	Slot Used
Graphics Card (GPU)	Renders images, video, and 3D graphics for display output	PCIe x16 slot
Sound Card	High-quality audio input and output (replaces built-in audio)	PCIe x1 slot
Network Interface Card (NIC)	Provides wired Ethernet or Wi-Fi connectivity	PCIe x1 slot
Wi-Fi Card	Wireless internet connectivity (802.11ac/ax)	PCIe x1 or M.2 slot
TV Tuner Card	Receive and record TV broadcasts on PC	PCIe x1 slot
RAID Controller Card	Manages multiple hard drives in RAID configuration	PCIe x4/x8 slot
USB Expansion Card	Adds extra USB ports (USB 3.0/3.2/4.0)	PCIe x1 slot
Capture Card	Capture video from cameras/gaming consoles for recording/streaming	PCIe x1 slot

8.2 Ports and Connectors

Port/Connector	Full Form	Description	Speed/Data
USB Type-A	Universal Serial Bus (rectangle)	Standard USB port for keyboards, mice, drives, chargers	USB 2.0: 480 Mbps; USB 3.0: 5 Gbps
USB Type-C	USB-C (oval shape)	Reversible connector; supports USB, DisplayPort, Thunderbolt, Power Delivery	Up to 40 Gbps (USB4/Thunderbolt 4)
HDMI	High Definition Multimedia Interface	Digital audio + video output to monitors and TVs	Up to 48 Gbps (HDMI 2.1); 4K/8K support
DisplayPort (DP)	DisplayPort	High-performance digital video output for monitors	Up to 80 Gbps (DP 2.0); supports 8K, VRR
VGA	Video Graphics Array (15-pin)	Older analog video output. Blue trapezoidal connector.	Analog only; max ~2048×1536 resolution
DVI	Digital Visual Interface (white)	Digital video output, older standard; no audio	Single/Dual link; up to 2560×1600
RJ45 (LAN)	Registered Jack 45	Ethernet network connector for wired internet	Up to 10 Gbps (Cat6a cable)
3.5mm Audio Jack	TRS / TRRS	Headphone (green), Mic (pink), Line-in (blue)	Analog audio

Port/Connector	Full Form	Description	Speed/Data
PS/2	Personal System/2	Older round connector for keyboard (purple) and mouse (green)	Legacy, mostly replaced by USB
eSATA	External SATA	External version of SATA for hard drives	Up to 6 Gbps
Thunderbolt 4	—	Intel high-speed port (same as USB-C connector). Supports video, data, charging all in one.	40 Gbps; 100W power delivery

8.3 Internal Cables and Connectors

Cable/Connector	Description	Used For
SATA Data Cable	Thin 7-pin L-shaped connector	Connect HDD/SSD/optical drive to motherboard
SATA Power Cable	15-pin connector from SMPS	Power HDDs, SSDs, optical drives
24-pin ATX Power	Main power from PSU to motherboard	Powers the entire motherboard
8-pin CPU Power	Square 8-pin from PSU	Powers the CPU (EPS12V connector)
PCIe 6/8-pin Power	6 or 8 pin from PSU to GPU	Powers graphics cards requiring extra power
IDE/PATA (Legacy)	Wide 40/80-pin ribbon cable	Old hard drives and optical drives (pre-2006)
Fan Header (3/4-pin)	Small connector for case and CPU fans	Connects fans to motherboard for speed control

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SECTION 9: DATA STORAGE DEVICES

9.1 Primary Storage vs Secondary Storage

Type	Examples	Speed	Volatile?	Access Type
Primary Storage (Main Memory)	RAM, ROM, Cache	Very Fast	Yes (RAM)	Direct CPU access
Secondary Storage (Mass Storage)	HDD, SSD, CD/DVD, USB	Slower	No (persistent)	Through OS/file system

9.2 Hard Disk Drive (HDD)

> *HDD uses spinning magnetic platters to store data. A read/write head moves over the platters to access data. Traditional, affordable, but slower than SSD.*

Component	Description
Platters	Circular magnetic disks that store data. Most HDDs have 2-5 platters.
Read/Write Head	Reads and writes data on platters without touching them; floats micrometers above surface
Spindle Motor	Spins the platters at constant speed — RPM determines speed
Actuator Arm	Moves read/write head across the platter surface
Cache (Buffer)	Small amount of fast SRAM on HDD PCB; improves read/write performance

- RPM: Revolutions Per Minute. 5400 RPM (laptop, quieter) or 7200 RPM (desktop, faster)
- Interface: SATA III (6 Gbps) for modern HDDs; legacy PATA/IDE for older drives
- Capacity: Typically 500 GB to 20 TB for consumer drives
- Fragmentation: Over time, files get scattered across platters, slowing down access — use Defragment tool

9.3 Solid State Drive (SSD)

> *SSD uses NAND Flash memory chips to store data. No moving parts, much faster than HDD, silent, and more durable. Now the standard for modern computers.*

Feature	HDD	SSD
Technology	Magnetic spinning platters	NAND Flash memory chips
Speed (Read/Write)	80-160 MB/s	500 MB/s (SATA) to 7000 MB/s (NVMe)
Moving Parts	Yes — motor, head, platters	No moving parts
Noise	Audible (spinning, clicking)	Completely silent
Durability	Fragile — shock can damage heads	Very durable — survives drops
Power Use	Higher (motor)	Lower power consumption
Cost per GB	Cheaper	More expensive (but prices falling)
Lifespan	3-5 years typically	5-10 years (limited write cycles)

- Form Factors: 2.5-inch (SATA, fits laptop bays), M.2 (2280 size, NVMe or SATA), PCIe add-in card
- NVMe SSDs: Connect via M.2 slot using PCIe lanes — up to 7000 MB/s read speed

9.4 Optical Storage

Type	Full Form	Capacity	Description
CD-ROM	Compact Disc Read-Only Memory	700 MB	Read only; audio CDs, software distribution
CD-R	CD Recordable	700 MB	Write once, read many times (WORM)
CD-RW	CD Rewritable	700 MB	Can be erased and rewritten multiple times
DVD-ROM	Digital Versatile Disc ROM	4.7 GB (SL) / 8.5 GB (DL)	Movies, software; read only
DVD-R/RW	DVD Recordable/Rewritable	4.7 GB	Recordable DVD for backups and media
Blu-ray Disc (BD)	—	25 GB (SL) / 50 GB (DL)	High-definition video; blue laser
BD-R / BD-RE	Blu-ray Recordable/Rewritable	25-100 GB	Recordable Blu-ray for archiving

9.5 Other Storage Media

Device	Type	Capacity	Use
USB Flash Drive (Pen Drive)	Flash Memory	4 GB – 1 TB	Portable data transfer; plug-and-play
SD / MicroSD Card	Flash Memory	2 GB – 1 TB	Cameras, smartphones, Raspberry Pi
External HDD/SSD	Magnetic / Flash	500 GB – 8 TB	Backup and portable large storage
NAS (Network Attached Storage)	HDD/SSD array	1 TB – 100 TB+	Centralized file storage over network
Magnetic Tape	Magnetic	10 TB – 100+ TB	Long-term archival backup (data centers)
Cloud Storage	Remote servers	Unlimited (paid)	Google Drive, OneDrive, Dropbox — access anywhere

SECTION 10: VIDEO AND MULTIMEDIA INPUT/OUTPUT DEVICES

10.1 Graphics Card (GPU)

> *A GPU (Graphics Processing Unit) renders images, video, and 3D graphics. It can be integrated (on CPU die) or discrete (separate card installed in PCIe slot).*

Type	Description	Performance
Integrated GPU	Built into the CPU chip (Intel UHD, AMD Radeon Graphics). Shares system RAM.	Low-medium; fine for office work, videos
Discrete GPU	Separate graphics card with its own VRAM (Video RAM). Installed in PCIe x16 slot.	High performance; needed for gaming, 3D, video editing

- VRAM: Video RAM on GPU. Higher VRAM handles higher resolutions and more textures. 8GB-24GB common
- Video Memory Types: GDDR6, GDDR6X (fast graphics-specific memory on GPU)
- GPU Manufacturers: NVIDIA (GeForce RTX series) and AMD (Radeon RX series)
- GPU Output Ports: HDMI, DisplayPort, DVI (older). Multiple ports allow multiple monitors

10.2 Monitors and Display

Technology	Full Form	Description
CRT	Cathode Ray Tube	Old, bulky, heavy. Uses electron beam to illuminate phosphor screen.
LCD	Liquid Crystal Display	Thin, flat panel. Uses liquid crystals + backlight. Low power.
LED	Light Emitting Diode	LCD with LED backlight. Brighter, thinner, more energy efficient.
IPS	In-Plane Switching	LCD variant with better color accuracy and wider viewing angles.
TN	Twisted Nematic	Cheaper LCD. Faster response time but worse color/viewing angles.
VA	Vertical Alignment	Better contrast ratio than IPS/TN. Good for movies.
OLED	Organic LED	Each pixel is its own light source. Perfect blacks, vivid colors, thin.
QLED	Quantum LED	Samsung's technology. Quantum dots enhance LCD brightness/color.

- Resolution: Number of pixels (width x height). 1920x1080 (Full HD), 2560x1440 (QHD), 3840x2160 (4K UHD)
- Refresh Rate: How many times/second screen updates. 60Hz (standard), 144Hz, 165Hz, 240Hz (gaming)
- Response Time: How fast a pixel changes color. 1ms (gaming) to 5ms (office). Lower = less motion blur

10.3 Multimedia Input Devices

Device	Description	Use
Webcam	Camera for capturing video/images through USB or built-in	Video calls, streaming, security
Microphone	Captures audio input; internal or USB/3.5mm external	Voice calls, recording, voice commands
Digital Camera / DSLR	High-quality still and video capture	Photography, video production
Video Capture Card	Digitizes analog or HDMI video from external sources	Recording gameplay, digitizing VHS tapes
Scanner	Converts physical documents/photos to digital images	Document management, OCR
Graphic Tablet / Stylus	Draws digitally with pressure sensitivity	Digital art, design, note-taking

10.4 Audio Devices

Device	Type	Description
Speakers	Output	Convert digital audio to sound waves. 2.0, 2.1, 5.1 (surround), 7.1 channel systems
Headphones	Output	Personal audio output. Wired (3.5mm/USB) or wireless (Bluetooth)
Headset	Input + Output	Headphones + microphone combined. Used for calls and gaming
Sound Card	I/O	Dedicated audio processing card. Better quality than onboard audio
USB Audio Adapter	I/O	External USB sound card. Adds audio ports when built-in is broken/absent

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SECTION 11: PRINTERS

11.1 Types of Printers

> *A printer is an output device that produces a physical (hardcopy) printout of digital documents or images on paper or other media.*

Category	Type	Working Principle	Best For
Impact	Dot Matrix Printer	Pins strike inked ribbon against paper. Noisy but cheap to run.	Multi-part forms, invoices (cheap consumables)
Non-Impact	Inkjet Printer	Sprays microscopic droplets of liquid ink through nozzles onto paper.	Home printing, photos, moderate volume
Non-Impact	Laser Printer	Laser beam creates static charge on drum; toner (powder) sticks; heat fuses it to paper.	Office high-volume printing; fast, cheap per page
Non-Impact	Thermal Printer	Heat activates special thermal paper or ribbon. No ink cartridges needed.	Receipts (POS systems), ATMs, barcode labels
Non-Impact	Dye-Sublimation	Heats dye ribbons (CMYO) to produce continuous-tone photographic quality output.	Photo printing, ID cards
Special	Plotter	Moves pens or inkjet heads over large paper/media. Can produce very large formats.	Engineering drawings, architectural plans, CAD
Special	3D Printer	Deposits material (plastic, resin, metal) layer by layer from digital model.	Prototyping, manufacturing, medical models

11.2 Printer Specifications

Specification	Description	Example Values
DPI (Dots Per Inch)	Print resolution — higher DPI = sharper, more detailed prints	600 DPI (office), 1200-4800 DPI (photo)
PPM (Pages Per Minute)	Print speed — how many pages printed per minute	Laser: 20-70 PPM; Inkjet: 5-20 PPM
Duplex Printing	Automatically prints on both sides of paper	Auto-duplex saves paper and cost
Connectivity	How printer connects to computer	USB, Wi-Fi, Ethernet (LAN), Bluetooth
Paper Size Support	Paper sizes the printer can handle	A4, A3, Letter, Legal, Envelopes
Ink/Toner	Consumables used for printing	Ink cartridges (Inkjet); Toner cartridge (Laser)
Memory (Laser)	Printer's internal memory for processing print jobs	32MB – 1GB

11.3 Inkjet vs Laser — Detailed Comparison

Feature	Inkjet Printer	Laser Printer
Print Technology	Liquid ink sprayed through nozzles	Toner powder fused by laser + heat
Print Quality (Text)	Good	Excellent — sharper, crisper text
Print Quality (Photos)	Excellent (photo paper)	Good but not as vibrant as inkjet
Speed	Slower (5-20 PPM)	Faster (20-70 PPM)
Cost of Printer	Cheap to buy	More expensive to buy
Cost per Page	Higher (ink cartridges expensive)	Lower (toner lasts much longer)
Warm-up Time	Instant	Slight warm-up time (fuser heating)
Usage	Low to medium volume; home/photo printing	High volume; office use

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SECTION 12: PORTABLE COMPUTERS AND DEVICES

12.1 Types of Portable Computers

Device Type	Description	Features
Laptop / Notebook	Portable all-in-one computer with keyboard, display, and battery built-in	12"–17" screen, 4-12 hours battery, full OS (Windows/macOS/Linux), keyboard, touchpad
Ultrabook	Thin and light premium laptop category (Intel specification)	Very thin, lightweight, fast SSD, long battery, premium build (e.g., Dell XPS, HP Spectre)
Chromebook	Laptop running Google ChromeOS; web-focused	Lightweight, low cost, fast boot, limited offline apps, uses Google cloud services
2-in-1 / Convertible	Laptop that can also be used as tablet (touchscreen + detachable or 360° hinge)	Touch screen, stylus support, flexible use modes (e.g., Microsoft Surface, Lenovo Yoga)
Tablet	Touch-screen device with no physical keyboard; lightweight	iOS (iPad), Android (Samsung Galaxy Tab), Windows tablets; app-focused
Netbook (Legacy)	Very small, cheap laptops designed for internet use. Mostly obsolete.	10"–11" screen, minimal specs; replaced by tablets and ultrabooks
Workstation Laptop	High-performance portable for professionals	Powerful CPU/GPU, calibrated display, large RAM; used by engineers, designers

12.2 Laptop Components

Component	Laptop Version vs Desktop
CPU	Mobile CPU (lower TDP, more efficient). Intel Core i-series (H/P/U suffix) or AMD Ryzen mobile
RAM	SO-DIMM form factor (smaller than desktop DIMM). Often soldered to board in thin laptops.
Storage	2.5-inch SATA HDD or M.2 NVMe SSD
Display	Built-in LCD/OLED panel — IPS most common; 60-165Hz refresh rates
Battery	Lithium-ion (Li-ion) or Lithium Polymer (LiPo) rechargeable battery
Cooling	Thinner heat pipes and smaller fans; thermal throttling to protect components
Keyboard	Built-in; smaller layout; often no numpad in 13"–14" models
Touchpad	Replaces mouse; supports multi-finger gestures
Ports	Fewer than desktop. Typically USB-A, USB-C, HDMI, 3.5mm, SD card
Webcam	Built-in at top of display bezel

12.3 Other Portable Devices

Device	Description	OS/Platform
Smartphone	Pocket computer with cellular, camera, GPS, apps, touchscreen	Android (Google) or iOS (Apple)
Smartwatch / Wearable	Wrist-worn device synced with smartphone; health monitoring	Wear OS, watchOS, Tizen
E-Reader	Dedicated device for reading digital books; E-ink display, excellent battery	Kindle (Amazon), Kobo
Portable Media Player	Dedicated device for music and video playback	iPod (legacy), generic Android players
Handheld Game Console	Portable gaming device	Nintendo Switch, PlayStation Portable (PSP)

12.4 Laptop Battery and Power

- Battery measured in mAh (milliampere-hours) or Wh (Watt-hours) — higher = longer life
- Lithium-ion (Li-ion): Rechargeable, lightweight, used in most laptops and phones
- Lithium Polymer (LiPo): Thinner/flexible design; slightly more expensive; used in ultrathin laptops
- Battery Best Practices: Avoid 0% and 100% extremes; optimal range 20%-80% for longevity
- Charging: AC adapter converts wall power (230V AC) to laptop DC voltage (typically 19V-20V)

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SECTION 13: CONNECTING COMPUTERS

13.1 Types of Networks

Network Type	Full Form	Coverage	Example
PAN	Personal Area Network	Few metres (personal space)	Bluetooth devices, phone-to-PC transfer
LAN	Local Area Network	Building or campus	Office network, school computer lab
MAN	Metropolitan Area Network	City or town	City-wide Wi-Fi, cable TV network
WAN	Wide Area Network	Country or world	The Internet, corporate global networks
WLAN	Wireless LAN	Building (via Wi-Fi)	Wi-Fi hotspot in office or home
VPN	Virtual Private Network	Internet (encrypted tunnel)	Secure remote access to office network

13.2 Network Devices

Device	Function	Layer (OSI)
NIC (Network Interface Card)	Connects a computer to a network; has MAC address	Layer 2 (Data Link)
Hub	Basic device connecting multiple computers; broadcasts to all ports (obsolete)	Layer 1 (Physical)
Switch	Connects multiple devices in LAN; sends data only to intended device (uses MAC address)	Layer 2 (Data Link)
Router	Connects different networks; routes data packets between them using IP address	Layer 3 (Network)
Modem	Modulates/Demodulates signals to connect to ISP (converts digital to analog and back)	Layer 1/2
Access Point (Wi-Fi AP)	Provides wireless connectivity; extends Wi-Fi coverage	Layer 2
Repeater	Amplifies and regenerates network signal over long distances	Layer 1 (Physical)
Bridge	Connects two LAN segments; filters traffic by MAC address	Layer 2
Firewall	Monitors and filters network traffic based on security rules	Layer 3/4
Gateway	Translates between different network protocols/architectures	All layers

13.3 Wireless Connectivity Standards

Standard	Name / Frequency	Max Speed	Notes
Wi-Fi 4 (802.11n)	2.4 GHz / 5 GHz	600 Mbps	Common in older devices; good range
Wi-Fi 5 (802.11ac)	5 GHz	3.5 Gbps	Standard in most current devices; shorter range than 2.4GHz
Wi-Fi 6 (802.11ax)	2.4 / 5 / 6 GHz	9.6 Gbps	Better in crowded environments; lower latency
Wi-Fi 6E	6 GHz band added	9.6 Gbps	Less congestion; requires Wi-Fi 6E router and device
Bluetooth 5.0	2.4 GHz ISM band	2 Mbps	Short range devices: headphones, keyboards, mice
Bluetooth 5.2	2.4 GHz	2 Mbps	LE Audio standard; supports multiple devices simultaneously
NFC	Near Field Communication (13.56 MHz)	424 Kbps	Very short range (4cm); contactless payment, pairing
4G LTE / 5G	Cellular bands	150 Mbps / 10 Gbps	Mobile internet; smartphones, mobile hotspots, laptop SIMs

13.4 IP Addresses and Basic Networking

> *An IP Address (Internet Protocol Address) is a unique numerical label assigned to each device on a network for identification and location addressing.*

Term	Description	Example
IPv4	32-bit address; 4 groups of numbers (0-255); ~4.3 billion addresses	192.168.1.1
IPv6	128-bit address; 8 groups of hex numbers; ~340 undecillion addresses	2001:0db8:85a3::0000:8a2e:0370:7334
Private IP	Used within local network; not routable on internet	192.168.x.x, 10.x.x.x, 172.16-31.x.x
Public IP	Globally unique address assigned by ISP; visible on internet	103.21.244.1
DHCP	Dynamic Host Configuration Protocol; automatically assigns IP addresses	Router assigns 192.168.1.x to devices
DNS	Domain Name System; translates domain names to IP addresses	google.com → 142.250.x.x
MAC Address	Physical hardware address of network card; 48-bit; permanent	00:1A:2B:3C:4D:5E
Subnet Mask	Defines which part of IP is network vs host	255.255.255.0 (/24)

13.5 Types of Network Cables

Cable Type	Description	Speed / Distance
Twisted Pair (UTP/STP)	4 pairs of copper wire; most common for LAN (Cat5e, Cat6)	Up to 10 Gbps / 100m
Coaxial Cable	Central copper conductor with shielding; used in cable TV and broadband	Up to 10 Mbps / 500m
Fiber Optic Cable	Transmits data as light pulses through glass/plastic fiber; immune to interference	Up to 100 Tbps / kilometres

- UTP = Unshielded Twisted Pair (cheaper, most common in offices and homes)
- STP = Shielded Twisted Pair (extra shielding for electromagnetic interference-prone environments)
- Single-mode Fiber: Thin core; long distances (km); used in telecom backbone
- Multi-mode Fiber: Thicker core; shorter distances; used within buildings/campuses

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SECTION 14: QUICK REVISION POINTS

Key Points for Exam

Power & Electricity

- SMPS converts 230V AC to 3.3V/5V/12V DC for computer components
- UPS provides battery backup during power failure
- ESD can permanently damage PC components — always use anti-static wrist strap

CPU & Motherboard

- CPU has ALU + CU + Registers + Cache (L1, L2, L3)
- CPU speed measured in GHz | Cores = independent processing units
- Motherboard form factors: ATX (largest), Micro-ATX, Mini-ITX (smallest)
- CMOS battery (CR2032) keeps BIOS settings alive when PC is off

BIOS & Memory

- BIOS runs POST on startup, then loads OS. UEFI is modern replacement for BIOS
- RAM hierarchy: Registers (fastest) > Cache (L1>L2>L3) > RAM > HDD (slowest)
- DDR5 is latest RAM; NOT compatible with DDR4 slot
- ROM types: PROM (write once) > EPROM (UV erasable) > EEPROM (electrical) > Flash

Network Cables

- T568B standard (most common): Orange-White, Orange, Green-White, Blue, Blue-White, Green, Brown-White, Brown
- Straight-through cable: PC to Switch | Crossover cable: PC to PC
- Cat5e = 1 Gbps / 100m | Cat6 = 1-10 Gbps | Cat6a = 10 Gbps

Storage, Ports & Networking

- SSD (NVMe) = fastest storage. HDD = cheaper per GB, larger capacity
- USB-C supports USB4/Thunderbolt (40 Gbps) + power delivery + video
- Hub = broadcasts to all | Switch = sends to specific device | Router = connects networks
- DHCP = auto assigns IP | DNS = converts domain name to IP address

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SECTION 15: IMPORTANT MCQ QUESTIONS

Multiple Choice Questions (MCQs)

> *20 important exam questions. Correct answers marked with ✓ and explanation provided.*

Q1. SMPS stands for:

(a) Simple Mode Power Supply
(b) Switched Mode Power Supply ✓
(c) Standard Mode Power System
(d) Serial Mode Power Supply

Explanation: *SMPS = Switched Mode Power Supply. It converts 230V AC from the wall socket to the DC voltages (3.3V, 5V, 12V) needed by computer components.*

Q2. Which voltage rail in SMPS powers the CPU and GPU?

(a) +3.3V
(b) +5V
(c) +12V ✓
(d) -12V

Explanation: *+12V rail powers the CPU, GPU (graphics card), hard drive motors, and case fans. +5V powers USB and older drives. +3.3V powers RAM and modern logic chips.*

Q3. What does POST stand for in the context of BIOS?

(a) Power On Start Test
(b) Power-On Self Test ✓
(c) Process On System Test
(d) Primary Output System Test

Explanation: *POST = Power-On Self Test. It is the first process run by BIOS when the computer powers on. It tests CPU, RAM, keyboard, and other hardware. Beep codes signal errors.*

Q4. Which of the following RAM types is the latest generation?

(a) DDR2
(b) DDR3
(c) DDR4
(d) DDR5 ✓

Explanation: *DDR5 is the latest generation of RAM as of 2024. It offers higher bandwidth, lower voltage (1.1V), and is used with Intel 12th Gen+ and AMD Ryzen 7000 series processors.*

Q5. The CMOS battery on a motherboard is used to:

(a) Power the CPU when PC is off
(b) Keep BIOS settings and system clock when PC is off ✓
(c) Charge the UPS
(d) Run the cooling fan

Explanation: *The CMOS battery (CR2032 coin cell) provides power to the BIOS chip to retain settings (date/time, boot order, passwords) even when the computer is unplugged.*

Q6. In the T568B Ethernet cable standard, what color is Pin 1?

(a) Green-White
(b) Blue
(c) Orange-White ✓
(d) Orange

Explanation: *T568B Pin 1 = Orange-White (striped). Pin 2 = Orange. Pin 3 = Green-White. This is the most commonly used standard in India and worldwide for network cable termination.*

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Q7. Which cable type is used to connect two computers directly without a switch?

(a) Straight-through cable
(b) Crossover cable ✓
(c) Rollover cable
(d) Coaxial cable

Explanation: *A Crossover cable is used to connect two similar devices directly (PC to PC, Switch to Switch). One end uses T568A and the other uses T568B wiring standard.*

Q8. Which storage device has the fastest read/write speed?

(a) HDD (7200 RPM)
(b) SATA SSD
(c) NVMe SSD (M.2) ✓
(d) Optical DVD Drive

Explanation: *NVMe SSD connected via M.2 slot using PCIe lanes is the fastest consumer storage. Speeds up to 7000 MB/s read. SATA SSD = 500 MB/s. HDD = 80-160 MB/s.*

Q9. Which bus is used to connect a graphics card to the motherboard?

(a) SATA
(b) USB
(c) PCIe x16 ✓
(d) ISA

Explanation: *PCIe x16 (PCI Express x16) slot is used for graphics cards. It provides the maximum bandwidth needed for GPU data transfer. PCIe 4.0 x16 = up to 32 GB/s.*

Q10. What is the full form of UPS in computer hardware?

(a) Universal Power Supply
(b) Uninterruptible Power Supply ✓
(c) Ultra Power System
(d) Unified Power Source

Explanation: *UPS = Uninterruptible Power Supply. It provides battery backup when mains power fails, giving time to save work and safely shut down the computer.*

Q11. Which printer type uses heat to print on special thermal paper?

(a) Laser Printer
(b) Inkjet Printer
(c) Dot Matrix Printer
(d) Thermal Printer ✓

Explanation: *Thermal printers use heat to activate special heat-sensitive paper. No ink cartridges needed. Used in ATMs, billing machines, and receipt printers at shops.*

Q12. ESD stands for and it is harmful because:

(a) Electric Static Damage — it shorts circuits
(b) Electrostatic Discharge — it can permanently damage sensitive components ✓
(c) Electronic System Damage — it slows the CPU
(d) Electrical Signal Disruption — it corrupts data

Explanation: *ESD = Electrostatic Discharge. Static electricity built up on your body can discharge into sensitive components (CPU, RAM, GPU) when you touch them, causing permanent damage.*

Q13. Which network device sends data only to the specific destination device using MAC addresses?

(a) Hub
(b) Repeater
(c) Switch ✓
(d) Modem

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Explanation: *A Switch uses MAC addresses to forward data only to the intended device, making it efficient. A Hub broadcasts to ALL connected devices, wasting bandwidth. Switch operates at Layer 2.*

Q14. What is the function of DNS in a network?

(a) Assigns IP addresses automatically
(b) Translates domain names to IP addresses ✓
(c) Connects different networks
(d) Encrypts network traffic

Explanation: *DNS (Domain Name System) translates human-readable domain names (like google.com) into IP addresses (like 142.250.190.46) that computers use to find each other.*

Q15. Which port/connector carries both audio and video in a single cable to monitors and TVs?

(a) VGA
(b) DVI
(c) HDMI ✓
(d) PS/2

Explanation: *HDMI (High Definition Multimedia Interface) carries both digital video AND audio in a single cable. VGA is analog video only. DVI is digital video only (no audio). PS/2 is for keyboard/mouse.*

Q16. The maximum speed of a Cat6a Ethernet cable is:

(a) 100 Mbps
(b) 1 Gbps
(c) 10 Gbps ✓
(d) 40 Gbps

Explanation: *Cat6a supports up to 10 Gbps at distances up to 100 metres. Cat5e = 1 Gbps. Cat6 = 1 Gbps (10 Gbps only up to 55m). Cat8 = 25-40 Gbps.*

Q17. Which form factor is the smallest motherboard commonly used in compact PC builds?

(a) ATX
(b) Micro-ATX
(c) Mini-ITX ✓
(d) E-ATX

Explanation: *Mini-ITX is the smallest common motherboard form factor at 170mm × 170mm. It has only 1 PCIe slot but is used in small form factor (SFF) and HTPC builds.*

Q18. RAM is called volatile memory because:

(a) It is very expensive
(b) It explodes when overheated
(c) Data is lost when power is turned off ✓
(d) It can only read data, not write

Explanation: *RAM is volatile memory — it requires constant power to maintain stored data. When the computer is switched off or power fails, all data in RAM is immediately lost.*

Q19. Which wireless standard is also known as Wi-Fi 6?

(a) 802.11n
(b) 802.11ac
(c) 802.11ax ✓
(d) 802.11g

Explanation: *802.11ax is Wi-Fi 6. 802.11n = Wi-Fi 4, 802.11ac = Wi-Fi 5. Wi-Fi 6 operates on 2.4/5/6 GHz, offers up to 9.6 Gbps, and handles crowded environments better.*

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Q20. What does DHCP do in a network?

(a) Translates domain names to IP

(b) Automatically assigns IP addresses to devices ✓

(c) Encrypts network data

(d) Connects two different networks

Explanation: *DHCP (Dynamic Host Configuration Protocol) automatically assigns IP addresses, subnet mask, gateway, and DNS to devices when they join a network — so you don't have to set them manually.*

Best of Luck for Your Exam!

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